Moving More Money

Can aggregation catalyse off-grid financing?

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The Shaping Sustainable Markets group works to make sure that local and global markets are fair and can help poor people and nature to thrive. Our research focuses on the mechanisms, structures and policies that lead to sustainable and inclusive economies. Our strength is in finding locally appropriate solutions to complex global and national problems.

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Photo caption: Solar powered irrigation system for small-holder farmers, Nepal
Photo credit: SunFarmer, Nepal

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The off-grid energy sector continues to have a tremendous funding gap. Aggregation has great potential to channel finance into the millions of off-grid projects and products that will make universal energy access by 2030 possible. By bringing together projects and companies into portfolios, aggregation can reduce transaction costs and mitigate risks, while opening an attractive pathway for bigger investors to move more money into off-grid energy projects. AEPC in Nepal, IDCOL in Bangladesh, and SunFunder mostly in East Africa, have all forged unique pathways to crowding in more public and private finance, and providing support beyond financing to grow off-grid markets – for example in building demand, awareness raising, quality assurance and monitoring, training, data collection and information sharing.

Public and private investors, governments, and implementing energy companies can learn from their success and failures. There is a clear need for building and tailoring aggregator platforms if the 1 billion people without electricity and 3 billion without clean cooking are to be reached.

Contents

Executive Summary 4

1 Energy access now 6

2 Summary Case Studies 11

2.1 Case study 1: Alternative Energy Promotion Centre (AEPC) 12

2.2 Case study 2: Infrastructure Development Company Limited (IDCOL) 13

2.3 Case study 3: SunFunder 14

3 Analysis 16

3.1 Finance for aggregators 17

3.2 Finance for companies 17

3.3 Support beyond financing 18

3.4 The key role of quality assurance 19

3.5 Deeper than data: Keeping the focus on the customer, and the poorest 19

4 Recommendations and ways forward 21

4.1 Aggregators: The way-forward 22

4.2 Learning from aggregators: Recommendations for sector-wide stakeholders 23

4.3 Looking Forward 27

5 Detailed case studies 28

5.1 Case study 1: Alternative Energy Promotion Centre (AEPC) 29

5.2 Case study 2: Infrastructure Development Company Limited (IDCOL) 34

5.3 Case study 3: SunFunder 39

Methodology 45

Annex 1: Research method an approach 45

Annex 2: List of stakeholders 51

Notes 53

Executive Summary

With just over a decade left to achieve Sustainable Development Goal 7 (SDG 7) – universal energy access – there is still a significant shortfall in the financing needed to bridge the gap. Despite rapid growth in the off-grid sector over the past decade, current public and private investment flows are simply insufficient to reach the roughly one billion people without electricity, let alone the three billion without clean cooking facilities.

Providing efficient and affordable electricity for all will require a technology split between grid extension and millions of off-grid projects and products. However, investors are often reluctant to provide the kind of patient capital needed to nurture energy companies in a sector that is still experimenting with business and delivery models. The IEA reports that US$52 billion is needed annually to reach SDG 7. But the off-grid energy sector has only received about US$1.6 billion in disclosed investments in the seven years since 2012,[56] with much of that concentrated in a few companies. Many more energy companies will be needed to absorb the huge amounts of investment necessary for universal energy access. Crucially, financing models are needed to channel these investments into appropriate early-stage grant, concessional finance, and much-needed equity to grow the sector.

Financial aggregation, why is it needed?

Financial and technical intermediaries, or 'aggregators' as we call them in this report, are promising vehicles for catalysing investments by bundling projects and companies into portfolios to pool risk, reduce costs and increase investment sizes to attract larger investors. Although aggregation itself is not a new concept, it does show particular promise for igniting energy access, and for reaching some of the poorest and most marginalised people in remote areas. They are also well positioned to offer start-up and early-stage energy companies with mixes of tailored finance and other forms of support that companies need to grow and explore new markets.

Through interviews and data analysis of three aggregators and the energy companies that they have financed, we assess how these aggregators have been able to deliver energy access at scale. For comparability, we focus on off-grid electrification, specifically standalone solar solutions, and mini-grids. Some of the aggregators analysed also support clean cooking, and we anticipate the findings outlined below will be relevant to the clean cooking sector. The three aggregators we looked at are:

- **The Alternative Energy Promotion Center (AEPC), a national executing agency for renewable energy projects in Nepal.** AEPC has used a subsidy driven approach to build the market and reach some of the remotest populations.
- **The Infrastructure Development Company Limited (IDCOL), a state-backed vehicle for financing infrastructure projects in Bangladesh.** IDCOL also uses a subsidy driven approach but combines this with concessional loans and commercial finance, and strong partnerships with the private sector.
- **SunFunder, a commercial financial intermediary in East Africa, channels money from investment funds into debt loan facilities for energy companies**. SunFunder has an increasingly sophisticated set of debt finance offerings, while raising significant amounts of money from private, public and institutional investors.

To date, these three aggregators have mobilised more than US$1.3 billion for the off-grid and clean cooking sector, the largest being over US$900 million in IDCOL over a 16-year period.

Challenges and learnings

Our findings show that IDCOL and AEPC have reached some of the poorest and most remote communities in their respective countries through generous subsidy schemes, with IDCOL mixing subsidies and concessional loans. In East Africa, SunFunder has attracted significant investments, disbursing multi-million dollar loans to larger companies while being able to offer some of the smallest disbursements in the industry, to companies generating revenue that can service loans.

While so far quite successful in expanding access, each aggregator will have to continue innovating to respond to dynamic off-grid markets. The subsidy heavy programmes of IDCOL and AEPC have not responded to changing market conditions as rapidly as SunFunder and must build more sustainable markets. Without the mandates or subsidies of AEPC and IDCOL,

SunFunder will have to seek alternative ways to reach underserved markets. Indeed, SunFunder is pursuing partnerships to couple its debt facilities with grants to expand its reach.

AEPC could learn from IDCOL's successful mix of subsidies/grants and credit, building up sustainable markets by setting (and meeting) targets and using signals to lead the market, such as planned phasing out of subsidies. In turn, IDCOL could adapt elements of AEPC's community-owned model to help scale-up solar mini-grids and solar irrigation pumps.

Lessons going forward

Drawing on the experience of the companies and aggregators in this study, we offer the following recommendations on aggregation within the energy sector:

- **More public finance should be channelled** and contextualized into inclusive financial instruments, over extended periods. Our findings from IDCOL and AEPC show that targeted subsidies have reached some of the poorest and most remote communities. Companies have experimented and grown thanks to crucial injections of public money, but the volume must greatly increase to identify viable business models, especially for those working towards reaching the most marginalised.
- **More data and feedback should be packaged and shared** to help stimulate market growth. SunFunder's annual report provides valuable insights, but companies, aggregators and investors need to be bolder in the information they publicly share. AEPC and IDCOL use feedback from companies for policy advocacy and adjust financial offerings according to market needs, but could do more to gather and analyse data to rapidly respond to changing market conditions.
- **Financial instruments should be coupled with grant-funded capacity development initiatives** – particularly – for early-stage companies – to develop the thousands of companies needed to meet SDG 7. Aggregators are naturally well placed to understand companies' capacity needs and facilitate targeted training, but these efforts must be financed with grants distributed according to a long-term vision.
- **Access to finance should be contingent on complying with standards and quality assurance** procedures derived from a consultative process with private companies and government bodies, since companies cite delays related to standards as hindering their growth.
- **Investors, aggregators, and companies must work together to establish richer metrics** that reveal end-user experiences and impacts. Using them, companies could be better placed to navigate sudden changes in ability and willingness of end-users to pay – as shown by the spike in defaults on IDCOL's solar home system programmes due to unforeseen grid expansion and an influx of low-quality generic systems. .
- **Impact metrics should be used to better target investments**, policies, business models, financial instruments, and products to reach the poorest. Market forces alone will not suffice. Capital must be more patient and guided by better metrics to enable energy access for everyone – including the most marginalised.
- **Coordination must be strengthened** between financiers, private, and public sector actors to prevent overlap and undue competition between public programmes and private projects from constraining the sector. For example, several Development Finance Institutes and investors who provided financing for SunFunder undermined the aggregator's customer base by investing in some of its client companies.
- **Special purpose platforms could be established** at the national or provincial level to perform aggregation functions and rapidly test finance and policy interventions. Feedback could be used to refine activities and quickly take them to scale. These platforms could carry the financial weight of the IDCOL model, or alternatively bring together a coordinated effort which would require senior-level buy-in to rapidly respond to sector needs and constraints.

The aggregators we examined have successfully contributed to expanding energy access to millions. Besides mobilising and channelling finance, there is clearly an important role for aggregation in building demand, awareness raising, quality assurance and monitoring, training, data collection and information sharing. Aggregation shows particular promise for delivering energy access to some of the poorest and most remote populations, but more needs to be done to efficiently direct aggregation across Africa and Asia – including increasing the targeted use of public finance.

Elaborating on these recommendations, IIED will continue action-oriented research while seeking and brokering sector-level dialogues and partnerships. We hope the findings from this research will help to mobilise more investment into off-grid systems – contributing towards a big push to provide energy access for all by 2030.

Energy access now

1

The United Nations Sustainable Development Goal 7 (SDG 7) aims to achieve universal access to affordable, reliable, sustainable and modern energy by 2030.[1] But at the start of 2019, nearly one billion people lack access to electricity and almost three billion do not have access to clean cooking facilities.[2] From Tier 1 lighting and improved cookstoves, to Tier 5 grid stability and highly efficient cook facilities,[3] the technologies needed to bring energy to everyone already exist. But it will only be possible to roll these systems out at scale with the help of workable business models and a lot more investment.

This issue paper explores the roles energy finance aggregators can play in catalysing off-grid markets, presenting the results of in-depth research into three different aggregators and 23 of the energy companies that they have financed. We focus on electricity delivery – rather than cookstoves – since the aggregators we interviewed mostly support companies supplying off-grid electricity systems.

The financier funding gap

Large populations in Sub-Saharan Africa and Asia still lack access to electricity. While some Asian countries are on track to achieve universal access based on policy changes and targets,[4] most countries in Sub-Saharan Africa are falling further behind.[5] Sustainable Energy for All (SEforALL) continues to highlight the persistent and enormous public and private financing gap evident in the electricity sector, especially for off-grid systems.[5, 6, 7, 8, 9] While international private finance for electricity jumped from US$1.2 billion to US$2.9 billion from 2013–14 to 2015–16, international public finance declined from US$10.5 billion to US$8.8 billion. In short, there is not enough money being invested to close the energy access gap – not by a long shot. The funding that is available is mostly going to grid-connected renewable energy and fossil fuels systems, with only US$400 million of the overall energy financing mix invested into essential off-grid solutions such as mini-grids (MG) and solar home systems (SHS) in year 2015–16.[5]

IIED has tracked energy finance flows and identified a number of barriers that prevent public and private investment from reaching decentralised energy markets and companies serving low-income customers in developing countries. Investor expectations of quick returns often jar with the patience needed to build sustainable off-grid markets, where business models are still being proven. Many of the companies active in the off-grid sector are too small to offer the kind of large-scale investment opportunities many funds prefer. Even for investors committed to backing off-grid projects, the transaction costs involved in parcelling out small loans to start-ups and early stage companies can be prohibitive. These smaller companies often find it equally difficult to raise affordable loans from commercial banks. Many developing countries lack the kind of robust and tested regulatory frameworks needed to build private sector confidence in the off-grid sector – and the rules that are in place are rarely flexible enough to keep pace with fast-changing markets.[10, 11]

Business models and technologies to reach everyone

Achieving energy access for all will require a mix of technologies and business models that are capable of evolving as markets change. The International Energy Agency (IEA) has modelled the technology split needed to achieve universal electricity access by 2030 as follows: central-grid (39 per cent), off-grid systems powering a single home such as SHS (26 per cent), and decentralised mini-grids (35 per cent).[12] Ultimately, the optimal mix of technologies will be unique to each specific context, informed by factors including the needs of a particular community, the policy environment, and the availability of essential inputs and supporting infrastructure. Companies are also increasingly recognising the importance of productive uses of energy (PUE) – a term used to refer to the many ways in which electricity can be harnessed to increase income or productivity, which further increases demand for electricity.[13]

There is ample evidence that innovative new business models and technological breakthroughs are driving decentralised energy systems forward at an accelerating rate, especially solar. Wireless and internet connectivity coupled with smart software platforms allow real-time performance monitoring across thousands of customers. Smart metering, mobile payments, and remote shut-off circuits power pay-as-you-go (PAYG) systems that create opportunities for more efficient consumer financing by eliminating upfront cost barriers and reducing transaction costs.[14] Across the world, business models are evolving in response to these kind of technological breakthroughs. Well-established vertically-integrated companies such as ZOLA Electric,[15] operating across East and West Africa, and M-KOPA[16] in East Africa, have integrated PAYG into the core of their business models, driving market expansion and the development of more energy-efficient consumer appliances, including televisions. Others such as Greenlight Planet Inc,[17] operating across Africa and India, work through local distribution partners to deliver PAYG products. Meanwhile, companies like Angaza,[18] which offers a sales and data platform to developing markets, are partnering with manufacturers and distributors in Africa and Asia to provide business-to-business PAYG solutions.

Though mobile payments systems have been a major boost to decentralised energy in East Africa, many Asian countries, notably India, are still primarily cash-based economies.[19] Energy companies have therefore

built business models based on the strong micro-finance institute (MFI) infrastructure, and aggregate energy demand through cooperatives, while partnering with financial institutions.[20] Business models integrating PAYG with MFIs are also beginning to gain traction, giving end-users access to energy and the formal financial system at the same time.[21]

Measuring impacts

There is a small but growing pool of evidence on the impact of off-grid energy across the socio-economic spectrum. But more research is needed to standardise indicators and discern how the data can be harnessed to mobilise investments to serve the poorest and most remote communities.

Industry participants are increasingly focused on developing more precise yardsticks. For example, the Global Off-Grid Lighting Association (GOGLA) recently updated their impact metrics framework[22] – a significant step towards standardizing impact measures across the industry. Additionally, Dalberg Advisors and Lighting Global's 2018 Off-Grid Solar Market Trends Report recommends pathways for trying to understand both customers and impacts.[23] And finally, GOGLA and Altai Consulting's report on SHS also points to some of the possible economic benefits: additional work hours, new job opportunities, and enhanced business revenues.[24] Promising steps towards more efficient data collection include Acumen's "Lean Data" approach, which mixes technology and standardized social performance indicators to reduce the overall costs of measuring impact.[25] There is also a growing body of evidence on both the opportunities and barriers women face in terms of energy access[26] – although further research could help align energy systems more closely with women's requirements.

Energy companies and the finance challenges

If the world is going to achieve SDG 7, then many more energy companies will be needed to develop the off-grid market. One think tank estimates that it would take 7,000–20,000 domestic companies to deliver universal access to energy.[27] Recent modelling by Catalyst Off-Grid Advisors suggests that almost 400 SHS companies and 39,000 mini-grids will be needed to deliver SDG 7 for Africa alone.[28] Such an ambitious pipeline will only be feasible if the right financial architecture is in place to channel investment to the start-ups and early stage companies that can power faster off-grid growth.

The challenge for the sector is that private investment has so far mostly gone to a relatively small number of relatively larger companies. From 2012 to 2017, financing for the off-grid solar market mostly flowed into ZOLA, M-KOPA, Lumos Global, and Mobisol, which raised a joint total of about US$515 million – representing 57 per cent of total financing for the sector in this period. The top 10 off-grid solar companies attracted 87 per cent of total funding,[29] with most capital flowing into off-grid solar going to well-established PAYG companies. Although energy companies are raising growing amounts of commercial and crowdfunding debt, some industry stakeholders are concerned that fundraising strategies are misaligned with actual company growth.[30,31]

Start-ups and early stage companies are facing much bigger hurdles in securing enough capital. An analysis by Acumen has revealed the challenges faced by companies that are too big for seed funding but too small to raise commercial finance – a predicament known as the "pioneer gap."[32] Some of these companies are finding that financing packages are rarely aligned with their business models and that risk-averse capital sets impossible terms.[33] Investor expectations of quick returns pose another challenge. Although funding for energy access has increased six-fold over the last five years, more patient capital will be needed to fund future growth. With worldwide foreign direct investment (FDI) in 2018 dropping to levels not seen since the 2008 financial crisis,[34] attracting money to any sector will be difficult, let alone smaller companies stuck in the "pioneer gap"

Even the most well-established companies are facing pressures. PAYG sales were mostly flat in the first half of 2018, with currency devaluation and import tariffs hitting many markets. Lighting Global continues to cite the threat faced by many companies from the prevalence of cheaply-made 'generic' solar kits.[35] Any market takes time to mature, but decentralised energy systems face a particularly complex challenge: simultaneously building both electricity supply and demand to create viable price structures.[36]

Against this challenging backdrop, our research suggests that the public sector can play a vital role in boosting private sector investment in off-grid energy by creating a favourable policy and investment climate, or offering direct financial incentives in terms of subsidies, grants and concessional loans.[37] Nevertheless, the case studies in this report underscore that any attempt to design more efficient state-backed financing instruments will require careful discernment on the part of policy-makers. Public finance can be leveraged to mobilise the private investment needed to provide off-grid power in the most remote communities, but an over-reliance on subsidies can impede the development of sustainable markets.[38]

The future is millions of decentralised systems

SEforALL highlights the fact that investors do not respond to funding needs, but opportunities,[39] and the opportunities in energy access are many and growing. The Climate Aggregation Platform (CAP) argues that the energy systems of the future "will incorporate many millions of individual small-scale, low-carbon energy assets, made-up of both distributed renewable energy generation and consumer-driven energy efficiency measures".[40] The challenge will be to find ways to turn these millions of smaller systems into viable opportunities for investors.

IIED's preliminary research on aggregation has found that bundling small-scale energy projects and companies into a larger portfolio is a promising vehicle to mobilise investment in inclusive energy access. Smaller off-grid projects have limited appeal to investors, especially in a sector with high perceptions of risk. By creating large portfolios of mixed-sized projects spreading across regions and jurisdictions, aggregators can offer investors much bigger ticket sizes and help them hedge against risks associated with off-grid energy projects.[41, 42, 43]

Aggregating to overcome obstacles

The aggregators IIED reviewed operate at different stages in the value-chain to cut costs and achieve scale. Some characteristics might include: blending public and private financing; pooling company and customer demand; focusing on specific technologies or business models; and integrating functions such as capacity building needs and product standards.[44]

These aggregation functions help to overcome the many problems smaller companies face in securing finance. Investors usually overlook companies that have little track record and want only relatively small deals for capital-intensive projects – particularly when their markets, technologies, supply chains and business models can all seem fraught with uncertainty. Further, many investors still believe that cash-poor households – the cornerstone of many off-grid energy companies – are high-risk. Aggregation can help reduce both risks and costs: Consolidating companies and their assets into portfolios, and bundling small loans, can create much more attractive investments.[45]

In the case of mini-grids, for example, pooling projects can help reduce costs through wholesale purchasing and standardisation of equipment and services, and create opportunities to layer complementary forms of capital.[46, 47] Crucially, mixing highly "bankable" projects with less "bankable" projects could potentially mobilise capital for apparently riskier installations that might nevertheless deliver greater social impact.[47]

Less conventional sources of finance continue to develop. Energy4Impact (E4I) notes that the dramatic growth in crowdfunding debt and equity in recent years is likely to continue.[48] BBOXX has taken a particularly innovative approach to crowdfunding, partnering with Lendahand to raise a series of solar bonds.[49] Nevertheless, leading crowdfunding platforms such as Lendahand, bettervest, and TRINE are still financing fairly established companies – such as Azuri Technologies and Sollatek – rather than start-ups. Indeed, TRINE concedes that it has "moved towards bigger and more established partners that are less sensitive to sudden changes".[50] Though potentially a significant growth driver for the rest of the sector, crowdfunding may only be able to play a limited role in supporting seed or early stage companies.

IIED research on "aggregators"

Our research aims to support inclusive energy access by generating a deep understanding of the role that aggregation can play in unlocking additional financing for the sector, and how energy companies are using aggregators to grow their businesses. We looked at what we are calling three aggregator models:

- SunFunder, mostly operating in Africa as a commercial financial intermediary
- The Infrastructure Development Company Limited (IDCOL), a financial intermediary for funding infrastructure projects in Bangladesh set up by the Government of Bangladesh
- The Alternative Energy Promotion Centre (AEPC), a national executing agency for renewable energy projects in Nepal set up by the Government of Nepal (GoN)

Figure 1 shows their main functions, aggregating:

- Financiers into larger pots of money
- Companies into diverse portfolios of projects and companies
- Additional services beyond financing such as technical assistance
- Data and feedback to inform policies and program/ business delivery
- End-users to confirm and pool demand

As companies continue to innovate, these aggregators could play even more crucial roles in supporting early and middle stage companies, and ultimately unlocking much more financing for the off-grid sector – especially for projects serving the poorest.

Figure 1

* Amount of public finance (mostly as concessional loans) IDCOL received from various donors and DFIs, and the GoB since 2002 from data available from published sources. See detailed case study on IDCOL in Section 5.

** Total amount of public finance (mostly grants) AEPC received for several key programmes since 1996. See Table 1 in Section 5 programme specific financing.

*** Approximations

Summary Case Studies

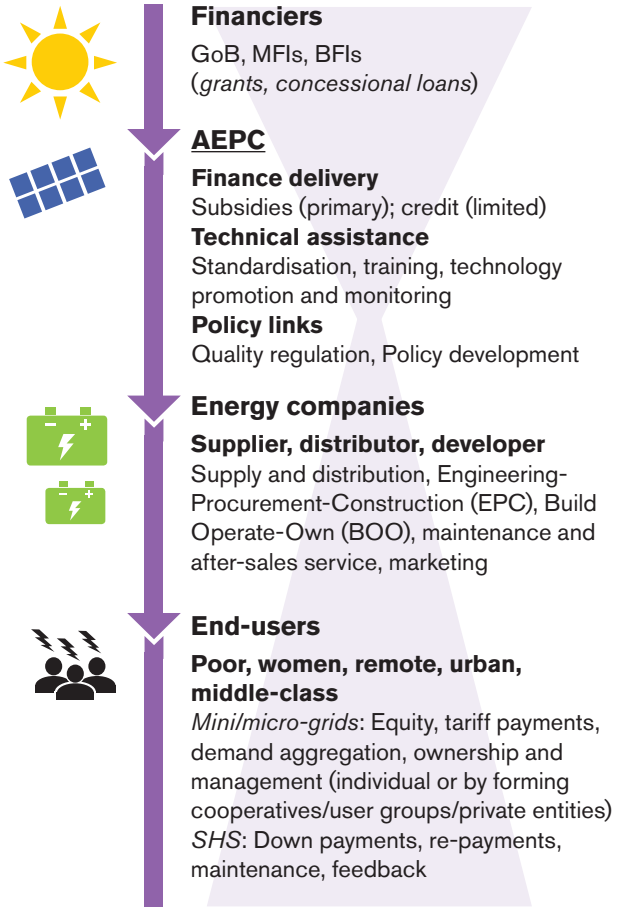
2

The following case studies are based on interviews with the three aggregators and 23 companies conducted from June to November 2018. This section builds the foundation for the analysis and recommendations that follow. More detailed case studies can be found in Section 5.

2.1 Case study 1: Alternative Energy Promotion Centre (AEPC)

The Government of Nepal (GoN) set up AEPC in 1996 as the national executing agency for the planning and implementation of renewable energy programmes. This case study examines AEPC's programme to distribute solar home systems (SHS) and community-based systems (mini- and micro-grids powered by solar or micro-hydro).

AEPC's business model

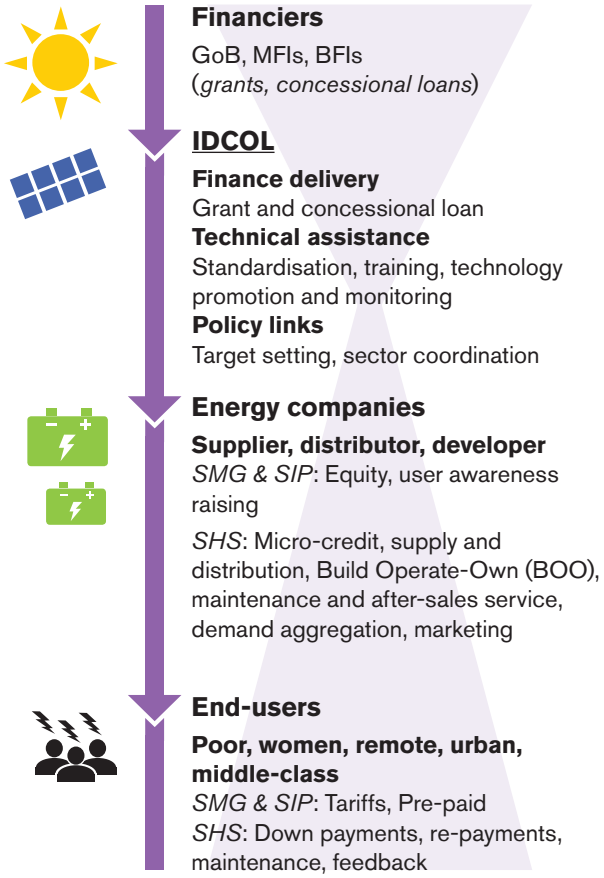


During the National Rural Renewable Energy Programme (2012–2017), AEPC received around US$80 million from GoN and about US$60 million from multiple international donors and Development Finance Institutions (DFIs). Around US$80 million from the combined total was spent on subsidies – with US$23 million of this total going to subsidies for SHS and just over US$1 million as credit. AEPC, supported by donors, set up the Central Renewable Energy Fund (CREF) to ensure better fiduciary standards for managing large funds and channel subsidies and credit to community developers and energy companies who comply with the criteria set by AEPC, international donors, DFIs and the GoN. AEPC, via the CREF, subsidised over 359,000 SHS during this period.[108] More than 35 per cent of these went to the most remote populations and approximately 45 per cent were owned by women.[51] A Renewable Energy Subsidy Policy (2013 and 2016) set the scope of the subsidies, including incentives to reach vulnerable communities. For community-based systems, AEPC worked with regional non-governmental organisations (NGOs) and local governments to aggregate energy demand from a particular community, then find an appropriate company to build a project to meet it. Under AEPC's traditional business model, companies usually build systems and then transfer ownership to communities who register as the developer. Given the many complexities inherent in the community-owned model, the Subsidy Policy was revised in 2016 to allow companies to own and operate mini-grids and receive subsidies. A more recent ADB-funded South Asia Subregional Economic Cooperation (SASEC) programme employs a new version of the community-ownership model designed to address some of the challenges. Grant funding is also used to pay for quality assurance, monitoring, reporting and technical assistance, which includes training (for AEPC staff, developers, companies and installation technicians), PUE, and mainstreaming gender and social inclusion within projects.

AEPC's market-building activities and subsidies have contributed significantly to the growth of Nepal's off-grid sector. However, a change in national governance and reduced support from international donors is pushing AEPC into a transition phase. Recent tranches of donor and DFI funding focused on mini-grids and micro-grids, is leaving a financing gap for the smaller off-grid technologies needed to reach poorer populations, notably SHS. Some energy companies are urging AEPC to develop longer-term strategies and do more to blend subsidies with credit-based instruments. Companies are also starting to undertake more rigorous monitoring to generate the data they need to respond to changing social and market dynamics. AEPC's future as an aggregator will hinge on its ability to strengthen its role in implementing credit-focused financial instruments; establish stronger impact monitoring; address inefficiencies in finance delivery and due diligence processes, and collaborate with local and provincial governments which are mandated to deliver energy at the local level.

2.2 Case study 2: Infrastructure Development Company Limited (IDCOL)

IDCOL's business model



The Infrastructure Development Company Limited (IDCOL), is a non-bank financial institution owned by the Government of Bangladesh (GoB). IDCOL uses public-private partnerships to finance SHS, solar mini-grids (SMG) and solar irrigation pumps (SIPs). Since the launch of the programme with World Bank funding in 2002, IDCOL has worked with partner organisations (POs), including microfinance institutions, energy companies and NGOs. In return for subsidies and concessionary loans from IDCOL, these POs invest equity in SMG and SIP projects – meaning they have a strong stake in its long-term success. For each SHS, IDCOL gave POs a subsidy and long term concessional loan who then provided 3-year loans to end-users.[59, 134]

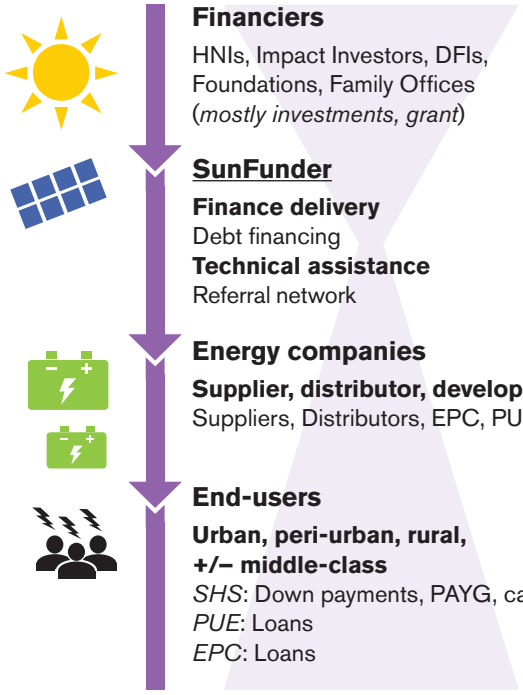
Three years ahead of schedule, the project exceeded its initial target of installing 50,000 SHS units by 2005. This early success attracted more support from multiple DFIs, donors and funds, and by 2013, IDCOL was installing an average of about 71,000 SHS per month.[52] By 2018, POs (mostly MFIs and NGOs) had distributed more than four million systems. IDCOL has since phased out its subsidies for SHS and gradually reduced concessional loans. The only remaining subsidy targets the poorest by offering US$20 for each SHS below 30 Watts. By 2019, IDCOL had invested US$696 million in the SHS program: US$600 million in loans and US$96 million in grants.[53]

However, IDCOL has faced challenges despite its impressive growth. By 2017, the number of SHS sales had plummeted to just over 4,000 per month – less than six per cent of the 2013 peak. This sharp decline was due to a combination of factors: rapid extension of the grid; an influx of generics into the unregulated market; poor loan collection by POs and the free distribution of SHS under a government-led social 'safety net' programme, resulting in high rates of customer defaults. Some of the larger Bangladeshi NGOs involved in the programme incurred such heavy losses that they are now hoping the GoB will write off their debts. To mitigate these headwinds, IDCOL has convinced the GoB to use only IDCOL-approved POs to install the SHS provided under the 'safety net' programme so they can generate cash to repay their IDCOL loans. IDCOL is also running a Collection Efficiency Improvement Programme to support POs to improve their debt collection. IDCOL has also undertaken other measures to reduce defaults, including: introducing pre-paid technologies; working with the Bangladesh Rural Electrification Board (BREB) to ensure SHS customers have settled their repayments before they qualify for grid connections; and staging promotional campaigns to advertise the higher-quality SHS sold by its POs.[54] Although there is some anecdotal evidence to suggest such measures may be helping, they have yet to be subjected to a data-driven evaluation.

IDCOL is currently focused primarily on expanding SMGs and SIPs, which it began financing with pilots in 2009 and 2010 respectively. Energy companies have installed more than 1,000 SIPs and over 25 SMGs under the programme – but IDCOL aims to reach 50,000 SIPs and 100 SMGs by 2025.[59] Given the high costs, both IDCOL and its partner companies are re-evaluating their business models and aiming for better PUE integration. IDCOL is also providing grants to fund technical and financial training for energy companies and boost consumer awareness through workshops and promotional activities. IDCOL continues to focus on implementing uniform technical standards and quality assurance, and rolling out an accreditation system – crucial for differentiating its POs in Bangladesh's lightly regulated energy market. IDCOL is now coordinating increasingly closely with other government agencies over the extension of the national grid in rural areas, and has also begun to monitor how solar markets are evolving in order to lobby for appropriate regulatory and policy responses.

2.3 Case study 3: SunFunder

SunFunder's business model



As a financial intermediary based in Nairobi, SunFunder takes investments from funds and tailors them into loan facilities for energy companies mostly operating in Africa. Established in 2012 and growing in tandem with the off-grid market, SunFunder evolved from crowdfunding, to private capital, to more ambitious structured funds – gradually diversifying its investor and company customer mix and securing larger capital raises to meet growing demand for debt in the off-grid solar sector.

While moving away from crowdfunding, SunFunder persuaded several high net worth individuals to invest, which it used to begin establishing a credible track record. This success managed to attract several foundations into structured funds, which then catalysed 11 times the amount of capital into less risky layers of the structured funds, including DFIs.[161] In a sense, SunFunder reversed the traditional blending model where public finance is usually used to leverage private capital.[170] SunFunder's structured funds have three layers to attract investors across the spectrum of risk. Investing in the 'first-loss layer' trades high-risk for high returns and this layer offers protection to the other, less risky, layers of investment (see SunFunder case study). This opens a pathway to more risk-averse investors and more money for the sector.

Between 2012–2018, the off-grid sector raised more than US$400 million in term loans and venture debt,[55, 56] of which SunFunder raised about US$62 million— or about 15.5 per cent of the total, a significant amount. Anchored by a US$25 million investment from the Overseas Private Investment Corporation (OPIC), SunFunder's latest fund close of US$42.5 million in February 2019 was its largest yet, bringing its total fund raises to an impressive US$104.5 million.[57]

By the end of 2018, SunFunder had disbursed more than 125 loans from 59 loan facilities to 44 energy companies worth a total of US$53.7 million with committed loans of US$61.7 million. This company portfolio crosses a variety of solar-based business models, products, and technologies in the off-grid and weak-grid spaces. To accommodate this variety, SunFunder tailors interest rates and loan covenants to individual business' circumstances. Most energy companies are still exploring customer value propositions and delivery models, which limits the ability to standardise methods and processes across companies.

SunFunder offers three basic loan types: inventory and working capital financing; asset backed financing; and project financing. It mainly serves energy companies that have the cash flows needed to service the principal and interest on timebound loans. This precludes many start-ups and early-stage companies. Most companies must have a proven track record and an equity-to-debt ratio that SunFunder believes makes sense for the sector.

Company customers view SunFunder as highly approachable and flexible, but companies at different stages of growth perceive the aggregator's total value differently. SunFunder remains a vital source of financing for early-stage[141] SHS and EPC companies that have established sufficient track records and cash-flows but still have few other financing options. Middle-stage[142] SHS and PUE companies said that although they valued SunFunder's flexibility and structuring expertise, they now had access to more debt options as more funders have crowded in. SunFunder has excellent relationships with the late-stage[143] SHS companies we interviewed, but these companies' longer and successful sales and finance track records allow much greater leverage to pick and choose financing options — a challenge the aggregator will need to address if it continues to seek growth through them.

"They take us as a very young baby that needs unique care" – Finance Manager in a company financed by SunFunder

To continue staying relevant in a highly dynamic market, as more non-specialist funders enter the space, SunFunder could emphasise its specialist offerings such as syndication (a group of lenders investing together), structuring expertise (eg special purpose vehicles) and local currency loans. Additionally, SunFunder's recent fund close will allow it to deploy larger loans with longer tenors – the kind of patient capital needed to fund diversification into commercial or industrial solar applications such as mini-grids. SunFunder is pursuing large programmes such as the World Bank's Kenya Off-Grid Solar Access Project (KOSAP)[58] – which will blend grant and loan facilities to target some of Kenya's poorest districts– and opens an avenue for delivering off-grid solar to underserved areas that might otherwise be impossible to reach through a purely commercial model.

Analysis

3

Although the three aggregators and their associated 23 energy companies use various approaches in different contexts, our interviews revealed a number of core dilemmas which we explore in the following pages. The Methodology in Annex X shows how we classified the companies into 'early', 'middle' and 'late' ; and how we categorised their responses into a 'few', 'some', 'most' and 'all' based on how many gave a similar reply. (Note: we did not interview investors or customers).

In this section, we begin at the aggregator level, classifying them according to their access to financiers (public and private), and exploring how they have mobilised and channelled investments. We then examine companies' own access to finance, and the non-financial costs associated with acquiring it. We also explore issues pertinent to aggregation beyond financing, such as company capacity building, and the role of quality assurance. Finally, we try to understand the impact of aggregator finance on customers.

3.1 Finance for aggregators

All three aggregators are blending finance in different ways to help build energy markets.

SunFunder has built larger investment pots by mixing investment from institutions and individuals with DFI financing. By structuring their funds in layers spread across a risk spectrum, they have further broadened the range of potential investors.

AEPC and IDCOL both pool public finance from multiple donors and DFIs into a funding model that combines consumer finance from customers and commercial equity from energy companies. This model has enabled many new local energy companies to enter the off-grid space and helped some incumbents to expand to new markets.

Grants enabled aggregators reach companies at different growth-stages, to help them grow and strengthen off-grid markets

One of the main impediments to raising money for early-stage off-grid companies are the transaction costs involved with smaller deals. Backed by public financing, IDCOL and AEPC were able to address this problem by absorbing the transaction costs of disbursements as small as a couple of hundred dollars – which proved crucial in supporting the many small companies needed to fulfil their mandates to bring energy to the most remote and vulnerable communities.

For SunFunder, a grant from the Mott and IKEA Foundations for 2017–19 offset the transaction costs associated with some early-stage companies. By the end of 2018, SunFunder had reviewed 120 Sub-Saharan Africa opportunities, while closing nine deals, and linking some smaller companies with a nascent referral network consisting of other funders, individuals and organisations capable of providing investment or mentorship.

With access to grants from donors and DFIs, AEPC and IDCOL have also sought to build increasingly robust off-grid markets, including by promoting: quality assurance; technical and financial training; monitoring; and demand aggregation. Energy companies told us that these kinds of measures had been crucial in underpinning their growth. In East Africa, one company said that support from SunFunder to streamline its financial controls had been particularly critical. However, SunFunder noted that it would not be financial viable to scale such support without further grants.

3.2 Finance for companies

The type of value an aggregator offers to an energy company varies according to a range of factors. These include: the company's growth stage; type of business model; technologies and services provided, as well as the nature of their market. A few early-stage and mostly domestic companies we interviewed found SunFunder's straight loan offerings to be the most affordable financing option. By contrast, more mature companies with international operations and longer track records were interested in more complex SunFunder offerings, such as 'special purpose vehicles'. These bigger companies were also better positioned to strike a harder bargain when negotiating loans.

SunFunder has a clear value proposition in providing debt to smaller companies in East Africa, with few other financiers in the sector able to offer affordable loans smaller than US$500,000 (though crowdfunding continues to grow). Interest rates on local currency commercial loans can be 20–25 per cent, with collateral requirements of 50–150 per cent – either in fixed assets, or sometimes cash, completely unaffordable to energy companies.

All seven companies said they had great relations with SunFunder, citing various positive attributes: flexibility; approachability; quick responsiveness; a Nairobi office; and off-grid expertise.

Since AEPC and IDCOL provide particularly attractive subsidies and concessional finance, only a few companies currently explore complementary financing options. All the IDCOL companies we interviewed said that grants and long-term concessional loans were crucial in allowing them to experiment with

new business models to deliver SIPs and SMGs. Nevertheless, some early-stage companies under AEPC emphasised the need for more innovative credit-focused financing. They said this would help develop a sustainable market; incentivise companies to improve their business models; and allow them to access commercial financing by improving their credit ratings.

''We are constrained by our current credit line (and cash position), not by our pipeline. What I need (to scale-up) are credit guarantees, climate insurances…'' (General Manager, company from Nepal).

Although many companies benefited from AEPC, some had criticisms, arguing that the agency's failure to reduce subsidies and increase credit had hindered the development of sustainable markets and undermined the sector's ability to evolve.

Despite the attractive financing packages offered by some aggregators, companies still often have to look elsewhere to bridge gaps. For example, IDCOL and AEPC both provide finance in instalments, which means most companies have to take expensive bridging loans from commercial banks. In addition, IDCOL generally requires 100 per cent bank guarantees or land mortgage as collateral for the loan portion of solar mini-grid and irrigation pump projects – even though many companies do not own land and struggle to afford the high quarterly margin fees and interest rates charged by Bangladesh's commercial banks. To assuage such problems, IDCOL has reduced its bank guarantee requirement to 50 per cent, and plans to reduce it to 25 per cent – though only for companies with a good credit record.[59] AEPC has been less responsive.

Reporting requirements can also impose additional costs. SunFunder requires either monthly or quarterly reports, and several early and middle stage companies said the cost of monthly reporting might outweigh the advantages of a SunFunder loan. Nevertheless, recipients agreed that this kind of rigorous reporting did help them maintain healthy financial systems. In contrast, more established companies report quarterly, which highlights the different circumstances companies of various sizes face in acquiring finance.

3.3 Support beyond financing

Beyond the provision of affordable finance, companies valued aggregators for supporting the aggregation of information, capacity building, and quality assurance.

The key role of capacity building

Companies of all sizes may value guidance, but such support is especially crucial for less-established companies. Since aggregators have close relationships with energy companies, they can often readily identify how company needs are evolving – and spot opportunities to aggregate responses. SunFunder used to offer limited support to companies to build their own pipeline. For example, the aggregators supported one of the companies we interviewed to establish a stronger financial management system, including by requiring the hiring of a finance director – which in turn made the company a more viable SunFunder customer. But not all companies received or needed such support, and SunFunder has moved away from the more hands-on technical support it used to offer due to the high associated costs.

In Bangladesh, IDCOL offers standardised packages of financial and technical support, while in Nepal AEPC facilitates training for SHS installers through private sector associations. Energy companies say this kind of aggregated support has ensured that the technicians who work with their systems in remote locations – often employed by independent distributors – receive adequate training. Most companies we interviewed, particularly early-stagers, said this aggregated support was vital.

Customers see benefits in investing in customer awareness raising

Investing in helping customers understand off-grid technologies helps build trust, can potentially reduce defaults, and aggregate demand – particularly among first-time users. Several innovative SHS companies financed by SunFunder are working closely with customers to boost their financial literacy to help them keep up payments on PAYG systems, reasoning that the cost of this engagement will be offset by quicker repayments and fewer defaults. IDCOL also supports mini-grid energy companies to conduct customer training – particularly in the use of energy efficient appliances. This helps manage expectations, build trust and increase customer's willingness to adopt new technologies. AEPC also helped aggregate demand for off-grid energy systems by working with local NGOs to raise awareness of renewable energy technologies in remote communities and show people how to operate them.

3.4 The key role of quality assurance

Aggregators are helping to propagate uniform product standards, which companies see as a vital part of quality assurance – although governments are still unevenly enforcing standards.

All three aggregators ensure that qualifying companies adhere to set standards in terms of business operations and product quality, which helps build end-user confidence in the market. But uneven government enforcement means that companies following standards often incur additional costs for doing business. For example, some companies importing solar equipment manufactured to a higher specification than cheaper kits available on informal markets in all three cases we studied reported facing major delays in clearing customs due to lengthy procedures, excessive bureaucracy and corruption. Neither is it always straightforward for aggregators to ensure standards are met. SunFunder assesses product quality during its due diligence process, using specifications including the Lighting Global Quality Standards (LGQS).[60] Nevertheless, our interviews confirm that companies continue to face considerable pressure from cheaper generic products, and that government standards can be unevenly enforced. One Tanzania-based company noted that it was facing significant extra delays and costs in satisfying the Tanzania Bureau of Standards (TBS) requirements for products that were already certified under LGQS.

Besides requiring its companies to meet certain criteria, AEPC has set guidelines and standards for installing micro-hydro mini-grids and specific technical standards for SHS. AEPC also certifies components and products through a national testing centre which enforces government-determined standards. Some energy companies pointed out, however, that these quality assurance processes are starting to look obsolete and lack effective measures to verify that equipment is properly tested and installed. Poor-quality products are still being allowed through AEPC's subsidy programs, undermining customer confidence.

With no national regulations in place in Bangladesh, IDCOL has set up its own technical standards and testing procedures for projects it finances. However, companies we interviewed pointed out that generics and government giveaways through the 'safety net' programme continue to undercut IDCOL's SHS programme. To try and mitigate these problems, IDCOL has persuaded the GoB to distribute its SHS through IDCOL-approved POs and use IDCOL's quality assurance systems. This has helped to safeguard product standards and provided an extra source of cash for POs who lost revenue due to the 'safety net' programme (see cases studies in Chapters 2 and 5).[52]

3.5 Deeper than data: Keeping the focus on the customer, and the poorest

The impact data gathered by all three aggregators tends to provide only a partial picture of what is happening on the ground. IDCOL and AEPC both use metrics such as the number of households reached or the number of systems sold primarily to report back to investors and for external communications. However, such 'proxy indicators' alone cannot reveal which energy services are reaching specific market segments, or – more importantly – flag the places where people are still unable to afford off-grid systems.

Our analysis of data from AEPC on subsidies disbursed for SHS show that more than 35 per cent of subsidies for SHS during 2012– 2017 went to most remote areas.

For example, AEPC's data provides little nuance in terms of how the off-grid market has evolved over time or insight into which kinds of customers have reaped the benefits. Although AEPC figures show that more than 45 per cent of subsidised SHS were purchased by women, these figures give scant insight into if or how women are actually using them.

According to IDCOL, its SHS programme installed more than four million SHS serving approximately 18 million rural people living in off-grid areas in Bangladesh.

Like AEPC, IDCOL makes only limited use of impact data to analyse market trends. Although IDCOL commissioned an independent impact study to inform the shaping and phasing out of SHS subsidies, there have been no subsequent assessments to ascertain the impact the phase-out may have had on poorer groups of potential customers.

SunFunder says that it has impacted 4.6 million people and avoided 412,000 tons of CO_2 annually.

SunFunder uses the GOGLA impact metrics, which are mostly formulas derived from product sales and assumptions about the 'average' customer. All of SunFunder's loan contracts stipulate that companies share impact metrics. While it can confirm unit sales when reviewing a company's financial reporting, the

companies we interviewed said that SunFunder did not explicitly verify impact metrics with them. This means that a company can pay back the loan through other revenue sources, but not necessarily sell the exact units tied to the loan, which highlights a lag or disconnect on verifying impact metrics. However, SunFunder stated that it is working hard on a more nuanced impact metrics framework that may alleviate some of these concerns.

Indeed, momentum is building across the sector towards establishing more granular impact metrics. AEPC and IDCOL have both started to conduct baseline surveys and long-term impact studies for mini-grid projects to meet donor reporting requirements.

Targeted financial instruments, such as subsidies, have incentivised companies to expand into rural and remote communities.

The AEPC program successfully leveraged Nepal's Subsidy Policy to encourage companies to serve the most remote communities, according to the companies we interviewed. IDCOL's subsidies worked to similar effect – an independent study[96] found that around 80 per cent of smaller SHS systems (less than 30 Watts) had indeed reached poor households. IDCOL provides additional subsidies to fund SMGs and SIPs in rural areas where near-term grid extensions look unlikely.

In East Africa, by contrast, few if any SunFunder companies are reaching the poorest or most remote communities, suggesting that commercial models may be insufficient to roll out truly inclusive off-grid access. For example, several of the companies we interviewed said that their customers probably live on US$4–10 per day – above the World Bank's poverty threshold of less than US$2 per day.

Companies know the value of collecting and analysing customer data, but many business models carry few incentives to do so.

The extent to which companies value data collection varies according to factors including their business model, investor requirements, and other interrelated incentives. For instance, AEPC's subsidy model does not require contracting companies to collect or track impact data metrics. Only a few of the companies we interviewed that rely on non-AEPC investment said that they use such data to inform their own business plans. The situation is different in Bangladesh, where IDCOL mixes subsidies and long-term loans with project equity from companies. This equity stake provides an incentive for companies to monitor and analyse the customer base for their SMGs and SIPs more closely. For instance, some companies we interviewed are actively seeking ways to integrate PUE into their business models to build further demand for their services.

"Customer data is currently not used for our other business decisions. We would like to- we could provide micro-entrepreneur loans for women, small crop loans, micro insurance- if we have a pilot for these things- our data will come in handy. But we are still starting." (Executive Director, company from Bagladesh)

Accordingly, off-grid companies in Bangladesh are starting to see the value of collecting more customer data to inform their day-to-day operations. One IDCOL-supported SHS company said that if companies could monitor changes in customers' ability and willingness to pay for off-grid systems, they could adapt their payment plans in response. PAYG, by contrast, can generate many more customer data points more easily – especially if data streams from the home systems are combined with other sources, such as information obtained when they were purchased, satisfaction surveys, feedback from call centres, and so on. Some SunFunder customers are using this information to test algorithms designed to gauge customer credit-worthiness and establish customer 'archetypes' to better target and design products. And all of them are looking for ways to monetise the financial data they gather on their customers, while also supporting initiatives such as GOGLA's consumer privacy code to help address any privacy or security concerns.[61] Non-PAYG SunFunder companies collect in-person or phone-based and text-based customer satisfaction surveys, take baselines, and even publish case studies. This information helps them modify their products and services and market themselves to investors.

Recommendations and ways forward

4

We have explored the aggregators across several themes: mobilising and channelling finance, providing support beyond finance, and collecting data to understand and serve different types of customers better, particularly the poorest and most remote. Section 4.1 contains recommendations to help the three aggregators learn from each other. In Section 4.2, we offer eight recommendations to help boost investment in the off-grid sector based on lessons learned.

4.1 Aggregators: The way-forward

Although the three aggregators have unique characteristics and operate in three very different markets, which are themselves constantly changing in response to political and economic drivers, it is possible to identify several unifying principles for aiding faster growth.

Assess market dynamics and respond rapidly

As a commercial aggregator, SunFunder is subject to market forces that mean it has to constantly evolve or run the risk of going out of business: the need to attract investors and deliver healthy returns; competition from other finance providers; and the changing needs of energy companies. In contrast, AEPC and IDCOL, are funded by public money – mostly through long-term grants or concessional loans. This lack of competition dilutes their incentive to monitor markets, innovate, and evolve their business models rapidly.

AEPC and IDCOL should build more of the positive aspects of market dynamics into their programmes. These could include establishing effective feedback mechanisms, such as regular stakeholder meetings and end-user surveys. Donor-driven or DFI-driven targets do provide an incentive to measure certain performance indicators, but the resulting data is not necessarily harnessed to respond to changes in market conditions or reach more customers. AEPC and IDCOL should develop the means to conduct the kind of comprehensive studies needed to design and pilot viable new financial instruments and update policies as markets develop.

Enter new market segments, and keep the focus on the poor

A range of factors have helped AEPC and IDCOL to succeed in reaching poor communities: clear mandates; access to public finance (including for subsidies); political buy-in at the national level, and a combination of pressure and support from donors and DFIs. SunFunder, by contrast, must deliver investor returns.

Since SunFunder assesses companies primarily on the basis of their ability to repay loans, rather than serve the poorest customers, it is unlikely to serve the most remote communities through a purely 'business as usual' approach. Recognising this dilemma, SunFunder has started to forge innovative partnerships to provide more inclusive access to energy.

For example in late 2018, SunFunder was awarded management of the debt facility in the World Bank's KOSAP programme, which will target 14 underserved counties in Kenya. The programme provides a results-based financing facility (RBF) that offers incentives to companies venturing into marginalised areas.[62] Although the model mirrors IDCOL's strategy of mixed financing, it also contains additional design choices – including separate entities managing the debt (SunFunder) and grant facilities (by an international NGO – SNV). The World Bank's decision to provide part of the money via loans to the Kenyan government could also bolster political buy-in to off-grid solar. Experience from Nepal and Bangladesh shows how political buy-in can create the enabling environment needed to bolster off-grid markets. A promising programme, SunFunder's involvement in KOSAP is a clear sign of the aggregator's willingness to innovate and provides a pathway for reaching communities in areas that a purely commercial model could not reach.

Despite their success in reaching the poor, AEPC and IDCOL need to make a continuous effort to monitor and adopt their approaches to changing social and market trends to ensure that investments are reaching the targeted groups.

Have long-term strategies, targets and diverse finance mechanism for mobilising public finance

Shared lessons: IDCOL and AEPC have much to teach one another

With both AEPC and IDCOL mobilising public finance to provide subsidies or concessional credit to the off-grid sector, there is ample scope for them to learn from each other on how best to leverage these flows to mobilise greater private sector investments and diversify their business models.

For example, AEPC could learn from IDCOL's success in mobilising substantial credit to finance off-grid systems for poor or more remote communities. Although AEPC had aimed to provide a balance of credit and subsidies, its persistent dependence on the latter has undermined the development of viable off-grid markets. IDCOL, by contrast, has managed to cut subsidies for SHS much more aggressively by providing companies with appropriate support and setting clear phase-out targets. IDCOL has also introduced a much more effective model for developing SMG and SIP projects

by offering energy companies a mix of grants and concessional loans to encourage them to invest equity in a particular project. Since companies hold ownership in these projects, they are far more likely to undertake crucial tasks such as maintenance, impact monitoring, innovation for PUE, and customer engagement. IDCOL, in turn, provides technical training for companies and engages end-users with awareness raising activities, which has helped build confidence among customers. AEPC, by contrast, mostly provides subsidies directly to communities. Community members band together and register as a community developer which can be in the form of a local community group, cooperative or a private entity. They then apply to AEPC for a subsidy, and work through AEPC to contract a private company to build and service the project. The community puts in a mixture of sweat equity and cash, and may also seek grants from the local government or NGOs. While this model has contributed to significant growth – particularly in the micro-hydro mini-grid market in Nepal— it is fraught with complexities. An over-reliance on grants can delay projects; communities may be tempted to set impossibly low tariffs; and projects can serve as lightning rods for community tensions. For instance, some micro-hydro mini-grids end up severely under-utilised. These risks make it much harder for the community developers to access credit from banks or other financial institutions.[63,64]

AEPC could possibly overcome some of these problems by adopting IDCOL's successful approach and channelling more of its support directly to energy companies, and encouraging them to provide equity. Not only are such companies much better placed to raise credit from banks than community associations, but their roles as builder-owner-operators gives them a much greater stake in a project's long-term success. AEPC took a step in this direction in 2016 by revising the subsidy policy to allow private companies to own mini-grids and receive subsidies. Donors have also taken note: A World Bank-backed mini-grid programme under AEPC aims to direct finace to private developers (see detailed case study in Section 5), while the ADB-supported SASEC mini-grid project seeks to address some of the challenges associated with community-model. AEPC could go further by adopting IDCOL's strategy of setting clear targets for rolling out renewables and using more innovative business models to leverage private sector capital.

In turn, IDCOL could potentially borrow elements of AEPC's community owned model to achieve its targets for expanding access to SMG and SIP. Energy companies are often reluctant to commit the large equity stakes needed to scale up such systems. IDCOL could possibly plug this gap by aggregating many small equity stakes from customers – and AEPC's experience with the complexities of community-ownership could provide useful pointers.

4.2 Learning from aggregators: Recommendations for sector-wide stakeholders

In the light of our studies of the three aggregators, we offer the following recommendations:

Mobilising and channelling finance

1. More public finance should be channelled through a diverse range of instruments that are tailored to specific contexts, target new markets, and experiment with new technologies and business models.

While the companies we interviewed were unable to reach the poorest using market forces alone, they have shown how public money can be harnessed to finance the successful provision of off-grid energy to some of the most remote communities in Bangladesh and Nepal. Their experience suggests that public finance should not necessarily be considered a short-term instrument but structured to serve a long-term vision of building a sustainable off-grid market.

Donors, investors, and aggregators should deepen the use of targeted financial instruments to reach specific market segments or regions to establish a self-sustaining market. For example, ZOLA Electric used US$6.1 million in grants,[65] and M-KOPA received US$9 million[66] to develop new technologies and business models in their crucial early stages. Nevertheless, there is still nowhere near enough public finance to continue to support the pipeline of thousands of companies that will be needed to reach SDG 7, and governments will have to make much bigger commitments to achieve that goal in partnership with the private sector. Channelling more public finance through aggregators or directly to companies in a coordinated manner (see Recommendation 7 and 8) will help catalyse the faster development of off-grid markets. In addition:

- Governments can galvanise greater political will to support off-grid energy by taking a direct stake in projects – through loans or equity.
- Energy policy makers should provide regulatory frameworks, quality assurance and risk mitigation options that will encourage commercial banks to develop affordable financing products for energy companies.

- Governments can use financial incentives to encourage specific energy goals, such as fostering the development of domestic companies. For example, a 20-year tax holiday and reduced import duties for renewable energy in Bangladesh enabled local companies to invest in the off-grid market.[134]

Subsidies must be efficient and targeted to avoid being counter-productive. Lessons learned from AEPC, IDCOL, and others – including Brighterlite in Myanmar[67] – show that subsidies are more likely to shape sustainable markets if, they are:

- Designed appropriately for local contexts and market conditions, such as interest rate regimes
- Available over an extended period (such as at least five years) with a clear process, timeline, and communication strategy for phase-out
- Adjusted in the light of impacts and market changes, which are tracked continuously
- Structured according to commercial principles to avoid crowding out existing private sector investment
- Delivered in a timely fashion to avoid cash flow bottlenecks
- Clearly defined in terms of their target demographic – and stick to those targets
- Include and implement standardisation processes for quality assurance
- Offer support beyond finance

2. More data should be channelled, packaged, and shared to help stimulate market growth.

Having developed a keen familiarity with the dilemmas facing off-grid companies – beyond a narrow focus on their financials – the three aggregators are uniquely positioned to support the broader needs of both developers and their customers. For example, SunFunder adjusted its fundraises in response to feedback from companies who needed to secure bigger loan offerings and longer payback periods. Both AEPC and IDCOL coordinate with the private sector to lobby governments over policy and regulatory changes.

Data aggregation can take many forms: one company cited the company case studies in SunFunder's annual report as a valuable source of market intelligence. More regular information sharing could help diffuse hard-won lessons and make an aggregator even more valuable to its customers. Aggregators could collate information on market trends; business dynamics; sector perspectives; loan usage and other data from individual companies (with their permission); and regularly share it with sector stakeholders. In addition, both investors and companies should be bolder in the amount of financial and technical data they share to help the whole sector refine strategies and spot risks.

Companies could also do much more to harness customer data from PAYG and prepaid meters to find synergies with the banking sector. Since such data is usually non-transferable, any customers who change suppliers often lose out on a potentially valuable source of credit history that they might otherwise have leveraged to gain access to formal financial services (though examples of this are elusive). Social impact-oriented projects such as BrightLife, FINCA Uganda, and Financial Inclusion on Business Runways (FIBR) in Uganda are experimenting with ways to offer customers with a solid track record of paying for solar home systems access to savings accounts or loans, streamlined using the PAYG technology.[68] Equally importantly, companies should make it easier for customers to switch suppliers by ensuring that data is easily transferable using standardized, encrypted protocols.

3. Financial instruments should be coupled with grant-funded capacity development initiatives — particularly for early-stage companies to build the pipeline.

Our research shows that many companies seek external support to optimise business functions and build capacity, but this task is much easier for larger companies. Aggregators can play an important role in identifying capacity gaps within energy companies and facilitating a response, particularly for smaller companies:

- Light-touch measures could be implemented immediately by commercial aggregators at little extra cost. For example, SunFunder could leverage its due diligence process to give basic technical assistance to companies.
- More comprehensive capacity building requires grant funding over the longer term. Crucially, any capacity building programme should be based on an extensive multi-year vision and commitment, including mentorship and network access. In this vein, IDCOL uses its grants to deliver technical and financial training by international experts to companies entering the mini-grids market.

Our research suggests that SunFunder could leverage the extensive due diligence it does on a company's cash flow, business model, debt repayment mechanisms and so on to help a company improve its financial management. SunFunder is now considering how it could provide basic capacity building support by presenting the data it gathers to companies in a more systematic way.

Our findings suggest that donors,[69] DFIs,[70] governments and philanthropic organisations should dramatically increase funding for capacity building programmes – particularly among early-stage and domestic companies – since they will be crucial to developing the kind of

company pipelines capable of reaching SDG7. While not all companies that receive this kind of support will succeed, sharing the lessons they learn will help others to thrive.

4. Access to finance should be contingent on complying with standards and quality assurance procedures derived from a consultative process.
AEPC and IDCOL play important roles in establishing and harmonising standards by making their financial support contingent on meeting their technical specifications. SunFunder also supports uniform standards by only accepting companies who offer verifiably high-quality or certified products. Policymakers and companies should also explore how best to standardise products, and some public and donor funding should be devoted to piloting cheaper and more effective ways of managing the 'fake' product problem, such as through raising consumer awareness or by certifying distribution chains. Aggregators can continue to support such efforts by building on their due diligence processes and lobbying government.

In general, standards should:

- Seek standard equivalency as much as possible to prevent unnecessary recertification
- Have clear customs border policies and communicate them clearly, with a rapid appeal process
- Explore and test alternative/complementary approaches such as registering certified actors in the supply chain in an online database (suppliers/distributors/retailers/technicians). Make customers aware of this system with an easy to use suggestions/complaints feedback mechanism
- Be developed in consultation with government bodies and industry associations
- Be periodically reviewed incorporating feedback from stakeholders (end-users, private companies, government bodies, and so on)

Understanding the customer

5. Investors, aggregators, and companies must work together to establish better metrics that give a richer understanding of end-user experiences and impacts.
Experience from AEPC shows that a failure to understand underlying social and cultural currents, and to monitor changes in affordability, can lead to end-user defaults and force companies to shed staff. Several of the micro-hydro mini-grid companies we interviewed noted how business had dwindled significantly due to delays in communities providing the promised equity – which can take up to five years to materialise. In Bangladesh, generics and government giveaways have undermined end-user perceptions of IDCOL's SHS program, vastly reducing repayments and system uptake. Experience from East Africa suggests that companies usually only start to chase defaulting customers if they default when they are already several months into their contract. Richer, earlier engagement could prove valuable insights that would allow companies to finesse their strategies for maximising repayment.

There is also great scope for improving data collection. Most monitoring and impact frameworks measure data points such as unit sales, numbers of connections, or remoteness. But these 'proxy indicators' provide only a partial picture. Customer experience should also be evaluated in terms of income generation activities; seasonality of income; household expenditures and other socio-economic factors. Individual tastes and cultural values should also be taken into account, specifically:

- Financiers and donors should fund and push for deeper but efficient metrics
- Energy companies should invest in understanding their customers and monitoring changes that might affect them
- Researchers, practitioners and planners working in off-grid energy access should use tools (such as the Energy Delivery Model)[71] and work with companies and community organisations to develop practical ways to collect and analyse more granular impact data and evidence

Although there is no doubt that consistent time series data can help companies refine their business models and inform policy and practice, more dialogue and advocacy will be needed to persuade stakeholders that these impact metrics can be used to open new markets. Nevertheless, there will always be a trade-off involved in weighing the value of more data against the resources needed to collect it: A smaller range of consistent metrics may often represent the optimal choice.

6. Better impact metrics should be used to target investments, policies, business models, financial instruments, and products to reach the poorest. Market forces alone will not suffice.
Although it may be comforting to imagine that merely financing solar companies will automatically help the poorest, our research suggests that this is not the case. No purely commercial model has so far proven capable of reaching the poorest customers in the absence of significant state-backed incentives. Investors who want to make a tangible difference for the most remote and vulnerable communities in Africa and Asia may have to show considerable patience and be prepared to accept only modest rates of return, at least in the initial stages. Nevertheless, progress will accelerate if:

- Policymakers and financiers work with energy companies to better understand the incentives needed to deliver these solutions to specific market segments
- Third-party researchers verify impact numbers to reduce the risk of counter-productive hype
- Investors, donors, and aggregators provide rewards (financial or otherwise) when energy companies hit their targets
- Industry associations (or aggregators) ensure that aggregated company data is collated to support national-level decision-making

Strengthening coordination

7. Coordination must be strengthened between financiers, private, and public sector actors.
To further the development of viable markets, donors and DFIs should align their investment strategies and coordinate with key market enablers such as aggregators and private sector actors to reduce the risk that separate initiatives might undermine one another and the off-grid sector as a whole. For example, the Entrepreneurial Development Bank (FMO) and OPIC appear to have set themselves up as both a supporter and competitor of SunFunder by investing in the aggregator while simultaneously financing some of its customers. (see in-depth SunFunder case study in Section 5). Brighterlite's experience in Myanmar shows how uncoordinated programs can adversely impact commercially oriented off-grid companies.[70]

To take another example, the Bangladesh government's decision to distribute free SHS as part of its 'safety nets' programme significantly undermined IDCOL's concessional finance model. Not only did this reduce the demand for IDCOL-financed SHS, it also undermined payment collection by POs when customers – seeing kits being given to others for free – refused to pay back loans they had taken to purchase their own kits.[52, 72]

Energy companies providing mini-grids in all three contexts emphasised the need for proactive coordination between government and the private sector – including opportunities to discuss policies and market dynamics in forums free from political interference. In Tanzania, our interviews revealed that developers received unexpected letters from the government in 2018 indicating that the grid would soon arrive in their prospective off-grid sites. While useful as information, it also highlights a lack of coordination in the sector that created considerable uncertainty for companies and their investors. IDCOL is now working with on-grid planners to identify mini-grid proposals that make the most sense, while lobbying the government to consult with the private sector on feed-in tariff and net-metering policies for when the grid does eventually arrive.

8. Special purpose platforms could be established at the national or provincial level to allow market players to react quickly to market changes.
Special purpose platforms could be created to bring together different government agencies, energy companies and civil society groups to assist coordination and create a space to test new approaches in dynamic market conditions. Such platforms would:

- Pool current thinking on barriers, issues, and opportunities
- Research information gaps, including seeking a better understanding of impacts
- Provide a space to test tweaks to financial and policy instruments, and group other supporting functions such as capacity building and quality assurance

The aggregator itself could serve as this kind of special purpose platform in some contexts, or form one of its pillars alongside private sector organisations.

In Bangladesh, a number of off-grid stakeholders flagged the need to adopt a coordinated, proactive approach to identifying barriers to faster growth, including by establishing a 'sandbox' environment to test policy and financial instruments. IDCOL could play a key role here, but does not directly have the mandate to revise policy or regulations – which is the responsibility of the Sustainable and Renewable Energy Development Authority (SREDA). Nevertheless, IDCOL could still work towards establishing a useful platform by expanding its own mandate and cooperating more closely with the private sector.

Nepal's new federal structure has given AEPC an opportunity to reinvent itself by playing a stronger role in coordinating activities to promote the off-grid sector at the various levels of government. While donor and DFI finance will continue to flow to the federal Ministry of Finance, the GoN is planning to channel a greater proportion of its subsidies for off-grid energy through local governments who may nevertheless have little understanding of the sector or ability to track the financing of complex projects. AEPC could use its provincial offices to establish special purpose platforms to facilitate greater coordination and ensure that new policies and financial instruments are tailored to local contexts and tested before being scaled. The platform could engage closely with private companies, who tend to have provincial branch offices and help local governments champion their successes to attract more finance, and share lessons with other provinces. In Tanzania, the Energy Change Lab[73] convenes stakeholders to improve the financial viability and

customer experience of mini-grids by exploring new ways to harness the energy they provide for income-generating activities. Combining coordination and dialogue with practical experimentation, the Energy Change Lab is popular with the sector, but is not designed for financing or regulatory links. There will be many other opportunities for aggregators to create special purpose platforms by partnering with government, dynamic individuals from the private sector and funds such as the Energy Entrepreneurs Fund (EEF),[74] the United Nations Capital Development Fund's (UNCDF) CleanStart Program,[75] Zambia Beyond the Grid (ZBTG)[76] and many others.

4.3 Looking Forward

Aggregation in the off-grid solar market will be a critical avenue to unlock the investments needed to finance the millions of small, decentralised energy systems needed to achieve SDG 7. Our research has shown how investing public funds can catalyse the kind of private investment that will be needed to fund a dramatic expansion in the off-grid sector – particularly to support smaller companies that would otherwise struggle to secure capital. Nevertheless, much more needs to be done by investors, donors, aggregators, and governments to build the company pipeline and nurture smaller companies with long-term business and capacity development programmes, coupled with mentorship and guidance. To achieve the necessary growth, the sector will need to further develop the mix of financial instruments, such as repayable and convertible grants, loan guarantees, grants, impact-first investment and longer-tenor loans that can deliver crucial early-stage and patient, affordable capital. These finance delivery mechanisms must be able to evolve according to the needs of the market, including increasing productive use by customers. Further research could help identify potential new aggregation mechanisms to spur the necessary growth in the off-grid market, particularly for small and early-stage companies.

This report has built on IIED's previous work exploring financing for off-grid and cookstove markets – including delivery models which target poor and remotes communities;[77, 78, 79, 80] opportunities for unlocking more finance into off-grid energy[81, 82, 83, 84, 85] and approaches for integrating inclusive energy access in off-grid energy.[86, 87]

IIED intends to conduct further research on aggregation's potential for the off-grid sector as well as measuring impacts aiming to quickly grow an evidence base vital to bringing the goal of energy access for all by 2030 within reach.

Detailed case studies

5

5.1 Case study 1: Alternative Energy Promotion Centre (AEPC)

The drive for an aggregator: A national executing agency for renewable energy

The Government of Nepal (GoN), bilateral and multi-lateral donors, and DFIs have supported Nepal's renewable energy sector for several decades. The Alternative Energy Promotion Center (AEPC) was established in 1996 as the central government agency to integrate renewable energy[88] programmes under a single umbrella institution.[89] Initially set up under the Ministry of Science and Technology, AEPC now sits under the Ministry of Energy, Water Resources and Irrigation following the federalisation of the GoN in 2015.

AEPC acts as a technical and financial intermediary that pools public finance from the government and international donors, then channels investment into renewable energy projects via other financial intermediaries (banks and micro-finance institutions), service providers (energy companies and civil society organisations) and energy developers (communities that form user groups, cooperatives or private entities). AEPC's broader mandate also includes formulating and supporting the implementation of policies and planning, quality assurance, technical support, monitoring and coordination.[90, 91]

Channelling finance

Pooling public finance

The creation of AEPC and the GoN's strong commitment persuaded international donors to back several energy programmes from the mid-1990s that used subsidies to jump-start Nepal's off-grid renewable energy market.

Our case study draws on data derived primarily from the recently completed National Rural and Renewable Energy Program (NRREP), set up as a single programme modality with funding from multiple international donors. Our study also touches on approaches used in the more recent South Asia Subregional Economic Cooperation (SASEC) programme. Table 1 presents the funding pooled for some of the key programmes implemented by AEPC. For these key programmes, AEPC has received around US$350 million from multiple donors, DFIs and the GoN since 1996.[92]

Under the NRREP, the Central Renewable Energy Fund (CREF) was set up as a financial mechanism to ensure the effective delivery of subsidies and credit to the renewable energy sector, and strengthen fiduciary risk standards. CREF is embedded within a commercial bank (known as the handling bank) and provides subsidies and loans to energy companies through several other commercial banks.

Subsidy as a financial instrument

Subsidies have long been central to the development of renewable energy in Nepal, and AEPC adopted them as its primary financial instrument. The GoN and donors acknowledge that extensions to the national grid were not going to reach many of the poorest and most remote populations in the near-tem, and saw subsidies as an obvious way to help such communities offset the upfront costs of off-grid services. The goal was not only to increase access to energy, but stimulate the development of an off-grid market that would encourage the private sector to venture into these new market segments and regions.

Policies to guide subsidy delivery to targeted end-users

The GoN introduced the Renewable Energy Subsidy Policy and a supporting delivery mechanism in 2000 to guide and structure AEPC's subsidy disbursement. In 2006, the GoN adopted a Rural Energy Policy aimed at promoting off-grid renewable energy, backed by the Subsidy Policy for Renewable Energy (2013) and the Subsidy Delivery Mechanism (2010). These policies provided direction and implementation guidelines aimed at increasing off-grid provision for the most remote and most socially disadvantaged people, including women-headed households. The policy was revised in 2016 when it became clear that phasing out subsidies had not mobilised as much credit and commercial investment as had been hoped. The policy now extends subsidies to energy companies who can own, operate and manage off-grid energy systems – an evolution from the initial community-ownership model. In order to improve revenue generation from micro-hydro mini-grids, the new policy also allows larger scale PUE, such as for hotels and agricultural processing, which previously did not qualify for subsidies. The government has given CREF a mandate to both raise money to fund subsidies and to provide credit and credit guarantees to attract private investment.[98, 99, 100, 109]

Table 1. Public finance AEPC received for six key programmes

NAME OF PROGRAMME	SOURCE OF FINANCING	TOTAL PUBLIC FINANCE AND GON CONTRIBUTION- USD- MILLION
Energy Support Assistance Program (ESAP I and II) 1999–2011[92]	Grant financing from Denmark, Norway, Germany and UK, and the GoN	92[93] (7% GoN financing)
Rural Energy Development Programe (REDP) 1996–2011[94]	Grant financing from United Nations Development Programmeand World Bank (WB)	32.4
NRREP (Including RERL) 2012–2017[108]	Grant financing received from: ▪ GoN ▪ Bilateral donors: Norway, Denmark, UK, Germany ▪ Mutilateral DFIs: WB, Asian Development Bank (ADB) ▪ Other institutions and funds: SNV, United Nations Capital Development Fund (UNCDF) etc	141 (57% GoN financing)
SASEC 2016–2022[107]	▪ Credit line of US$5 million from Asian Development Bank's (ADB)s Special Funds ▪ Grant of US$11.2 million from the ADB administered Strategic Climate Fund (SCF) ▪ Around US$10 million from GoN for subsidy and tax incentives	26.2 (37% GoN financing)
Renewable Energy for Rural Livelihoods (RERL) 2011–2019[95]	Grant financing from GoN, UNDP, Gloal Environmental Facility (GEF), Norwegian and Korean Development Banks	59 (50.5% GoN financing)
Micro Hydro Debt Fund 2010–2019[108]	Grant financing from GIZ	1.5[93]
Scaling Up Renewable Energy Programme (SREP) 2014–2019[108]	Grant financing from the WB and GoN	14.9 (47% GoN financing)
Private Sector-Led Mini-Grid Energy Access Project 2019–2023[92,97]	Grant financing from the WB and GoN with expectation to leverage US$3.6 million from private sector (energy companies)	13.61 (44% GoN financing)

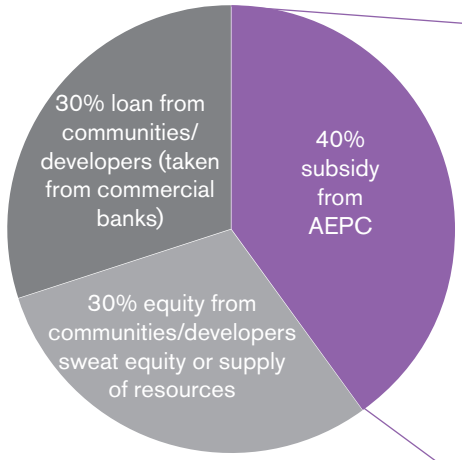
The Subsidy Policy 2016 outlines the level of subsidy available for different types of technologies, with higher awards compensating for the higher transport costs associated with projects in remote areas. Subsidies are usually issued in instalments. Figure 2 presents these as rough estimates from the model used in NRREP.[99, 101]

According to our analysis of SHS subsidies issued by AEPC during NRREP (a total of more than 359,000 SHS systems installed), over 35 per cent of these went to some of the most remote areas with low income households and 64 per cent went to more accessible areas where households were still not grid-connected.

Delivery of subsidies

During the NRREP programme, AEPC disbursed around US$80 million (over NPR 7 billion Rupees) via CREF as subsidies to end-users or communities

Figure 2



SUBSIDY INSTALMENTS FOR MINI-GRIDS AND MICRO-GRIDS	
10%	Advance payment
10%	Following bank guarantee from developer
50%	Following equipment delivery from energy enterprise
20%	Following power output test
10%	After 1–2 years following after sale and guarantee checks

SUBSIDY INSTALMENTS FOR SOLAR HOME SYSTEMS (SHS)	
90%	Following subsidy installation and checks
10%	After 1–2 years following after-sales and guarantee checks

through energy companies. SHS received around US$23 million of this figure as subsidy and just over one million as credit; micro-hydro mini-grids received around US$30 million in subsidies and just over US$200,000 as credit.[108, 102] The subsidy disbursed on a single occasion ranged from US$520 (NPR 50,000) to US$200,000 (NPR 20 million), varying according to the type of technology, project size and number of installations. The transaction costs are primarily paid by partner banks from the interest generated by the pooled financing. Companies sometimes pay a nominal (NPR 30) fee per transaction.[103]

Under NRREP, AEPC used two different subsidy delivery processes based on the type of systems installed. Subsidies usually covered 40–50 per cent of capital costs for mini-grids and 40–75 per cent for SHS:[99, 100, 101, 103]

1. *Community based systems such as mini-grid projects:* NGOs known as Regional Service Centre (RSC)[105] or the local government aggregates energy demand from a local community, which registers as a developer. Following feasibility studies, AEPC puts out a tender to install the project in line with procurement guidelines set by the government and donors, then facilitates the contractual agreement and subsidy payments. In Nepal, these systems are mostly owned and managed by communities who form and register as a community group, cooperative or a private entity.
2. *Stand-alone systems such as SHS:* Energy companies undertake market building activities to build demand and sell the systems to customers at the market price minus the subsidy set in the subsidy policy. The company applies to AEPC to claim the subsidy payments after installing the systems.

Although widely used in Nepal (which has installed more than 2,000 micro-hydro systems since the late 1990s), AEPC's community-ownership model has faced many challenges including weak legal agreements in loose community groups; significant delays in collating equity and loans for projects, which are often covered by additional grants from local governments or NGOs; unsustainably low tariffs; a lack of PUE; and poor civil engineering standards.[100, 101, 106, 103] More recent AEPC programmes have attempted to address these challenges.

Under the SASEC programme, project developers receive both a subsidy and credit to deploy mini-grids. Energy companies competitively tender to build and install the systems and provide civil engineering – a contrast with the previous practice in which the community would provide sweat equity. The mini-grid subsidy is approximately 60 per cent of the capital costs for hydro and 90 per cent for solar. The remaining capital costs are covered through a combination of credit from AEPC and additional loans and equity from the developer themselves. These developers are now required to be registered either as cooperatives or private entities.[106, 107]

Phasing out subsidies

Although NRREP's goal was to mobilise credit and gradually reduce subsidies, the programme lagged woefully behind in terms of its target of 50:50 mobilisation of credit and subsidy. In fact, only 1.8 per cent of subsidies were mobilised as credit during NRREP, due mainly to a combination of delays in setting up the CREF mechanism and amending the subsidy and credit delivery mechanism; low appetite among commercial and partner banks to extend credit to rural communities or invest in rural off-grid systems due to high perceived risks; continuous demand from

stakeholders – including companies – to increase subsidies; and the lack of capacity and drive to establish mechanisms to assess the barriers to greater credit allocation or the re-allocation of existing loans. Other ongoing programs such as the Micro-hydro Debt Fund and SASEC have had a stronger focus on credit mobilisation from the outset and are attempting to address these challenges. The CREF's role in credit mobilisation is also being strengthened.[106]

Support beyond financing: Quality assurance and training

Under NRREP, AEPC set up a Monitoring and Quality Assurance (MQA) Unit to verify the administration of subsidies. Figure 3[109, 110, 111] presents the different levels of quality assurance undertaken by AEPC prior to approving subsidy financing. Energy companies have also formed associations to raise concerns and provide recommendations to AEPC on process and policy. For example, the Solar Electric Manufacturers' Association of Nepal (SEMAN) is lobbying for the development and implementation of guidelines for net metering for rooftop solar systems. AEPC and private sector associations have taken an active role in the facilitation of certified training courses for technicians, funded by grants from inernational financiers.[106, 112]

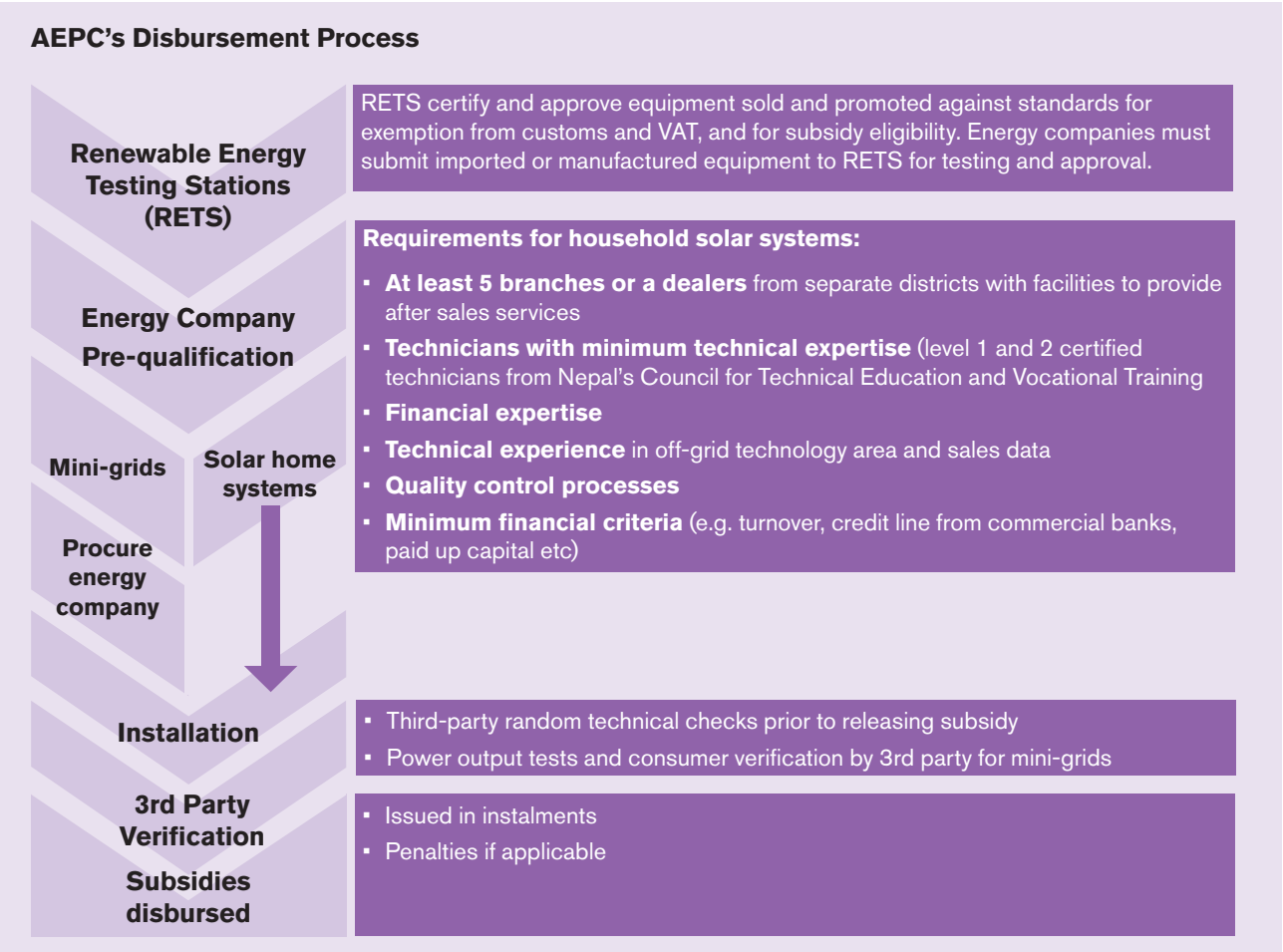
Following the transfer of projects to communities, AEPC undertakes financial and technical training for selected operators and managers. Under the SASEC programme, AEPC and CREF provide financial literacy training for savings and credit groups set up by the end-users.[113] Both programmes have dedicated training for PUE development for mini-grids.

Perceptions of energy companies

Nepal's off-grid energy market largely consists of companies operating under an Engineering, Procurement and Construction (EPC) model in which project ownership is transferred to the local community. This approach depends on APEC subsidies, and only a limited number of companies have managed to diversify their funding sources and business models.

Three of the mature and mid-level energy companies we interviewed – which began operations in the early 1990s – emphasised that their initial interest in the off-grid sector stemmed from the public financing offered by international donors. More than 60 per cent of these companies' annual turn-over (at times as high as 90 per

Figure 3. Quality assurance process used for subsidy approval



cent) came from subsidised installations. According to AEPC's estimates, the number of energy companies qualified to install solar off-grid systems increased from 15 to 92 between 2001 and 2012, and each of these had a network of at least five or six dealers spread across different districts.[114] Between 2015 and 2017, 59 energy companies installed subsidised SHS and received AEPC financing.[115]

Despite this impressive growth, subsidies can cause headaches for companies, which must find enough working capital to fund installation work taking place in the gaps between instalments. Six companies who depend mostly on subsidies said they had to take out loans, overdraft facilities and bank guarantees from commercial banks at market rates on company or privately owned collateral. Such companies can only repay their debts if they receive subsidies from AEPC and CREF and equity from communities on time, and delays have caused serious problems. The SASEC programme has sought to solve this problem by requiring developers to consolidate total project financing (subsidy, loans and equity) in one bank account prior to commencing construction.[116]

The widespread dependence on subsidies meant that many companies were forced to downsize when international financiers withdrew from NRREP in 2017, their problems compounded by falling demand for urban solar due to the National Electricity Authority's moves to improve the reliability of the grid. With the Asian Development Bank (ADB) setting strict criteria for the subsidies it provides through SASEC, some of the early and middle stage energy companies say they are struggling to qualify, and the main beneficiaries have been larger companies with the necessary turnover and track record.

Several early-stage and middle-stage companies argued that AEPC should shift its focus to developing credit financing instruments to help them secure the loans they will need to survive the fall in subsidy funding from its 2012–2017 peak. As these companies move beyond the traditional, subsidy-dependent EPC model, they want to develop the creditworthiness that will allow them to thrive in the long-term without direct state support.

Monitoring impacts

AEPC is often bound to procedures and metrics for gender and social equity impacts set by international donors and DFIs. For example, AEPC's MQA unit is responsible for regularly assessing progress against set results and annual plans. The 'proxy indicators' it has adopted include the number of households connected; number of beneficiaries; emissions reductions, and the number of systems and capacity installed. However, the donors and DFIs backing NRREP did not demand rigid monitoring of all these indicators, and data collection tended to centre on subsidy distribution and the number of connections made. While AEPC has a gender equality and social inclusion (GESI) unit, it has focused on sensitisation during policy development and programme implementation, and lacks the resources to undertake detailed impact assessments. Although AEPC's subsidy delivery process in NRREP gathered useful end-user data, including on where systems were installed and ownership by gender, however it did not analyse it to understand the end-user level impacts. Nor were any detailed assessments carried out on projects where communities were defaulting on equity payments – missing a valuable opportunity to gain the insights needed to inform programme design and adopt new approaches.

The ADB-funded SASEC programme includes indicators that go deeper than the usual proxies, such as: the number of female-headed, below poverty-line and disadvantaged group households electrified; time spent on water and fuel collection by women; and capacity and financial requirements for encouraging female-led micro-enterprise development. So far, these indicators have been measured by AEPC as part of the baseline surveys and in reporting quarterly progress. SASEC requires at least 40 per cent women's participation in all technical training – which has been a challenge to meet, according to the quarterly progress report.[107] The exact reasons for this have not yet been assessed.

AEPC emphasised[117] that it would need more capacity and resources to conduct the kind of robust baseline studies and periodic assessments that could yield a more granular picture of the socio-economic and environmental impacts of aggregator-financed projects. Most companies interviewed assumed that impact monitoring was AEPC's responsibility and tended to see such activities as a drain on time and resources, as opposed to opportunities to gain insights into their customer base. Only a few of the energy companies we interviewed (whose diverse range of funders included social impact investors) said they had dedicated staff to monitor impact data for selected scalable projects to inform their future business models, financing and project development.

Future direction of AEPC

With the completion of NRREP and reduced support from international donors, there is now a dearth of the kind of public financing that was previously available to both small and large energy companies deploying a variety of off-grid technologies. Although various donors and DFIs have started providing funding via different technology-specific or technical assistance-focused programmes, an overall reduction in grant financing has also limited AEPC's ability to deliver other non-financing roles – including more effective impact monitoring.

Nevertheless, even as subsidies have become harder to finance, Nepal's new federal structure has given AEPC an opportunity to reinvent itself. Now placed under the Ministry of Energy, AEPC has a stronger platform to coordinate planning for off-grid energy and influence policy at national, provincial and local levels, and liaise with international donors and investors. Evolving from its initial focus on project implementation, the aggregator now plays an important role in providing technical and financial support to local governments. AEPC's role as an aggregator – with CREF serving as its financial mechanism – remains vital to ensuring that international and national funds are mobilised to finance off-grid projects where communities need them the most.

5.2 Case study 2: Infrastructure Development Company Limited (IDCOL)

The drive for an aggregator: A non-banking financial institution

Bangladesh initially established its Infrastructure Development Company Limited (IDCOL) as a non-banking financial institution to finance large infrastructure projects. Given its existing relationship with international donors, the Government of Bangladesh (GoB) designated IDCOL as the appropriate intermediary to channel World Bank finance to develop the off-grid SHS market in Bangladesh in 2003. IDCOL sits in the Ministry of Finance, and is governed by an independent board of directors from the Ministry of Finance, the Ministry of Information and Communication Technology, and the Ministry of Power, Energy and Mineral Resources.

IDCOL uses a public-private partnership model where partner organisations (POs) including microfinance institutions (MFIs), energy companies and non-governmental organisations (NGOs) channel finance from donors and MFIs to off-grid renewable energy projects. In addition, IDCOL sets technical standards, certifies products and provides technical assistance to its POs. This case study primarily explores its financing models for Solar Home Systems (SHS), Solar mini-grids (SMGs) and Solar Irrigation Pumps (SIPs).[118, 119]

Channelling finance

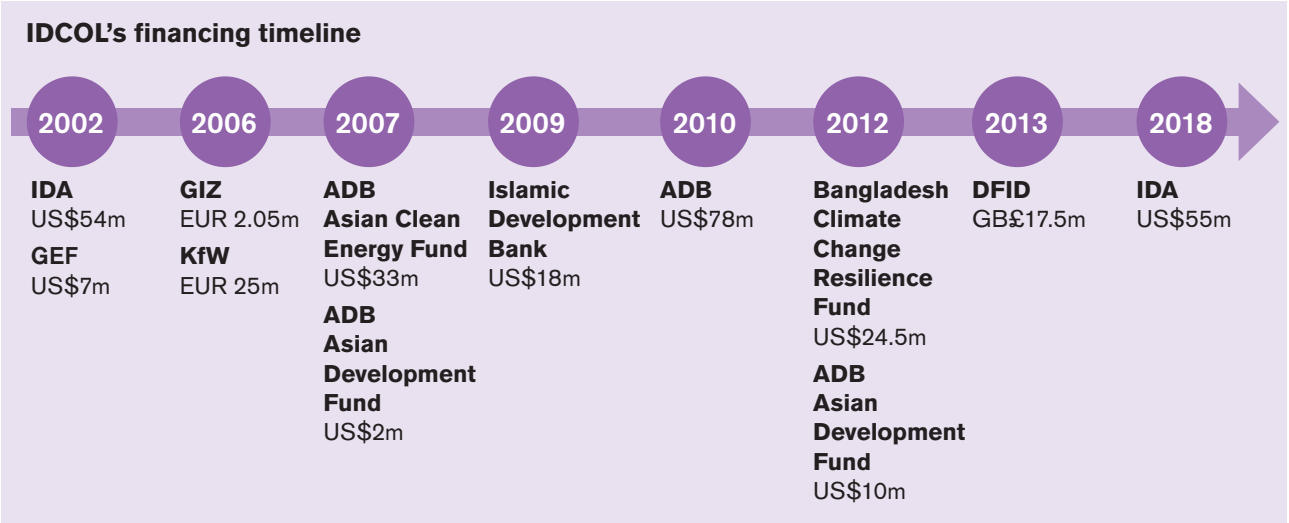
Pooling pubic finance

IDCOL receives grants and concessional loans from international donors and DFIs through the GoB. The GoB acts as the main borrower, and the Ministry of Finance of Bangladesh signs a 'subsidiary loan agreement' with IDCOL for investments in renewable energy projects. Figure 4[120, 121, 122, 123, 124, 125, 130] shows the inflow from several donors, DFIs and funds.

While Figure 4 only presents few funcing sources from publicly available data, IDCOL has received potentially over US$900 million from multiple donors, DFIs and GoB since 2003. And majority of this finance was received as concessional loans.[126]

IDCOL's SHS programme is one of the largest off-grid electrification initiatives in the world. Funded by the World Bank, the initiative started in 2003 under the long-term Rural Electrification and Renewable Energy Development project (REREDP I and II), The programme hit its target of installing 50,000 units over the five-year project period by 2005 – three years ahead of schedule. This early success prompted the World Bank to top up its financing, and by 2012 donors including ADB, KfW, GIZ, JICA and DFID were also contributing.[127, 128]

Figure 4. Some of the key long-term financing (grants or concessionary loans) received from various donors and DFIs for IDCOL's renewable energy portfolio



IDCOL is now focusing more on higher capacity renewable energy systems that can serve isolated off-grid islands and very remote areas like SMGs and SIPs. IDCOL continues to set targets for these programmes and Figure 5[130, 123, 121, 129] shows how far its latest goals have been achieved. Target setting for scaling up projects requires detailed analysis and planning. For instance, in order to set targets and expedite SIP project design, IDCOL engaged agriculturalists to collect data on the water requirements of more than 200 sub-districts in Bangladesh. IDCOL is also running promotional and awareness raising campaigns in different areas targeting both consumers (including farmers interested in SIGs) and potential energy companies. For SMGs, the key to expansion remains making them affordable, and IDCOL s in talks with an international organisation which is considering providing financial support to subsidise energy efficient appliances in project areas.

Financial instruments: Blending public finance with commercial and private finance

IDCOL provides both subsidies (which IDCOL refers to as 'grants') and credit support (concessionary loans). The goal is to bring equity from energy companies to fund SIPs and SMGs, and promote SHS by making the kits more affordable by offering end-users upfront subsidies or affordable loans. Figure 6 shows the financing models used for SHS, SMGs and SIPs.

Financing for the SHS programme

Since affordability was one of the primary obstacles to broader market penetration by SHS, IDCOL began its programme in 2003 by offering a generous subsidy of US$70 as a capital buy-down grant for kits of all sizes.[118] Under this approach, IDCOL was able to disburse subsidy payments ranging from US$100 to US$4 million to each PO.[129, 130] This enormous degree of flexibility allowed smaller POs to enter the market — the number operating under the SHS programme had increased from five in 2002 to 56 by 2015. By 2019, IDCOL's total investment under the SHS program was US$696 million, of which US$600 million was in loans and US$96 million in grants.[131] Most of the POs in the SHS programme were NGOs or MFIs pre-selected by IDCOL. The participants also received an 'institutional development grant' (initially US$20 per SHS) for capacity development. As the programme and the SHS market matured, the institutional development grant was gradually phased out by 2013 and the capital buy-down grant reduced. IDCOL and its donors agreed that the growing competition among POs and the increased demand had reduced the price of SHSs, thereby offsetting the reduction in subsidies.[132] In 2013, an evaluation study by IDCOL for the World Bank concluded that the buy-down grant should be kept at US$20 and made available for the small systems (up to 30 Watts), which tend to be purchased by the poorest households.[139]

Financing for SIPs and SMGs

Investment in SIPs and SMGs relies heavily on grants: with IDCOL providing grants worth 50 per cent of capital costs. The energy companies tend to follow a Build, Own and Operate (BOO) model – often recruiting branch officers to provide operational support and maintenance. IDCOL's concessionary loans for such projects have a tenor of 10 years and an interest rate of six per cent – much lower than rates offered by commercial banks.[119, 128] For instance, SIPs that

Figure 5. Targets set and achievement so far for SHS, SIPs and SMG

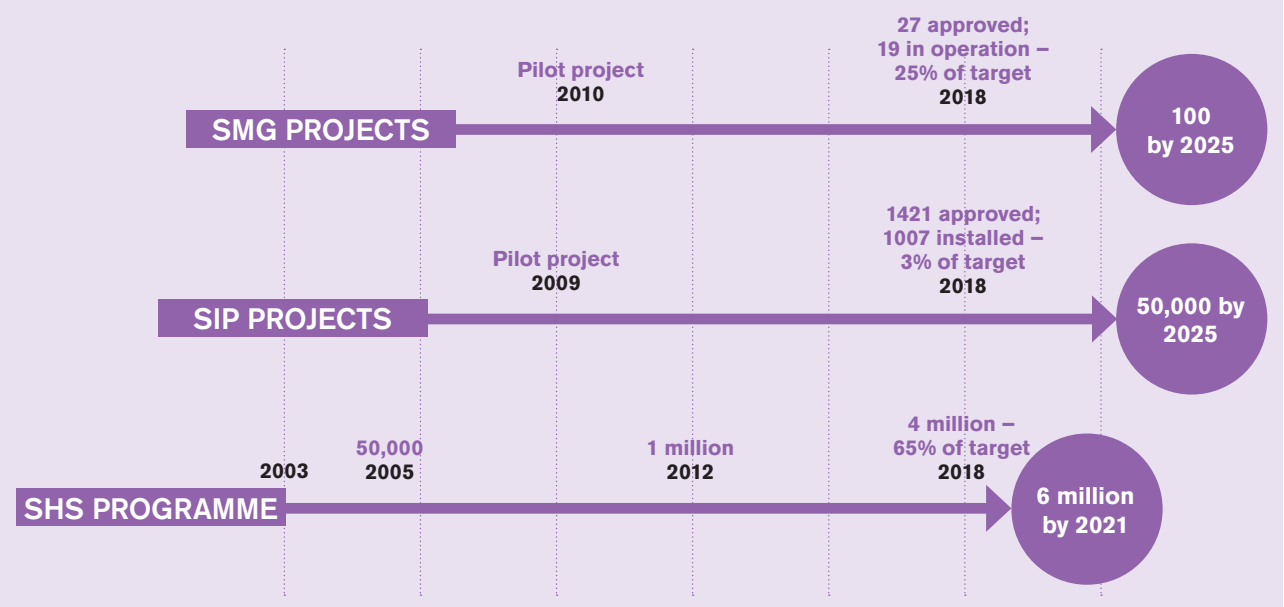
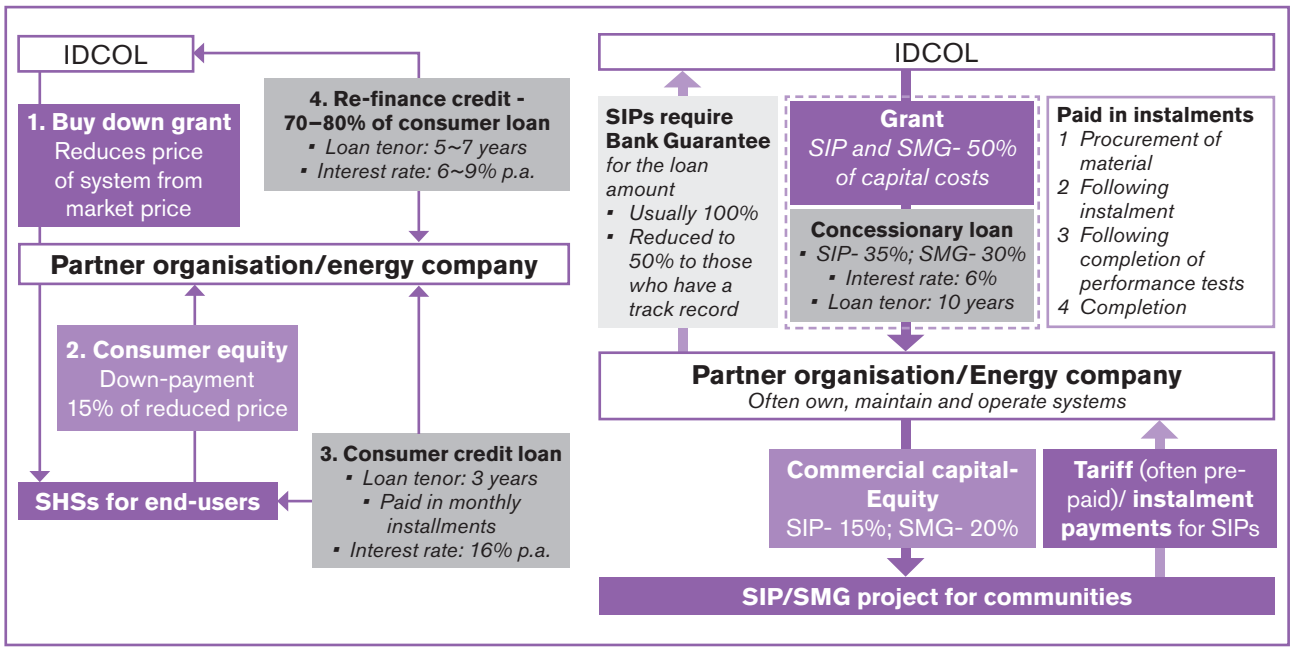


Figure 6. Different financing models used by IDCOL for Solar-SHS, SIPs and SMGs

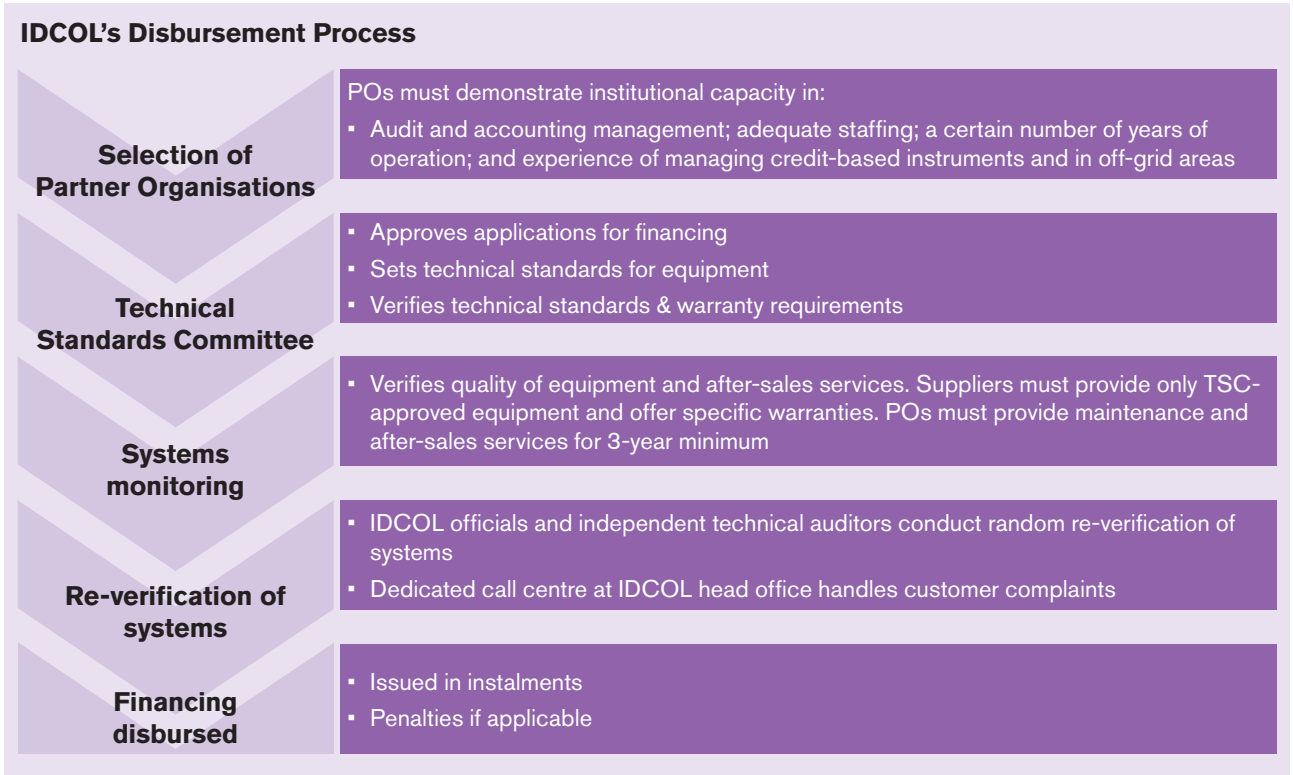


have been installed under the IDCOL programme (typically solar PV panels of 5–7 kilowatts operating 3.5–5-kilowatt water pumps) cost US$32,000–$45,000.[133] However, IDCOL expects to reduce the grant amount to nurture a sustainable commercial market for SIPs, as the market develops.[134] For SIPs and SMGs, the borrowers are mostly energy companies, who are also the primary owners of the systm.

Support beyond financing: Quality assurance, training, and innovation

IDCOL has strong quality assurance procedures in place. The organisation also selects its POs using clear eligibility criteria, and sets specifications for – and certifies – equipment. IDCOL's technical standards committee approves suppliers and systems. Figure 7 shows IDCOL's various levels of quality assurance

Figure 7. Levels of quality assurance used by IDCOL



– including a mandatory up-front requirement for POs to provide after-sales services. IDCOL has also played an active role in encouraging battery recycling initiatives led by several battery manufacturers in Bangladesh.[136, 135, 134, 119, 120]

In addition to channelling finance, IDCOL also provides training to its POs and targeted end-users, market survey support and new technology demonstrations. For complex systems such as the SIPs and SMGs, IDCOL has collaborated with international experts and government agencies to arrange various types of design and operational training. According to the energy companies we interviewed, IDCOL also provides budgeting and financial monitoring templates, backed by training.

For SMG projects, IDCOL provides financing to energy companies to conduct end-user training to encourage the use of energy efficient appliances to reduce bills from pre-paid meters. And for SIP projects, IDCOL has appointed agriculturists to help farmers learn efficient cropping patterns, water management and better irrigation and agricultural practices, while also providing valuable knowledge to energy companies and IDCOL.[136]

IDCOL piloted the first SMG project in 2010 to encourage energy companies to enter this new market by demonstrating its commercial viability. IDCOL says this process took seven years, as energy companies, learning through trial and error, gradually developed the confidence to undertake more ambitious projects. Furthermore, IDCOL helped companies to conduct detailed market surveys based on systematic random sampling to assess electricity demand and maximise the prospects of their project design generating revenue. Since then, IDCOL has approved 27 mini-grid projects since 2010, of which 19 are operational.[136]

A better coordinated approach

In 2013, IDCOL's SHS programme reached its peak with an average number of installations of about 71,000 units per month. This success was not to last: sales dropped to about 4,000 units per month in 2017. The primary reasons include: the rapid extension of the national grid by the Bangladesh Rural Electrification Board (BREB); the influx of a low-cost unregulated SHS market; poor loan collection by POs; and the free distribution of SHS under the government-led 'safety net' programme (TR-KABITA).[138] According to one of the POs interviewed, defaulting customers are generally allowed to keep their SHS since the installed kits have little resale value and it is not cost effective to collect them. Some of the large NGO partner organisations are hoping the GoB will grant them expensive waivers on their debts to IDCOL after suffering high rates of default.

The free distribution of SHS under the GoB's 'safety net' – which lacked a quality assurance mechanism – also meant that an influx of low grade generics began to undercut the quality-approved SHS kits rolled out under the IDCOL programme. IDCOL subsequently convinced the GoB to only use IDCOL-approved POs to install SHS provided under the 'safety net' programme to help POs generate additional cash-flow and repay their debts to IDCOL. To improve PO loan collection, IDCOL is also running a 'Collection Efficiency Improvement Programme', in which IDCOL monitoring staff support POs to improve their debt collection from end-users. Other measures include introducing pre-paid technologies; collaboration with the Bangladesh Rural Electrification Board (BREB) to collect payments before giving a grid connection to SHS customers; and staging promotional activities to advertise the higher-quality of SHS sold by POs.[52, 136]

Learning from these separate initiatives, IDCOL, BREB and the Sustainable and Renewable Energy Development Authority (SREDA) have increased their efforts to coordinate policy, electrification planning and regulation. Some of this coordination activities include:

- To avoid the risk of grid expansion rendering a particular solar project obsolete, IDCOL consults with BREB, SREDA and the Power Division of the Ministry of Power, Energy, and Mineral Resources to obtain clearance for the project area and ensure no grid expansion is planned within the next five years. GoB has also agreed in principle to purchase electricity if the grid reaches an area where a mini-grid had been built less than five years earlier.

For SIPs, IDCOL is in discussion with SREDA, REB and the Power Division to find ways to mitigate the risks to the solar business case posed by the installation of electric pumps.

Perceptions of energy companies for growth as markets change

IDCOL has helped bring SHS to customers in remote areas by financing POs with large distribution networks. While some of the POs are finding it difficult to recover loans from customers, one late-stage SHS company said it had achieved high recovery rates by making a significant effort to engage with customers and village leaders – showing how business strategies can evolve in light of insights into the dynamics at work in host communities.

The energy companies we interviewed were committed to meeting targets set by IDCOL. For instance, one company said it had set an ambitious target to install 5,000 SIPs by 2025 using finance provided by IDCOL and potentially other sources. Companies said they were keen to develop their business models, and tended to base decisions to commit equity for large systems on market surveys. The biggest challenge they face is to secure a reliable flow of affordable working capital to scale up SIPs and SMGs. Since IDCOL issues its grants and loans in instalments, energy companies are often forced to take short-term loans at 12 per cent interest rates from commercial banks to maintain adequate levels of working capital. IDCOL is looking at ways to ease the pressure on companies, perhaps by front-loading a greater proportion of grants through 'mobilisation funds' designed to help them cover their initial costs.[128]

In addition, IDCOL has softened its initial requirement that companies provide collateral worth 100 per cent of the loan value for SIPs and SMGs, often in the form of Bank Guarantees, which carry additional fee and interest rate obligations. Although IDCOL is wary of incurring too much credit risk, it has since eased the guarantee requirement to 50 per cent of the loan amount for companies with a sufficient operational track record and credit history.[136]

Monitoring impacts

IDCOL's SHS program has installed around 4.13 million systems providing electricity to around 18 million people – 12 per cent of the country's total population – who previously relied on kerosene lamps.[115] However, it is difficult to gain a more granular picture of the impact since IDCOL's reporting follows a donor focus on output-based indicators such as the number of systems installed; households benefiting; and people impacted, and estimates of CO_2 savings or job creation. Furthermore, IDCOL's attempts to implement more detailed impact monitoring tend to vary according to the requirements of each donor or DFI. For instance, IDCOL undertook a detailed impact assessment[139] of the effectiveness of the SHS programme which was used to inform the current business model. However, no further studies have been made to determine the effects of reducing SHS subsidies.

The standard impact monitoring activities IDCOL undertakes to mitigate potential social and environmental risks of solar technologies can be summarised as follows[136, 138]

- SHS: IDCOL has a tracking mechanism to ensure the proper disposal of warranty-expired batteries in accordance with its guidelines and offers POs financial incentives to recycle them
- SIPs: IDCOL has introduced a special environmental and social screening template for monitoring impacts on ecosystems and excessive water pumping during the construction and operation of SIPs. IDCOL has also commissioned water availability surveys in various potential areas
- SMGs: IDCOL requires a mandatory environmental and social impact assessment (ESIA) by a third-party consultant to mitigate any negative impacts on land use

Although most companies we interviewed gathered some form of impact data through the various market surveys and assessments required by IDCOL, these were primarily used to comply with reporting requirements rather than inform business decisions.

IDCOL's future

With renewed interest in SIPs and SMGs among the GoB, donors and energy companies, IDCOL has set targets for expanding access to energy in rural Bangladesh, and is raising money from donors, DFIs and the Green Climate Fund (IDCOL received accreditation in 2017) to meet them. In light of feedback from companies, IDCOL has improved the financial incentives it offers, but will only reach its targets if there is a significant rise in the volume of loan requests from POs – and the pace at which they are approved.

Increasingly, IDCOL is coordinating with government entities and regulatory bodies to create a more enabling environment for the private sector. Both IDCOL and the companies we interviewed are exploring more innovative ways to deliver off-grid energy – particularly through integrating PUE into SIP and SMG projects to help customers make optimal use of electricity and further boost demand. IDCOL should also examine whether community-owned models might play a role in raising the extra equity needed to scale projects up faster. Finding better ways to monitor impacts will also be crucial, not least to help companies refine the way they operate in each particular context.

5.3 Case study 3: SunFunder

The drive for an aggregator: Financing the funding gap

The off-grid sector has seen tremendous growth over the last decade, with new energy products and business models emerging around the globe. To fuel this rapid growth, companies sought various combinations of grants, debt, and equity as markets expanded. However, the off-grid sector attracted only a fraction of total energy finance, especially debt. This is where SunFunder saw its opportunity.

SunFunder began as a crowdfunding platform in 2012, originally based in San Francisco, to help channel finance into the sector. The aggregator started with more than a thousand small investors in 2012, raising US$440,000. Up to 2018, more than 50 individual and institutional investors have invested about US$62 million into SunFunder funds. Its main office is located in Nairobi.

Energy company customers and loan types

SunFunder's portfolio of energy companies covers a range of business models spanning Africa, Asia, and the Pacific. As seen in Figure 8, 79 per cent of cumulative business is in Africa – mostly energy companies in East Africa.[180] Concentrating on specific technologies and regions allows SunFunder to reduce costs by standardising common elements and focusing expertise.

SunFunder finances suppliers and distributors of turnkey solar consumer products (such as SHS); engineering, procurement, and construction (EPC) of custom solar projects; and productive uses of energy (such as refrigeration). SunFunder's energy company customers offer consumer pico-solar products (0–10W), Solar Home Systems (SHS) (0W–1kW), or the construction and installation of income generating asset services (1kW–2MW) to their respective markets.

Debt financing to feed energy company growth

SunFunder started in 2012 by offering simple, timebound loans to companies in order to feed a nascent industry hungry for debt. It now offers each company a facility, which they can draw from up to a maximum amount. SunFunder offers three types of debt loans through individual facilities to their energy company customers to address the needs of various business models:

- **Inventory and working capital** to allow companies to finance the expansion of their operations
- **Structured Receivables** asset-backed financing unlocks end-user receivables, allowing for example, PAYG companies to leverage their end-user contracts (the promise of future payments) through special purpose vehicles, pushing debt off company balance sheets
- **Project financing** allows EPC companies or end-users to construct and install solar projects, with the contract from the project as a promise of future repayment

Figure 8. SunFunder Portfolio geographic split

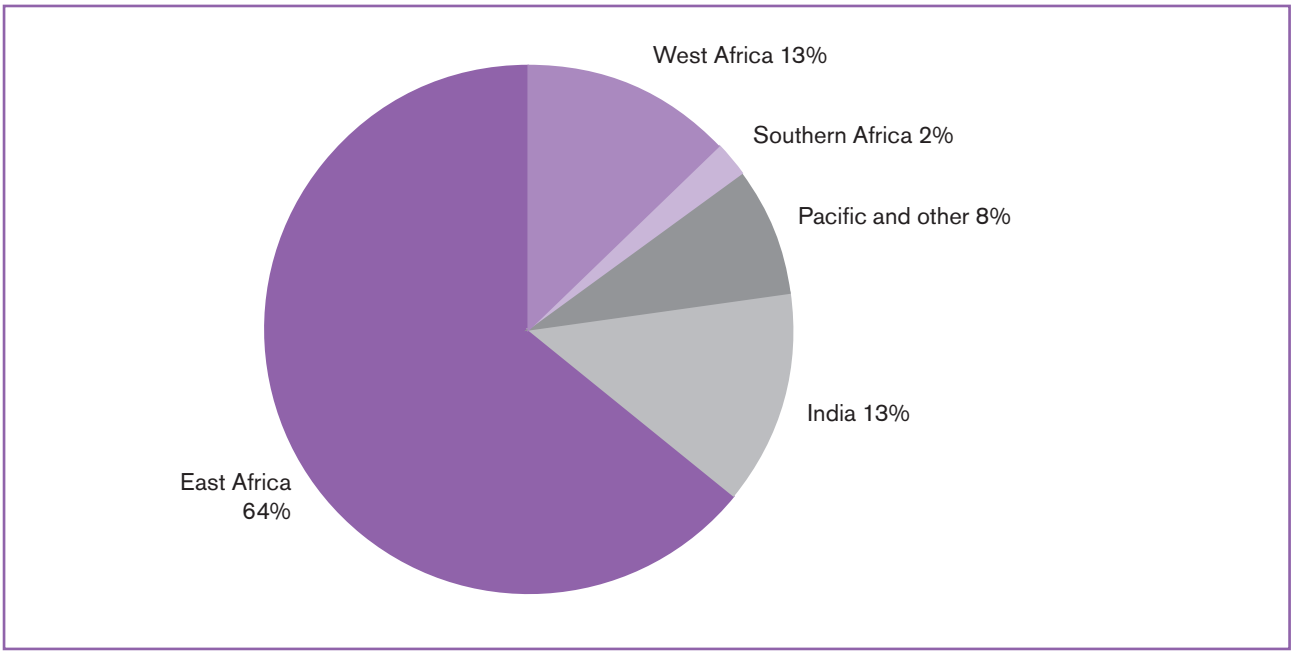


Figure 9. SunFunder's proportion of facilities and committed principal to company size

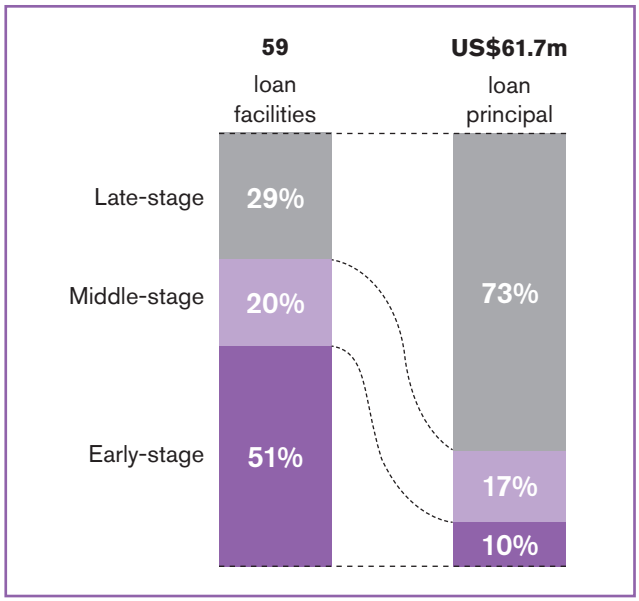
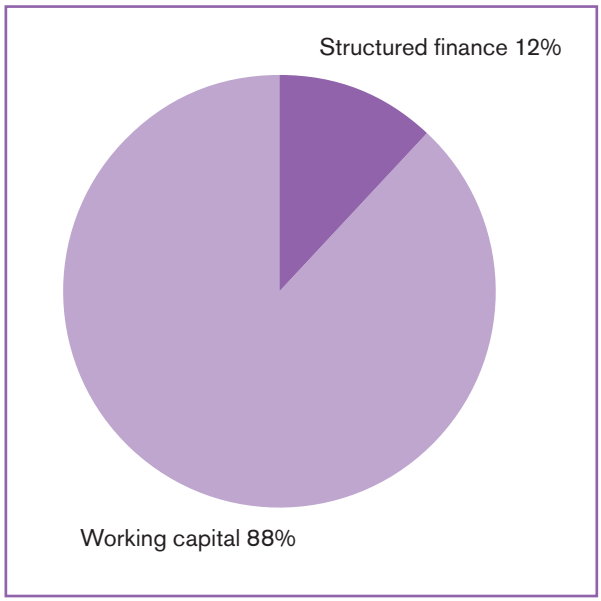


Figure 10. SunFunder loan type as % of active portfolio



From 2012–2018, SunFunder committed loans of US$61.7 million through 59 loan facilities to a total of 44 companies (see Figure 9), the majority of which (88 per cent) addressed the working capital and inventory needs of energy companies, with structured financing addressing a remaining but important sliver (12 per cent) (see Figure 10). SunFunder's core business, as measured by number of loans disbursed, has been working capital loans below US$500,000, which reflects the ongoing needs of the market.[140, 180] SunFunder has fuelled its recent growth through larger facility and loan sizes, but its future growth will not necessarily come from bigger tickets. Competition from impact investors, other financial intermediaries, DFIs and the anticipated entry of commercial banks among others for large debt offerings to energy companies will put pressure on SunFunder's business model. But SunFunder has specialised offerings such as special purpose vehicles, local currency loans, and syndicated deals that already set it apart from newer, non-specialist funders. The aggregator also aims to offer larger and longer-term loans to expand its offerings to different business model types – such as commercial and industrial projects – as well as PUE.

Figure 10 shows that in terms of company size and growth stage, SunFunder has disbursed loans to 30 early-stage,[141] 12 middle-stage,[142] and 17 late-stage[143] companies since 2012.[144] Most of the principal amount disbursed has gone to late-stage companies (~73 per cent), followed by middle-stage (~17 per cent), and a much smaller amount of principal going to early-stage (~10 per cent).[180] This simply reflects the way the needs of well-established companies have grown in proportion to an expanding market.[145]

SunFunder tailors loans with custom interest rates and loan covenants based on company circumstances and local operating conditions. Interest rates for the companies we interviewed ranged from approximately 9–12 per cent for loans in US dollars, which companies said were competitive for the industry, balanced against other considerations such as speed, structure and flexibility.

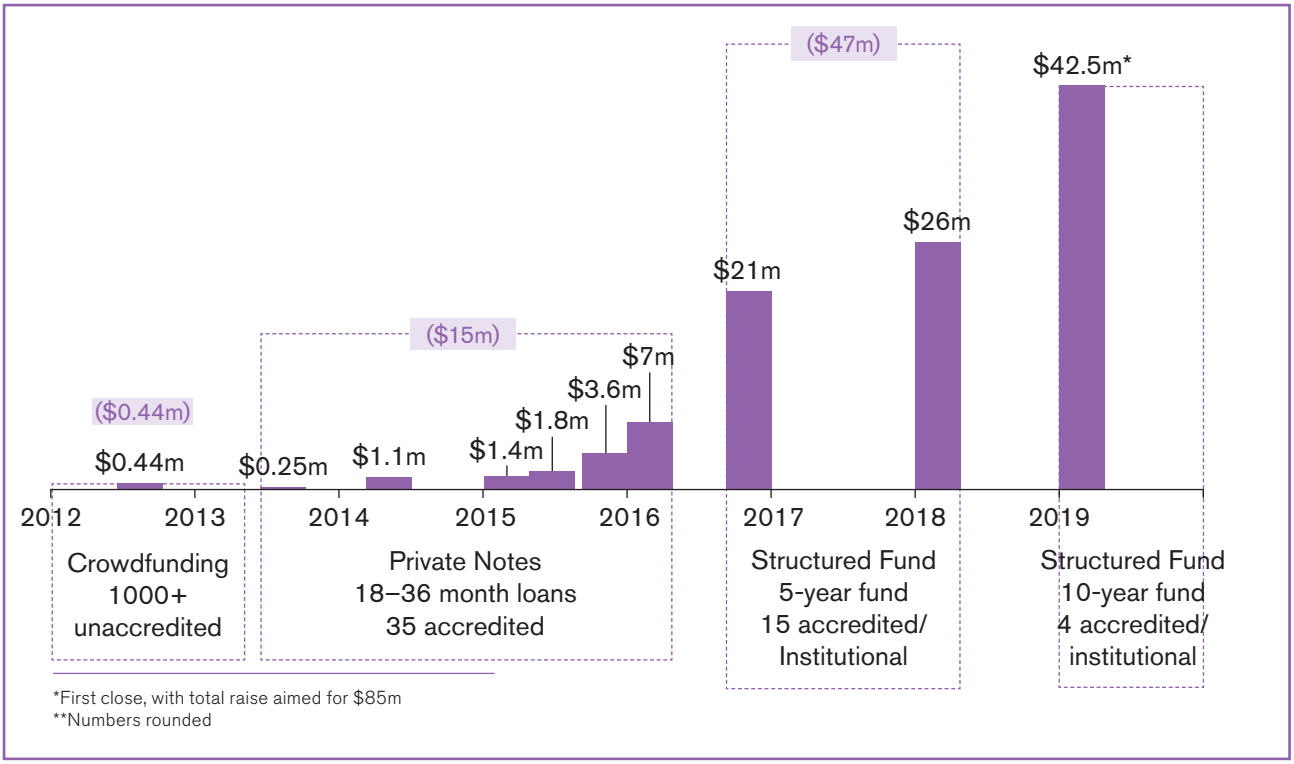
Channelling finance

Investor and fund mix

Figure 11 traces SunFunder's seven-year capital raising story through private debt offerings and structured funds.[180] SunFunder moved away from crowdfunding and into private debt funds after it found the resource intensity and time limitations of crowdfunding to be unsuitable for meeting company debt needs, especially as these needs regularly surpassed seven figures in 2015.[146, 147]

From 2014–16, SunFunder raised a series of five private debt funds, each noticeably larger than the last and with lengthening term periods. This rapid growth and successful investor repayment showed that SunFunder could raise and manage significant funds, while meeting the growing needs of energy companies. It also mirrored rapid investment growth in the sector. The year 2016 saw almost US$240 million in debt, equity and grants pour in to off-grid solar, up from US$49 million in 2014 and US$180 million in 2015.[148] By April 2016, SunFunder had disbursed US$8.7 million in loans to 23 solar companies in 10 countries.[149]

Figure 11. SunFunder's capital raise over time



From 2016 to the start of 2018, SunFunder managed to raise US$47 million in a five-year structured fund, anchored by a US$15 million investment from the Overseas Private Investment Corporation (OPIC).[150] Significantly more than all SunFunder's previous raises combined, the fund enabled SunFunder to disburse loans of up to US$5 million,[151] while the sector achieved its own milestones of US$80 million in debt for M-KOPA at the end of 2017[152] and US$55 million in equity for ZOLA Electric at the beginning of 2018.[153]

Nevertheless, overall sector investments fell to US$175 million in 2017[154] as stakeholders debated the state of the sector, its growth and maturity.[155, 156] Sales of pico-products such as SHS also slowed. This period marked the first time that debt overtook equity finance, almost doubling from 2016 to 2017 as more funders entered the debt space.[157]

SunFunder closed out the year 2018 having committed US$61.7 million to 44 companies across 18 countries,[180] a strong track record with promising growth prospects.

In February 2019, SunFunder achieved a first close of US$42.5 million on its newest, 10-year structured fund, which includes a US$25 million investment from OPIC[158] and a US$5 million first-loss investment from IKEA Foundation. Longer-term debt funds give SunFunder opportunities for growth, for example with mini-grid developers, who typically require longer-term funding of at least 10 years.[159, 160]

Tiered capital structures to attract more investors

SunFunder began experimenting with tiered capital structures in 2014 to attract investors across the risk-appetite spectrum. Tiered structures spread risk and returns proportionately across layers. Figure 12 outlines in detail what such a multi-layered investment structure might look like. A first-loss, "catalytic" layer provides some upfront protection for other investment layers, yielding higher potential returns in exchange for higher risk. The other layers exchange sequentially lower exposure to risk for lower returns, allowing SunFunder to match investors to their risk appetite, close larger funds, and open new new channels of investment for the sector. SunFunder argues that this structure allowed them to attract and blend the investments it has needed to grow its business.

However, filling the first-loss layer has been a challenge. Indeed, SunFunder had to finance part of its own "catalytic" layer but managed to convince high net-worth individuals (HNIs) and foundations (Facebook and Rockefeller) to eventually follow suit. Once filled, this protection attracted more HNIs, impact investors, and development finance institutes (DFIs) into the less risky layers.[161] In a sense, SunFunder is reverse blending: using private capital to de-risk and crowd in public money.[170] DFI investors included the Belgian Investment Company for Developing Countries (BIO), the Entrepreneurial Development Bank (FMO) and OPIC.[161]

Figure 12. Example of structured investment fund

TRANCHE	RISK PREFERENCE	ANNUAL RETURN	CREDIT PROTECTION AS A PORTION OF FUND SIZE (TOTAL FUND LOSSES BEFORE INVESTOR LOSES ANY PRINCIPAL)		
Super senior	Very low risk	3%	31.4M	41.9%	10 loans
Senior	Low risk	5%	17.4M	23.2%	6 loans
Junior	Medium risk	7%	7.9M	10.5%	2.5 loans
Catalytic	Equity-like risk	20%	2.4M	3.2%	1 loan

*Figure adapted from: SIMA Funds. "Choose your risk/return profile", viewed 10/01/2019, http://simafunds.com/fund/one

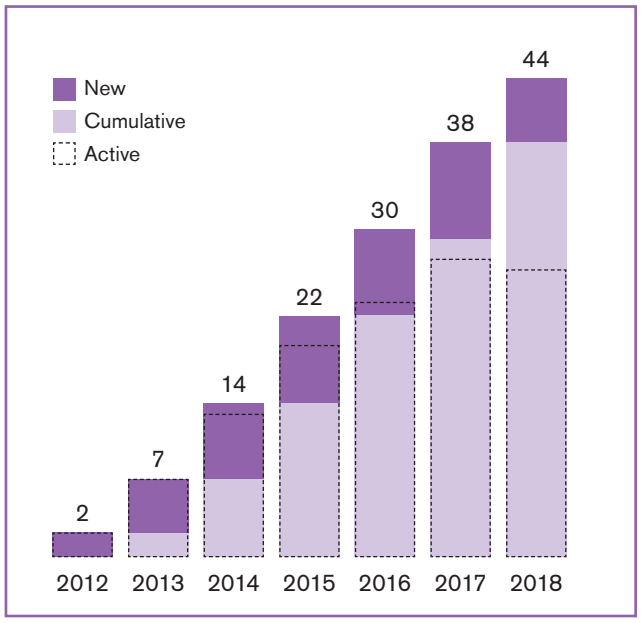
The investor mix

In developing its solar investor portfolio, SunFunder's management team nurtures investor networks and relationships to build pipelines for funds. SunFunder's investor mix has shifted from HNIs, and institutional investors in the early days, to impact investors and DFIs, with foundations filling key layers throughout. SunFunder further explored the evolution of its investor portfolio in a 2018 Whitepaper.[162]

SunFunder's investee growth

As Figure 13 shows, SunFunder started in 2012 by disbursing loans to two energy companies. Between 2013 and 2017, SunFunder added an average of seven new companies per year, with an additional six in 2018. Since early equity is reportedly in short supply for nearly 200 companies,[163] SunFunder's prospective clients list may be limited, which could explain why SunFunder broke its upward trend, adding slightly fewer new companies in 2018, with half of those new clients coming towards the close of the year. For active companies (those receiving disbursements), SunFunder has seen steady year-on-year growth – except in 2018 when this number fell slightly. This could reflect the general slowdown in the solar off-grid sector.

Figure 13. SunFunder's number of energy enterprises by year



Managing financial risk along the way

To manage risk, SunFunder has a due diligence process that starts with informal discussions and progresses through analysis of a company's track record, cash flow, business model mechanics, sources of debt facility repayment and so on, including financial modelling and stress testing. Overall, prospective companies must have the ability to service loans with interest, which would require evidence of consistent cash flows. This precludes most start-ups and many early-stage companies.

SunFunder does not offer financing for pilot projects. Occasionally, it will link equity investors to promising early-stage companies, as in the referral network mentioned below. However, SunFunder states that some of these deals have fallen through when the company was unable to secure the required equity.

Standardisation and quality assurance procedures

Support beyond financing: Technical input for sound financial structures

The Mott and IKEA Foundations gave a three-year grant to SunFunder in 2017 to help support the heavy transaction costs associated with some early-stage companies. As of the end of 2018, SunFunder had reviewed 120 opportunities in Sub-Saharan Africa, while closing nine deals, which it says represents an approximate average level of activity. Under this grant, SunFunder has also signed eight agreements with

organisations and individual investors, which it uses as a small referral network that can mentor and seed fund promising early-stage companies who do not yet qualify for SunFunder loans. However, SunFunder says it cannot sustainably offer loan facilities under US$250,000 without grant funding.

Quality control

SunFunder concentrates on energy companies that use solar technologies, which helps focus the necessary expertise and simplifies their business model. As part of its due diligence process, SunFunder verifies product and project standards. While SunFunder requires all its companies to use high-quality technologies, it says that it has never been approached by a company that does not already use certified products. Companies that seek loans through commercial channels will tend to base their business model on their reputation and credibility, suggesting they would choose certified products by default.

Energy companies and their business models: Perceptions for growth as markets change

All the energy companies we interviewed are still experimenting with their approaches or pivoting into other business models. Their successful pivots so far show the degree of agility that companies large and small need to survive in a very dynamic off-grid market. For example, a few have moved away from selling pico-products and into EPC contracts due to a perceived market saturation, general decline in pico sales, and unfavourable policy changes. Many companies cross-subsidize between business models and products (SHS, mini-grid, PUE, EPC, cookstoves), which gives them a built-in agility to weather shifting market conditions and sudden policy shifts, such as import tariffs. A few are transitioning from pay-as-a-service to pay-to-own models. And most have faced challenges raising sufficient working capital, which especially constrains smaller companies with less access to affordable finance.

Most of the companies use partnerships to fuel growth and reduce the time and resource requirements of expanding into new markets. These partnerships include local companies partnering with international companies and vice versa, as well as companies partnering with multi-national utilities.

SunFunder describes a few perennial challenges for their company clients, including difficulties in securing appropriate financing relative to their size, and hiring key talent. Our interviews with companies painted a similar picture. SunFunder states that few businesses, if any, are turning a profit. Indeed, if the sector is to crowd in more financing, consistent profitability will be crucial to convince more investors that the sector is ready for healthy returns on investments.

Public finance competing, not complementing

Competition is increasing between investors to finance more established companies seeking multi-million-dollar loans. Of course, companies will naturally choose attractive interest rates, and larger companies have the leverage to access more affordable debt. But there is evidence that some of the concessional finance invested in SunFunder is also being offered to some of its customers, which could undermine SunFunder's lending model. However, it could also be that this approach unlocks more affordable energy company finance more quickly. Cheaper money could translate to more rapid deployment and affordable pricing for end-users, but it could also just deliver investor returns and fuel 'impatient' capital. Key to moving the sector forward is establishing what aggregation and lending models will benefit the sector in the long-term and identifying how public and philanthropic money should be best directed to support these.

Indeed, SunFunder mentioned in its white paper that it has been squeezed out of deals "on more than one occasion"[164] by institutions who have also invested in SunFunder funds. SunFunder argues that this prolongs the need for concessional capital into financial intermediaries and delays sector maturity. Using publicly available information, IIED identified that FMO, one of the key DFIs supporting the off-grid sector, has previously invested directly into SunFunder's funds.[165] However, FMO also recently closed a local currency debt loan directly with ZOLA Electric,[166] a SunFunder client.[167] OPIC's long-term debt deal with Orb Energy in early 2018,[168] also a SunFunder financed company,[169] is another example of this type of direct lending.

While SunFunder declined to identify specific investors or transactions, these two examples challenge SunFunder's business model as an intermediary. In correspondence as part of this research, FMO highlighted that local currency debt is crucial for many energy access companies and it believes that DFIs have a strategic role to play in expanding affordable local currency debt. However, there are hints that misaligned investment strategies are a broader issue for the sector,[170] though few are willing to come forward and discuss this publicly. While investors face their own internal portfolio pressures and KPIs, and competition is generally good for markets, coordinating investment strategies between sector actors could help achieve universal access more quickly and sustainably.

While specialised financial products and expanding into other technologies such as mini-grids are fuelling its growth, SunFunder could also concentrate its core business on early- to middle-stage companies, leaving the larger companies to other, non-specialist investors.

However, the question remains as to who should support the energy company pipeline, which is essential for delivering SDG 7. Without the equity, mentorship, or capacity building efforts needed to feed emerging companies, this pipeline will not develop. Indeed, the Shell Foundation estimates that US$1 billion in "softer early-stage support will be needed to generate a pipeline of companies that are attractive to mainstream funders".[171] And perhaps this is where public and philanthropic finance can play a crucial role. These complex issues merit further monitoring, dialogue, and coordinated action between aggregators, investors (including DFIs), and energy companies.

Information aggregator

SunFunder has a birds-eye view of the sector thanks to the information it gathers from the many companies it finances. Although the aggregator has an active blog, it mostly uses it to market new investments and funds. One company cited SunFunder's annual review[172] as a good source of market intelligence – but this is obviously only released once per year. While safeguarding proprietary information, SunFunder could use anonymised or company-approved data to provide more regular updates regarding trends and significant innovations through quarterly newsletters, light analysis pieces, or by highlighting particularly innovative and impactful models and projects.

Monitoring impact

SunFunder reports 'proxy' metrics such as GOGLA's 'people impacted and CO_2 avoided annually' formulas.[173] But the average assumptions in these formulas can vary within and between countries. Kenya, for example, has an average of 3.9 people per household, while Tanzania has 4.9.[174] GOGLA assumes five people per household in their metrics, but does encourage companies to go beyond their framework. Some assumptions, such as kerosene replacement rates, would not apply in all markets.[175]

SunFunder says that that reporting on impacts is baked into financing contracts. But the aggregator could further support this initiative by requiring all company clients to establish streamlined impact systems and systematically report the data. Standardising metrics across the industry will be crucial to establishing the more nuanced picture of the market needed to help crowd in more investment to specific segments. All the energy companies we interviewed stated that SunFunder did not collect or cross-verify impact data directly with them. However, one company said that this should form part of funding negotiations. SunFunder could therefore incentivise companies to collect and report on more nuanced impacts (customer income, and so on) by adjusting contract covenants or interest rates accordingly. But this would require investors to consider lower financial returns in exchange for verified investing for impact. Both GOGLA and SunFunder continue to iterate more nuanced impact systems.

SunFunder's future direction

In a sector that is already struggling to attract adequate risk capital,[176] and where investor expectations of returns are not always aligned with what the sector can deliver,[177] SunFunder's first close on its latest and biggest fundraising round underscores its successful track record so far, and highlights investor confidence in its business model. Additionally, OPIC's investment in two different risk layers suggests that DFIs are developing a growing appetite for risk in off-grid solar – which could in turn help to crowd in larger private investments, including for SunFunder funds. However, incentives and business models of development banks may need strengthening if they are to mobilise more private capital.[178]

SunFunder continues to fuel growth with multi-million-dollar deals, but competition from other investors may limit that growth avenue soon. Continuing to specialise, with for example structuring expertise, will probably provide some relief, since newer investors tend to be less familiar with the sector and pursue larger, less risky deals with more established companies. Through innovative opportunities like the KOSAP program, SunFunder will gain access to more companies and business models, while probably allowing it to reach more and different people, and solidifying its position in the sector.

The challenge for the sector will be to channel more investment towards the start-ups and smaller companies that have difficulty raising capital. One of SunFunder's strengths is its ability to offer facilities to companies in a range much lower than most other investors. However, its potential pipeline of early-stage companies may be limited by the severely restricted supply of equity in the sector,[163] as well as the business acumen and skills gap. Its efforts around a referral network could strengthen this pipeline. While SunFunder is unable to sustainably offer direct technical assistance to companies itself, partnerships with technical assistance programs might be beneficial for its pipeline. Indeed, some donors and governments are taking note[179] by blending funds with technical assistance grants and project preparation facilities, for example.

If SunFunder can continue innovating and evolving to overcome some of the major challenges, such as the proliferation of non-specialist debt offerings, its future is indeed bright.

Methodology

Annex 1: Research method an approach

Our research involved review of energy access literature both globally and in the countries relevant to the three aggregators (Nepal, Bangladesh, Kenya and Tanzania), interviews with key stakeholders and a regional workshop in Tanzania. In this section we outline our analytical framework that we used to analyse the three aggregators, an overview of the case study and interview methodology and a summary of the outputs from the validation workshop.

Analytical framework

Our analytical framework traces the flow of money from financiers to end-users via aggregators, energy companies and other financial intermediaries. It also reflects the different financial instruments uses to mobilise finance for off-grid energy services, and how aggregation can support the sector at different stages of the value-chain. The columns below highlight some of the core stakeholders in the sector that we considered. We define the key terminology used in the report in Box 1 below.

Financiers	Aggregators	Financial instruments	Energy companies	Other intermediary actors	End-users
▪ High net-worth individuals ▪ Impact investors ▪ Foundations ▪ Family offices ▪ Development finance institutes (DFIs) ▪ Multi-lateral banks (MLB) ▪ Government (transnational and domestic) ▪ Philanthropic financiers ▪ Commercial banks	▪ SunFunder as a commercial financial intermediary ▪ IDCOL and AEPC as government agencies or institutions	▪ Blended finance ▪ Subsidies ▪ Concessionary loans ▪ Loans ▪ Grants for capacity building	▪ Suppliers ▪ Distributors ▪ Manufacturers ▪ Engineering, Procurement, Construction companies	▪ National governments ▪ Local governments ▪ MFIs ▪ CSOs ▪ Public developers (community group and cooperatives) ▪ Agents ▪ Installers ▪ Private sector associations	▪ Consumers ▪ Poorest ▪ Most remote ▪ Women ▪ Socially disadvantaged communities

BOX 1: TERMINOLOGY USED IN THIS REPORT

- **Aggregators:** Platforms that bundle financial products to offer investors the opportunity to invest in larger portfolios (with larger ticket sizes and potential impact) and to diversify risk. In some cases, aggregators bundle demand for electricity among customers. (adapted from Shakya C and Byrnes, R (2017) Turning up the volume: financial aggregation for off-grid energy. IIED, London. http://pubs.iied.org/16636IIED))
- **Off-grid systems:** Technologies that can provide energy without being connected to a mains electricity grid. This study primarily looks at three types of systems financed through the aggregators across the three contexts we examined.
  - **Solar Home Systems:** Stand-alone photovoltaic systems with a capacity of 10–1,000 watts, which can be connected to low-wattage appliances, such as televisions and fans.
  - **Mini-grids:** A distribution grid (electricity generation capacity of 10 kW to 10MW) which supplies electricity to a limited number of customers and can operate independently of the national electricity transmission network[1]. In the context of this study, we looked at off-grid mini-grids powered by solar or micro-hydro.
  - **Solar Irrigation Pumps:** Motor-based water pumps run by solar PV. Solar Irrigation Pumps are popular in rural areas where farmers may struggle to afford diesel and where reliable access to the grid is lacking.[2]
- **Financiers or investors:** Sources of money/finance for off-grid energy – whether domestic or international, public or private.
- **Finance type:** The type of financing for an aggregator is receiving, whether it is short- or long-term, grant or concessionary credit, and so on.
- **Energy companies:** Private companies that deliver services to customers and receive finance from aggregators.
- **End-users:** Consumers of the energy services provided by off-grid systems, and the ultimate beneficiaries of the finance that aggregators mobilise.
- **Impact:** How different groups of populations benefit from increased access to energy, in this case via off-grid systems. IIED research aims to identify the impacts on populations who are often marginalised, including women, the poorest and most remote communities, and other socio-economic groups.

* http://www.minigridpolicytoolkit.euei-pdf.org/system/files_force/RECP_Minigrid_Policy_Toolkit_doublepage%20(pdf%2c%2012.5MB%2c%20EN)_web60ab.pdf?download=1
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Categorisation of energy companies

For the purposes of this report, we have grouped companies working with each of the three aggregators into the following categories. Companies would typically exhibit one or more of the features described:

SUNFUNDER

- **Early-stage:** Operational for <2 years; Innovative and testing new products; Entering new geographical markets; Investment from the aggregator is less than US$300,001; Focus in 1 country
- **Middle-stage:** Operational for 2- 6 years; Investments from the aggregator range from US$300,001 to $1m; Presence in more than 1 country
- **Late-stage:** Operational for > 6 years; Investments from aggregator > $1m; Presence in more than 1 country

AEPC

- **Early-stage:** Operational for < 2 years; Innovative and testing new technologies and business models; Finance received from the aggregator is for only one type of technology; Finance received from aggregator <US$100,000 (estimated amount contributing to most recent annual company turnover).
- **Middle-stage:** Operational for 2-6 years; Finance received from aggregator used to fund more than one type of technology; Finance received from aggregator US$100,000-US$500,000 (estimated amount contributing to most recent annual company turnover).
- **Late-stage:** Operational for > 6 years; Finance received from aggregator for multiple technologies (particularly for mini-/micro-grids in addition to other stand-alone systems); Finance received from aggregator >US$500,000 (estimated amount contributing to most recent annual company turnover)

IDCOL

- **Early-stage:** Operational for < 2 years; Innovative and testing new technologies; Finance received from aggregator is for only one type of new technology; Finance received from aggregator is <US$300,000
- **Middle-stage:** Operational for 2-6 years; Finance received from aggregator for more than one type of technology; Investments from aggregator US$300,001–US$1million.
- **Late-stage:** Operational for > 6 years; Finance received from aggregator for scaling up new technologies (such as SMGs, SIPs); Investments from aggregator > $1m

Analysis of companies

To help ensure the data we gathered from companies remained anonymous, we have coded a range of responses (such as 1 to 3 enterprises) with a word (for example 'a few'). This avoids the need to constantly repeat longer phrases such as '1 to 3 enterprises'. The key for the company's responses are shown below:

AGGREGATOR	A FEW	%	SOME	%	MOST	%	ALL	%
AEPC	1 to 3	11–33%	4 to 5	44–56%	6 to 8	67–89%	9	100
IDCOL	1 to 2	14–29%	3 to 4	43–57%	5 to 6	71–86%	7	100
SunFunder	1 to 2	14–29%	3 to 4	43–57%	5 to 6	71–86%	7	100

Methods

Our 'Case Study' approach drew on a combination of in-depth, semi-structured interviews, data collected from the aggregators and energy companies, informal discussions with industry stakeholders, and a workshop to test our ideas.

Literature review

The initial phase of our research included a literature review of relevant topics: aggregation characteristics, techniques and approaches in the off-grid sector (crowdfunding, mini-grid pooling and so on); technologies that might enable aggregation (such as PAYG, IoT and so on); financial flows to the off-grid sector, including the discourse around barriers and data gaps; financial instruments to enable the sector; energy company evolution and needs at different stages; impact monitoring and measurement; and various analyses of off-grid markets. The reviews mostly included secondary sources (about 80 articles and reports).

Research Questions

Based on the literature review, IIED established the following research questions for aggregators and their energy companies.

1. Who is funding the three off-grid aggregators and what types of financing instruments do they utilise (for example, grants, loans, equity, programme-focused funding)?
2. What financial instruments have been used by the aggregators to target their markets and what other roles do they play in addition to mobilising funds (for example, quality assurance, technical assistance, training, mentoring and so on)?
3. How are energy companies delivering off-grid services using this finance and what do they perceive as opportunities, challenges and trends in the markets where they work?
4. How are aggregators and energy companies measuring their impacts and which markets are they reaching? Can aggregator financing reach the poorest, most remote, and those who lack access to energy?

Case studies

IIED approached several financial aggregators to gauge interest in supporting these research questions, especially in terms of their willingness to introduce IIED to their enterprise clients. We received very positive responses from three, whom we subsequently worked with: Alternative Energy Promotion Centre (AEPC) in Nepal, the Infrastructure Development Company Limited (IDCOL) in Bangladesh and SunFunder in East Africa.

We used separate questionnaires for aggregators and for on the energy companies receiving their finance based our research questions, and used them to structure discussions and record responses. All three aggregators were very generous with their time in the initial interviews, with our follow up questions, and the support they gave IIED throughout the research.

IIED engaged each aggregator individually to establish initial lists of companies they finance that we could potentially speak with. The criteria aimed to capture a range of companies who were at various stages of growth, spread across various geographies, and willing to engage and share data with the researchers. On this basis IIED interviewed 23 companies (seven with SunFunder, nine with AEPC, and seven with IDCOL), including one NGO (with IDCOL), as well as the three aggregators, using semi-structured interviews based on the questionnaires. These interviews took place from July to November 2018.

Semi-structured informal interviews with other stakeholders

We also undertook additional semi-structured interviews with several stakeholders. These interviews helped us better understand the enabling environment and underlying factors driving changes in the off-grid market that affect the role of the aggregators in East Africa, Nepal, and Bangladesh. These interviews included key stakeholders from private sector associations, policy institutions, national banks, and experts in the off-grid sector. See Annex 2 for a complete list of interviewees.

Workshop

We presented our initial findings at a workshop held in partnership with the Energy Change Lab on 12-13 November 2018 in Dar es Salaam, Tanzania. The workshop included interactive discussions on our initial research findings and recommendations, and brought together a mix of stakeholders to share experiences and brainstorm practical ways forward. The workshop audience included energy financiers, policy makers, energy companies, sector experts, development partners, and civil society organisations.

Key issues discussed

Participants reflected on the IIED research during the workshop. Below are the highlights of these discussions along with recommendations that emerged from the group work. These informed the analysis and recommendations presented in this publication.

Incentivising commercial banks *to enter the off-grid energy sector remains an untapped opportunity*

- Commercial banks need new capabilities and incentives to establish lending facilities for off-grid energy, such as the technical capacity to assess renewable energy projects and access to concessionary loan facilities.
- Local currency loans are still vital for domestic and international energy companies to hedge against exchange rate risk. Stakeholders should engage with key local financial institutions to unlock concessionary financing, and develop solutions together with policy makers, relevant government institutions, and financiers to address these challenges.

Provision of public finance *remains vital for developing diverse financial instruments that can reach the poorest and the most remote populations*

- Blended finance instruments – such as combinations of debt and subsidies/grants – could support the faster deployment of off-grid energy solutions by guaranteeing revenue and de-risking investment. But such instruments should always be deployed to support a longer-term vision to build sustainable distribution channels
- Grant funding can be used to catalyse financing for small local energy companies by offsetting transaction costs

Understanding and knowing the customer *is key to ensuring technical and financial solutions are designed appropriately with supporting interventions such as end-user training*

- For mini-grids, tariffs and financial incentives should be affordable and aligned with remote and poor communities' ability and willingness to pay. Data from regular socio-economic impact assessments could be used to help design more sustainable solutions
- Solar home system default and repossession data should be shared more widely to better understand the market; if a large company fails/defaults, it will reverberate throughout the off-grid sector, affecting everyone
- Incentivising after-sales services (as well as new customer acquisition) can foster more sustainable markets, with higher levels of customer confidence and fewer defaults. Customers (especially those in remote and rural areas) have very little leverage to demand quality and affordable energy services. Local governments could lead advocacy measures with suitable civil society organisations to train and create platforms where consumers can access information on quality assurance procedures and provide rapid feedback on products (such as by using mobile phones)

Local companies often lack the necessary skills to package projects/loan *applications to financiers, contributing to a large funding gap*

- Capacity building and mentoring to improve financial management and reporting can help local energy companies build their track record for increasing and diversifying their financier base
- International companies could partner more closely with local companies to build local capacity. Benefits for the international partner could include gaining immediate market knowledge and valuable in-country relationships – as well as a pathway to growth and expansion into new markets.
- Recruiting high-quality managers remains a challenge for most energy companies, especially for mid-level positions.
- Advances in off-grid technology require commensurate training for company staff – including operational and maintenance training for mini-grid operators and technical training for developers and engineers. International expertise and government institutions may be needed to build capacity at the local level.

Government policy is crucial for creating a sustainable energy market, ***but policy levers are often separated from energy financing needs***

- Sudden short-term policy changes can stem investment flows. To mitigate unfavourable policy shifts, governments need to create strong legal and regulatory frameworks for off-grid energy. These frameworks should support a longer term vision to develop the off-grid market and enforce breaches of contract in a timely manner.
- Local governments can play an important role in pushing for better renewable energy policies at the national level. Insights from customers and energy companies should inform decision-making by government ministries involved in regulating the off-grid sector.

Electrification projects often fail to meet ambitious targets set by governments on time.

- The uncertainty generated by this mismatch between political rhetoric and progress on the ground can deter investors from supporting promising off-grid projects in areas that are nevertheless unlikely to be connected to the grid in the near future. Governments and the energy sector should work much more closely together to coordinate rural electrification programmes and off-grid projects so they can mutually-reinforce – rather than undercut – each other. Government stakeholders should create a platform to facilitate closer coordination on key policies and programmes to create a favourable environment for the private sector.

Finance has not always managed to reach *the poorest and the most remote communities, and impact measures often fail to capture important socio-economic data*

- Public finance delivery (grants, subsidies, concessionary loans and so on) should be targeted at the communities that need them the most. They should be deployed in such a way as to avoid distorting markets, with timely disbursement to customers and/or companies, and clear signalling to the market on planned phase-outs. (Such phase-outs should be proactively designed but adapted in the light of feedback). Subsidising connection fees for mini-grids or product pricing could help lower customer costs.
- Successful impact measurement depends on having the appropriate procedures and resources in place to collect and assess data; measure whether target groups have been reached; and facilitate dialogue to broadcast successes and flag challenges so decision-makers can respond.

Research Limitations

- Considerations related to proprietary content and information limited the amount of detailed data that aggregators and companies made available for publication in this study. Additionally, internal processes delayed the authorization and release of certain data so long that it could not be included in the report.
- The aggregators were very cooperative in sharing information and data that had not been made public, but we were unable to publish all of it. As a consequence, some of the research is based purely on publicly available data. However, SunFunder was particularly bold in the amount of data it revealed to IIED that it had not previously made public. AEPC shared subsidy delivery data which were analysed by us to understand reach of subsidies for SHS. Both IDCOL and AEPC shared several internal programme-level documents which provided extremely valuable insights for our analysis and recommendations.
- IDCOL and AEPC receive a mix of grants and concessionary loans which are allocated to various long-term projects or programmes across different off-grid renewable energy technologies, some of which are still active. To manage the scope of the study, we mostly reviewed material from the last five years – although these two aggregators have been around considerably long. This meant our review was not as comprehensive as it might have been, but did allow us to make a more detailed assessment of recent activities.
- We did not interview financiers or end-users. Their perspectives were mostly captured from studies carried out by the aggregators themselves, or specific impact-related data shared by the companies or aggregators, or the industry as a whole.
- Although the sector's interest in our research topics was generally high, some companies had only limited time to contribute to the interviews – which ranged in duration from 45 minutes to four hours. For shorter interviews, we focused our questionnaires on the most relevant questions and data points.
- The sample size of 23 energy companies is quite small compared to the total portfolios of all the aggregators across the three study areas. Future studies could expand on these efforts to try to gain a more comprehensive picture of aggregators and their energy company clients. However, as noted, energy companies may still have limited bandwidth to work with researchers, and can be selective in terms of the data and information they reveal, particularly when it comes to investments or data connected with intellectual property.

Annex 2: List of stakeholders

The research team would like to thank the following individuals who shared their insights both formally and informally and at the November 2018 Workshop in Tanzania (Note: this list does not necessarily explicitly include companies interviewed for this research).

NAME	ORGANISATION
Narayan Adhikari	AEPC
Parbata Bhatta	AEPC – Gender and Social Incusion Unit
Rana Thapa	AEPC – Hydro component
Chaitanya Prkash Chaudary	AEPC – Solar component
Padam Adhikari	AEPC – Subsidy
Mukesh Ghimire	AEPC – Subsidy
Satish Gautham	AEPC – UNDP – Renewable Energy for Rural Livelihoods Programme
Rojen Kumar Shrestha	AG Power Company, Nepal
Nicolas Thonus	ARTI ENERGY Limited
Asif Iqbal	Bangladesh Bank (Central Bank of Bangladesh)
Dipal Barua	Bangladesh Solar & Renewable Energy Association (BSREA)
Sarah Wykes	CAFOD
Manu Binod Aryal	Central Renewable Energy Fund
Umesh Prasad Acharya	Central Renewable Energy Fund
Ibrahim A Haji	CRDB
Witek Lukaszynski	DEVERGY
Sisty Basil	Energy Change Lab
Basil Malaki	Energy Change Lab
Kavita Rai	Energy Sector Expert
Prosper Magali	Ensol Tanzania
Julius Mujuni	ENVenture
Kanizio Nwanamkuu	EWURA
Badrul Alam Khan	Gazi Renewable Energy Company Ltd (GREL), Bangladesh
Anjal Niraula	Gham Power, Nepal
Susie Wheeldon	GOGLA
Laura Sundblad	GOGLA
Purav Shah	Greenlight Planet
Eco Matser	Hivos
Bir Bahadur Ghale	Hydro Energy Concern, Nepal
S M Monirul Islam	IDCOL
Nazmul Haque	IDCOL – Investments
Sadia Raisa Khan	IDCOL – Renewable Energy

NAME	ORGANISATION
Farzana Rahman	IDCOL – Renewable Energy
Fungai Matura	IFC
Mina Steirnblad	InspiraFarms
Robert Wang'oe	JUMEME
Roshan Soti	Nepal Hydro & Electric Limited
Suman Pradhan	Nepal Yantra Sala
Dinesh Dulal	NMB Bank – Nepal
Rumman Rony	Parasol Energy Limited – Paragon Group, Bangladesh
Lydia George	PowerCorner
Eliud Mjuni	PowerGen
Tim Kipchumba	QuestWorks
Mustafizur Rahman	Raheemafrooz Renewable Energy Ltd, Bangladesh
Bengiel M Sofe	Rural Electrification Agency Tanzania
Khandaker Saiful Islam	Rural Services Foundation, Bangladesh
Salek Uddin	Salek Solar, Bangladesh
Aashish Chalise	Saral Urja Nepal
Caroline McGregor	SEforALL
Josh Sebastian	SNV
Wim van Nes	SNV
Purna Ranjitkar	Solar Electric Manufacturers' Association Nepal (SEMAN)
Fatma Muzo	Solar Sisters
Shah Noman Partho	Solargao Limited, Bangladesh
Mr. Bhanu Bakta Paudyal	Sun Safe Solar & Investment Pvt. Ltd, Nepal
Mr. Rudra Bdr. Pun	Sun Safe Solar & Investment Pvt. Ltd, Nepal
Avishek Malla	SunFarmer, Nepal
Ruhul Quddus	SunRim Energy, Bangladesh
Nabin Bhujel	Suryodhaya Urjan, Nepal
Taibur Rahman	Sustainable And Renewable Energy Development Authority (SREDA)
Keneth Lusesa	Tanzania Investment Bank
Roeland Menger	ZOLA Electric

Notes

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The off-grid energy sector continues to have a tremendous funding gap. Aggregation has great potential to channel finance into the millions of off-grid projects and products that will make universal energy access by 2030 possible. By bringing together projects and companies into portfolios, aggregation can reduce transaction costs and mitigate risks, while opening an attractive pathway for bigger investors to move more money into off-grid energy projects. AEPC in Nepal, IDCOL in Bangladesh, and SunFunder mostly in East Africa, have all forged unique pathways to crowding in more public and private finance, and providing support beyond financing to grow off-grid markets. Public and private investors, governments, and implementing energy companies can learn from their success and failures. There is a clear need for building and tailoring aggregator platforms if the 1 billion people without electricity and 3 billion without clean cooking are to be reached.

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