

The Road to Zero Interest

The Potential Role of Concessional
Consumer Financing in
Energy Access

May 2023



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Energy Saving Trust is an independent organisation dedicated to promoting energy efficiency, low carbon transport and sustainable energy use. We aim to address the climate emergency and deliver the wider benefits of clean energy in the just transition to net zero. We empower people to make better choices, generate insight to inform policy direction, deliver transformative programmes for governments and support businesses with strategy, research and assurance – enabling everyone to play their part in building a sustainable future in the United Kingdom and internationally.

Energy Saving Trust is co-secretariat of the Efficiency for Access Coalition, together with CLASP. Efficiency for Access is a global coalition working to accelerate clean energy access through affordable, high-performing, and inclusive appliances. It is co-chaired by the UK’s Foreign, Commonwealth and Development Office (FCDO) and the IKEA Foundation who also fund its foundational programme, the Low Energy Inclusive Appliances (LEIA) programme. LEIA is a research and innovation programme working to double the efficiency and halve the cost of a range of high-performing electrical appliances for off- and weak-grid households, small businesses and industrial customers.

This research was funded by Energy Saving Trust as its contribution to the LEIA programme and wider Efficiency for Access efforts. We would like to thank the FCDO and IKEA Foundation for co-funding provided in the form of staff time via the LEIA programme.

This report was authored by Jakub Vrba, Charlie Miller, Emilie Carmichael (all Energy Saving Trust), and Ed Day (Greencroft Economics) who led the affordability modelling section. The affordability modelling was based on the Off-Grid Solar Market Trends Report 2022 methodology and datasets.

The authors would like to thank Felicity Tolley, Ellie Grebenik, Chris Beland, Sophia Bates, and Kalina Stormonth-Darling (all Energy Saving Trust) for providing valuable inputs to shape the report and giving feedback during the internal review process.

The authors are immensely grateful to the following peer reviewers (in alphabetical order of the corresponding organisation) for their valuable inputs, feedback, suggestions and continuous support throughout the development of this report:

Acumen	Sarah Bieber
EnDev / GIZ	Sarah-Melissa Leitner
ESMAP	Johanna Galan
ESMAP / End User Subsidy Lab	Federico Hinrichs
GOGLA	Oliver Reynolds
Open Capital Advisors	Duda Slawek
Simusolar	Michael Kuntz
SolarAid	Jamie McCloskey, John Keane, Brave Mhonie, Ian Dodkins

The authors would also like to thank the following stakeholders (in alphabetical order of the corresponding organisation) who participated in one-to-one interviews to shape this report and share valuable insights to inform the findings.

AECF	Angelous Kamande, Caroline Toroitich
African Clean Energy (ACE)	Judith Joan Walker
BASE	Thomas Motmans
BFA Global	Jacob Winiecki
Charm Impact	Gavriel Landau
CLASP	Siena Hacker
ClimaFI	Yaron Cohen
DOEN Foundation	Beau-Anne Chilla, Jitske Harms
Energy 4 Impact / MercyCorps	Alba Topulli, Laura Clough Patel, Sammy Kitula
Energy Saving Trust	Harry Mayers, Kalina Stormonth-Darling, Matt Fraser, Sophia Bates
EnerGrow	Aaron Leopold
GOGLA	Carlos Sordo Olive, Drew Corbyn
Husk	Anubha Shukla
Inclusive Energy	Gareth Selby, Vijay Bhopal
Independent Consultant	Kevin Kennedy
International Institute for Environment and Development (IIED)	Kevin Johnstone
Kiva	Spencer MacColl
Open Capital Advisors	Harry Masters
Signify Foundation	Lou Van Reemst, Tarini Bhasin
SNV	Karimi Ndigah, Maryanne Wanjiru
SolarAid	Jamie McCloskey
SunCulture	Mikayla Czajkowski

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Abbreviations

AER	Annual Equivalent Rate
CCF	Concessional Consumer Financing
CO2	Carbon Dioxide
DC	Direct Current
EforA	Efficiency for Access
EV	Electric Vehicle
Forex	Foreign Exchange
HES	Home Energy Scotland
IDCOL	Infrastructure Development Company
KPI	Key Performance Indicator
LEIA	Low Energy Inclusive Appliances
MCS	Microgeneration Certification Scheme
MFI	Micro-Finance Institution
MTR	Market Trends Report
PAYG	Pay-As-You-Go
RBF	Results-Based Financing
SACCO	Savings and Credit Cooperatives
SDG	Sustainable Development Goal
SHS	Solar Home System
SME	Small and Medium Enterprise
SWP	Solar Water Pump
USA	United States of America
USD	United States Dollar
Wp	Watt peak

Foreword

Energy Saving Trust is dedicated to addressing the climate emergency while ensuring that no one is left behind. We have been working for decades with households, governments and businesses in the UK and Europe to promote clean energy and energy efficiency solutions. We have successfully managed schemes using concessional consumer financing – long-term, low-interest or zero-interest loans to end users – to overcome high upfront costs in Scotland and elsewhere in the UK. This approach has proven highly effective, enabling more households to access solutions that save money and reduce emissions, whilst using public funds as efficiently as possible. As the case studies in this report make clear, concessional consumer financing has a long history and has been successfully implemented in a wide range of countries and contexts.

When we launched our energy access programme in 2017, we were struck by how concessional consumer financing had not been widely used to address affordability in the Global South. We realised that, by drawing upon our experience in the Global North, we could make an important contribution to the debate around how to achieve universal, sustainable energy access.

We undertook this research to shine a light on how concessional consumer financing could help to make modern energy products – such as solar home systems, appliances, and productive use equipment – affordable to more people. This versatile public funding approach has the potential to accelerate access in on-grid, mini-grid and stand-alone off-grid settings.

We call for further piloting of this promising public funding mechanism in Sub-Saharan Africa, and encourage governments to think of concessional consumer financing as a potentially valuable new tool in the ‘toolbox’ of interventions that can be used to achieve access. Further innovation to overcome high upfront costs is essential if we are to overcome affordability barriers, achieve universal energy access and combat the climate crisis.



Mike Thornton OBE

Chief Executive

A handwritten signature in black ink that reads "M. Thornton". The signature is written in a cursive, slightly stylized font.

Executive Summary

This report is for governments, aid agencies, foundations and programme implementers interested in exploring how concessional consumer financing can be used to overcome affordability constraints and help to achieve Sustainable Development Goal 7. It takes stock of experience using concessional consumer financing in the energy sector globally, before exploring potential delivery models that could be considered in an energy access setting.

Concessional consumer financing (CCF) is financing provided to end users with an interest rate that is lower than commercial rates. CCF is often made available to end users by governments for products or services that deliver on desirable social, economic and/or environmental outcomes. CCF is typically offered to end users to incentivise them to invest in renewable energy or energy efficiency products by reducing the cost of financing.

In the Global North, CCF is commonly used to overcome high upfront costs and enable households to access renewable energy and energy efficiency products such as heat pumps, electric vehicles and home insulation. However, it has rarely been used in energy access projects in the Global South. It has been particularly successful in Scotland, Germany, Canada and the United States of America (USA) where it has enabled households to access finance for products that commercial lenders do not provide financing for because of risks associated with the nascency of new market segments (e.g. electric vehicles) and the very long repayment periods required to make monthly payments affordable (e.g. home refurbishment). One notable example of CCF in an energy access setting comes from the IDCOL solar home system (SHS) programme in Bangladesh, in which concessional loans were channelled from the World Bank and other donors, to the Government, to IDCOL, to participating microfinance institutions (MFIs), and finally to end users for the purchase of SHS.

The CCF case studies explored in this report show that it can be used to accelerate uptake of emerging technologies amongst early adopters. The programmes we studied have typically achieved high repayment rates through factors such as targeting households on higher incomes; having an attractive financial offering for a beneficial product; the use of credit checks; and negative consequences for non-payment. They have not negatively affected commercial lending. Key features of successful CCF programmes include the provision of impartial customer advice, product and supplier accreditation, and the participation of a wide range of suppliers and installers. Implementation over a long timeframe, combined with flexibility to adapt to evolving market conditions, has been critical.

CCF models that can be applied in an energy access setting can be split into models that involve third-party lending and models that involve direct lending by energy service providers. Third-party lenders could include development banks; commercial banks, MFIs or Savings and Credit Cooperatives (SACCOs); or non-profit organisations. Energy service providers that could lend directly include utilities; mini-grid developers; and pay-as-you-go (PAYG) companies. Providing CCF via PAYG was identified as having the greatest potential to reduce the affordability gap for energy access products in Sub-Saharan Africa.

CCF models for PAYG involve reducing the costs and risks that companies face when providing consumer financing, with savings passed on to end users in the form of lower interest rates. This report considers extended repayment periods, combining these with end-user subsidy, and service-based results-based financing (RBF). These more ambitious models have a greater potential impact on affordability, but also higher costs and risks, as well as more uncertainty around late payment and default rates. The potential impact of these models on affordability is analysed, building on the methodology and datasets used in the 2022 Off-Grid Solar Market Trends Report (MTR).¹

¹ Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

Our affordability analysis suggests that CCF can help to make Tier 1² electricity access affordable, help households move up the energy ladder more quickly, and access larger SHS or productive use systems.

With the traditional PAYG business model, 56% of unconnected households in Sub-Saharan Africa can afford a Tier 1 multi-light and mobile charging system. This rises to 60% with a zero-interest working capital facility for on-lending, to 66% with a zero-interest consumer loan, and 99% with a zero-interest consumer loan extended to five years. The most effective lever to increase affordability is extending the repayment period, but this would require a significant grant funding component to implement.

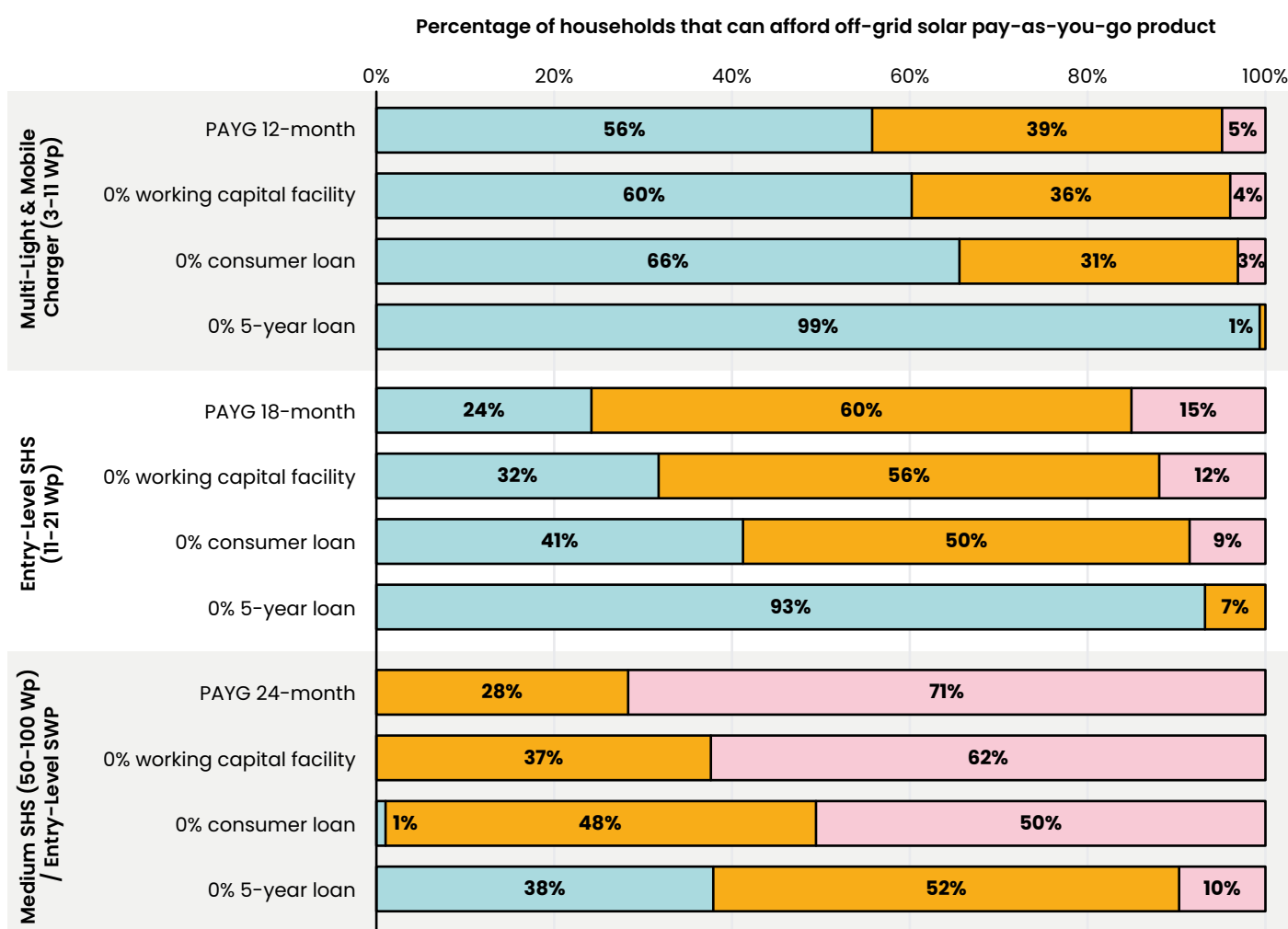


Figure 1. Impact of concessional consumer financing on affordability of pay-as-you-go solar systems across Sub-Saharan Africa (methodology and datasets derived from the Off-Grid Solar Market Trends Report 2022)³

² ESMAP. 2023. Multi-Tier Framework for Energy Access. https://www.esmap.org/mtf_multi-tier_framework_for_energy_access.

³ PAYG = Pay-as-you-go; Wp = Watt peak; SHS = Solar Home System, SWP = Solar Water Pump; "Affordable at a stretch" is based on a 10% of total monthly expenditure used for PAYG payments, compared to 5% considered as "affordable".

In the case of Malawi – a country with low electrification rates and low ability to pay – CCF could substantially reduce the affordability gap.

Only 16% of unelectrified Malawian households can currently afford a Tier 1 multi-light and mobile charging system under PAYG, but with a zero-interest consumer loan 20% of households could afford Tier 1 and with a zero-interest loan over five years the figure rises to 82% of households. The MTR estimates a subsidy requirement to achieve universal access to Tier 1 of 4.5 billion USD on the basis of PAYG accounting for 30% of new connections.⁴ If CCF helped to increase the penetration of PAYG to 70% of new connections, it could reduce the remaining affordability gap to just 2.4 billion USD for a zero-interest consumer loan, and to 1.8 billion USD if the PAYG term was extended to five years.

In practice, the design of CCF would be similar to the design of an end-user price subsidy channelled through companies. In end-user subsidy programmes, RBF amounts are typically set as a percentage of the unsubsidised retail prices for each product category, whilst in CCF, RBF amounts could be set to cover the difference between the average cash and average PAYG prices for each product category (or a proportion of it). If CCF schemes sought to extend repayment periods, companies would be required to show how they had used the RBF to extend the repayment period, and could also be required to offer extended warranties, helping to improve the delivery of long-term, high-quality after-sales service. Data-sharing using the PAYGo Perform KPIs⁵ could be used to monitor the impact of CCF on the market and adjust the design accordingly. Both mechanisms reduce or negate the 'poverty premium' that poorer customers typically face, and both can be designed to enable a wide range of companies to participate. Both mechanisms require careful targeting; clear consumer awareness campaigns; independent verification of claims; quality assurance and environmental and social safeguards.

Extending repayment periods could dramatically improve affordability, but the costs and risks of providing financing over longer timeframes are unknown.

CCF can only be considered a success if it proves to be a more efficient use of public funds for overcoming affordability barriers compared to simpler end-user subsidies. The concepts outlined in this report need to be tested. A CCF pilot should focus on understanding the impact on affordability, consumer behaviour, and company costs and risks – ideally while directly comparing with an alternative end-user subsidy approach in a similar setting.

4 Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/0992335110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

5 FinDev Gateway. 2023. PAYGo PERFORM KPIs. <https://www.findevgateway.org/paygo-perform-kpis>.

1. Concessional Consumer Financing – Track Record and Case Studies



1. Concessional Consumer Financing – Track Record and Case Studies

1.1. Introduction

Concessional consumer financing (CCF) is a public funding mechanism that seeks to make products more affordable, either by reducing the interest that consumers pay on loans, extending repayment periods, or both. A lack of access to affordable finance prevents households on low incomes from purchasing renewable energy or energy efficiency products which are currently unaffordable to them. CCF can be delivered by energy service providers, or by third-parties such as financial institutions. The loan amount, tenor, interest rate and requirements around collateral or deposit all vary widely depending on the technology being promoted and the intended end-user group's characteristics. In most cases, the key features of the loan are communicated to the end user in a transparent way.

CCF programmes have been used to accelerate uptake of new technologies as well as to expand access to mature technologies. Programmes seeking to accelerate uptake of nascent technologies have typically targeted 'early adopters' – wealthier households with higher risk appetite – whilst programmes seeking to expand access to mature technologies typically target less wealthy middle-income households in the 'early to late majority adopters' segment. Customer profiles vary significantly across the Global North and Global South in terms of overall income levels, expenditure on energy as a proportion of household expenditure, seasonality of income, availability of assets that can act as collateral, access to and familiarity with financial services, and availability of credit ratings or credit history.

The technologies financed through CCF in the energy sector vary widely. They include home energy generation technologies such as rooftop solar systems or heat pumps, home energy efficiency measures such as double-glazing

or insulation, e-mobility technologies such as charging stations or electric vehicles (EVs), and consumer durables such as solar home systems, solar water pumps and solar fridges.

Different technologies have different risk profiles depending on cost, complexity and moveability. For example, home insulation is a relatively simple, low-cost technology requiring minimal maintenance or after-sales service. Once it is installed it is also very difficult to move. In contrast, a portable solar water pump is relatively complex and expensive, requiring more maintenance and after-sales service. As a moveable asset, there is greater risk of the product being resold, stolen or not used for its intended purpose.

There are two main ways in which CCF has been made available to end users in the energy sector. In some cases, the provider of the energy product or service, which could be a utility, a mini-grid developer or a PAYG company, provides financing to the end user. In others, the energy product or service is provided by an accredited installer, and financing is provided by a third party such as a development bank, microfinance institution or non-profit organisation. Examples of these approaches are explored in *Section 1.2*.

1.2. Delivery Models

In this section, we share a selection of case studies showing how CCF has been used to promote the uptake of energy products and services around the world. The case studies cover a range of product categories and explore the different approaches taken to distribution/installation, consumer financing and consumer advice. The key features of each case study are summarised in *Figure 2*.

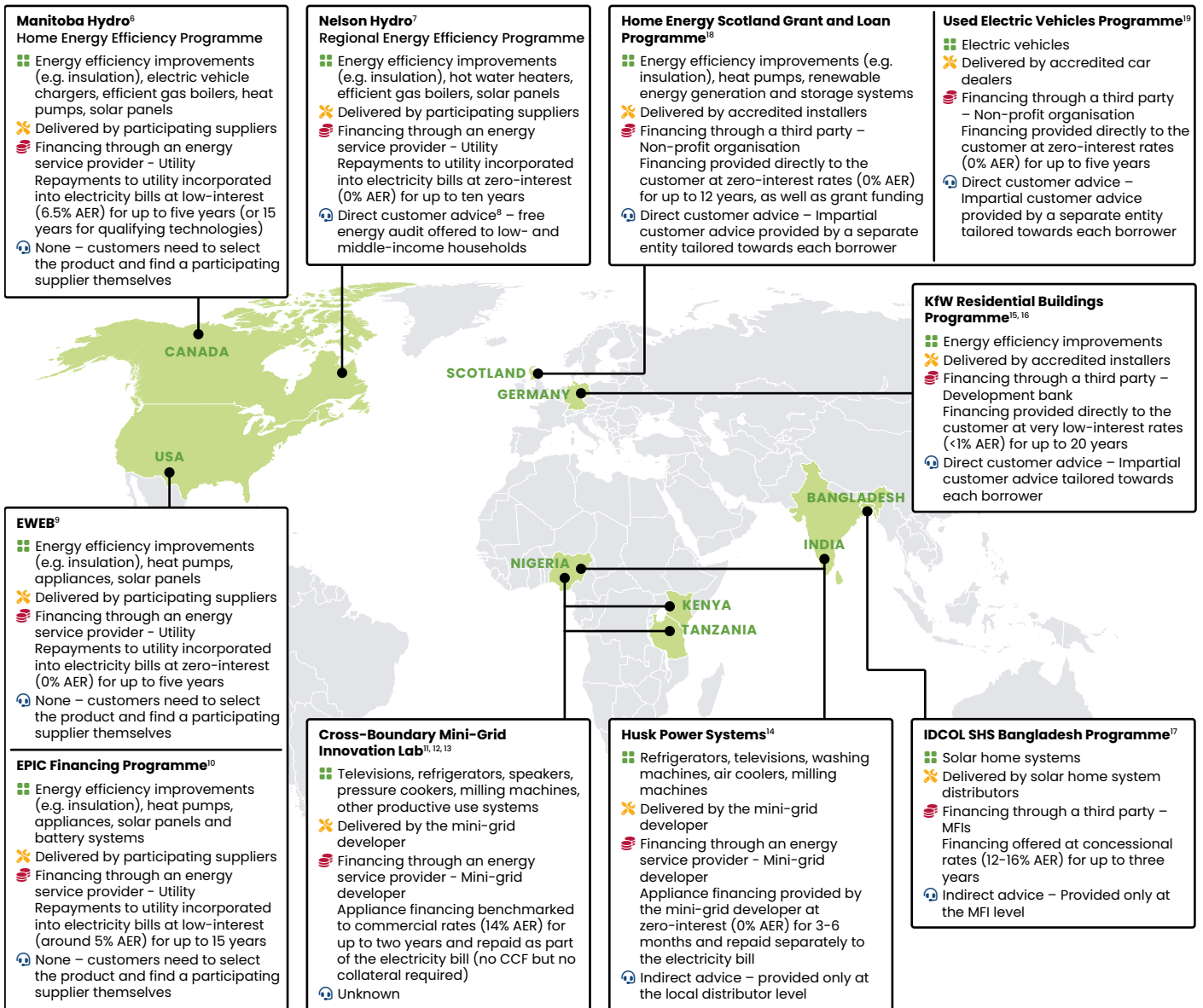


Figure 2. Key design features of selected consumer financing case studies

6 Manitoba Hydro. 2023. Home Energy Efficiency Loan. https://www.hydro.mb.ca/your_home/residential_loan.

7 City of Nelson - British Columbia. 2023. Regional Energy Efficiency Program. <https://www.nelson.ca/742/Energy-Retrofit-Program>.

8 'Direct' customer advice indicates that the programme implementer provides advice directly to the customers. On the other hand, 'indirect' advice is provided via an intermediary, for example when distributors are trained by the programme implementer to be able to provide advice to the customers.

9 EWEB. 2023. Rebates, Loans and Conservation. Eugene Water and Electric Board. <https://www.eweb.org/residential-customers/rebates-loans-and-conservation>.

10 City of Fort Collins. 2023. EPIC Homes. <https://www.fcgov.com/utilities/residential/conservation/financing/rental-property-single-family>.

11 CrossBoundary. 2021. Appliance Financing 1.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2021/04/CrossBoundary-Innovation-Lab-Appliance-Financing-1.0-Innovation-Insight-29-Apr-2021.pdf>.

12 CrossBoundary. 2019. Innovation Insight: Appliance Financing. <https://www.crossboundary.com/wp-content/uploads/2019/08/CrossBoundary-Innovation-Lab-Innovation-Insight-Appliance-Financing-Final-07-Aug-2019-1.pdf>.

13 CrossBoundary. 2019. Innovation Insight: Appliance Financing. <https://www.crossboundary.com/wp-content/uploads/2019/08/CrossBoundary-Innovation-Lab-Innovation-Insight-Appliance-Financing-Final-07-Aug-2019-1.pdf>.

14 Interview with Husk Power Systems.

15 Bettina Dorendorf. 2020. KfW Promotional programs for energy efficiency in buildings. Main elements and success factors. KfW.

16 KfW. 2023. <https://www.kfw.de/>.

17 GOGILA. 2021. How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh's Solar Home System Program. https://www.gogila.org/sites/default/files/resource_docs/case_study_-_lessons_from_bangladeshs_solar_home_system_program.pdf.

18 Home Energy Scotland. 2023. Energy Saving Trust. <https://www.homeenergyscotland.org/>.

19 Home Energy Scotland. 2023. Used Electric Vehicle Loan and chargepoint funding. <https://www.homeenergyscotland.org/find-funding-grants-and-loans/electric-vehicle-loans/>.

1.2.1. Concessional Consumer Financing through Energy Service Providers

a) Utilities

CCF provided by utilities is typically offered to grid-connected customers, with loan repayments integrated into utility bills.

The concessional aspect of the loan is usually underpinned by national or local governments to meet their social and environmental mandates.

On-bill financing has been particularly popular in Canada and the USA, where zero- and low-interest loans provided by utilities have enabled low-income customers to implement efficiency measures and install renewable energy systems. For example, the Manitoba Hydro Home Energy Efficiency Programme in Canada^{20, 21} offers its residential customers low-interest financing for eligible energy efficiency upgrades. The programme supports various interventions including windows, door insulation, electric vehicle chargers, efficient gas boilers, and heat pumps. The programme requires no down payment and follows relatively relaxed underwriting criteria (based on a 12-month utility bill history), resulting in a low rejection rate of 5%. The programme interest rate remained below 5% until 2022 (raised to 6.5% in 2023) and the default rate less than 0.5%. Another Canadian CCF on-bill financing programme called Nelson Hydro – Regional Energy Efficiency Programme²² offers loans at zero-interest rates with similar repayment success.

The Manitoba Hydro Home Energy Efficiency Programme follows eight main steps:²³

1. Manitoba homeowner checks their eligibility based on qualifying energy efficiency upgrade requirements.²⁴
2. The homeowner finds a participating supplier themselves.²⁵
3. The supplier works with the homeowner and submits the application on their behalf.

4. The loan provider reviews the application and conducts a customer credit review. If approved, the loan provider notifies the supplier for the project to begin.
5. The project is implemented by the supplier.
6. The homeowner signs the completion certificate once the project is delivered.
7. The loan provider pays the invoice costs directly to the supplier.
8. The loan repayment is integrated in the homeowner's monthly energy bill.

Utility-led CCF via on-bill financing also has a long track record in the USA. For example, EWEB,²⁶ a publicly owned water and electric utility in Oregon, provides zero-interest loans to households to implement energy efficiency measures. Eligible contractors are accredited to ensure work is carried out to a high standard. Similarly, the EPIC Financing programme led by Fort Collins Utilities²⁷ offers loans at approximately 5% interest rate, which enable customers to make energy efficiency improvements and buy efficient appliances on favourable terms including attractive, concessional interest rates, no upfront payments and loans covering the entire project cost. As these financing schemes are utility led, the lenders are able to disconnect customers who stop repaying their loans, similar to the PAYG model used in off-grid settings, where companies can lock the system remotely.²⁸ The threat of disconnection incentivises customers to continue with the repayments.

Customers who obtain loans from the four programmes are required to select the product and find the participating suppliers themselves, with one exception. The Nelson Hydro – Regional Energy Efficiency Programme offers a free energy audit for low- and middle-income households to recommend fit-for-purpose interventions based on individual customer needs.

²⁰ Manitoba Hydro. 2023. Home Energy Efficiency Loan.

²¹ Seref Efe, Inam ur Raheem, Tingting Wan, and Carter Williamson. 2015. Cheaper Power Bills, More Jobs, Less CO2: How On-Bill Financing Done Right can be a Quick Win for British Columbia. Pacific Institute for Climate Solutions. <https://pics.uvic.ca/sites/default/files/uploads/publications/On-Bill%20Financing%20FINAL.pdf>.

²² City of Nelson - British Columbia. 2023. Regional Energy Efficiency Program. <https://www.nelson.ca/742/Energy-Retrofit-Program>.

²³ Manitoba Hydro. 2022. Home Energy Efficiency Loan. https://www.hydro.mb.ca/your_home/residential_loan/.

²⁴ Manitoba Hydro. 2023. Qualifying upgrades. https://www.hydro.mb.ca/your_home/residential_loan/qualifying_upgrades/.

²⁵ The loan provider does not provide a list of participating suppliers or endorse any service professionals but provides tips how to do so.

²⁶ EWEB. 2023. Rebates, Loans and Conservation. Eugene Water and Electric Board. <https://www.eweb.org/residential-customers/rebates-loans-and-conservation>.

²⁷ City of Fort Collins. 2023. EPIC Homes. <https://www.fcgov.com/utilities/residential/conservation/financing/rental-property-single-family>.

²⁸ Pay-as-you-go is a financing technology that enables households or businesses to pay for a solar product in instalments over time. For more information, see: [https://energypedia.info/wiki/Pay-as-you-go_Approaches_\(PAYGO\)](https://energypedia.info/wiki/Pay-as-you-go_Approaches_(PAYGO)).

Utility-led consumer financing schemes offering loans at commercial market rates can still be impactful if loans have other attractive characteristics such as little/no collateral requirement, low upfront deposit, or easy repayment through on-bill financing.

For example, the largest Colombian private utility Promigas established a dedicated financing facility, called Brilla, to enable low-income households to access credit without the need for collateral. Customers interested in being connected to the gas grid were required to pay 25 USD upfront and then additional 10–15 USD was added to their monthly gas bills for up to three years.²⁹ The financing scheme was considered successful – default rates were only 2% despite the fact that nearly one third of all the borrowers under the scheme were not able to access any other formal financing.³⁰

b) Mini-Grid Developers

CCF provided by mini-grid developers can be offered through fee-for-service or lease-to-own approaches. In the fee-for-service approach, end users pay the mini-grid developer for use of the service or appliance, but do not own the asset. With the lease-to-own approach, end users own the asset once they have repaid the mini-grid developer.

The lease-to-own approach has been more common to date. This approach has been piloted by Village Infrastructure Angels and Sumba Sustainable Solutions in Indonesia, Vanuatu and Papua New Guinea, providing financing to end users for income-generating appliances such as milling machines. In Tanzania, a mini-grid developer called Jumeme provided credit to small and medium enterprises (SMEs) to expand their existing services, including grain milling and carpentry, and to support new services, such as egg incubation and ice production.³¹

In some cases, repayments have been made through electricity bills.³²

One example of on-bill financing via mini-grid developers was piloted by the Mini-Grid Innovation Lab (the “Lab”) led by CrossBoundary.³³ The Lab focuses on testing new business model innovations that mini-grids can leverage to stimulate demand and become financially viable. The Lab tested three appliance financing pilots:³⁴

1. The first pilot focused on household appliances (televisions, refrigerators, and speakers).
2. The second pilot focused on productive use systems (milling machines) with payments collected through the Angaza platform.
3. The last pilot focused on energy-efficient productive use systems customised specifically for the African mini-grid market.

In the first pilot, the Lab supported seven mini-grid developers to sell 730 appliances, including speakers, televisions, fans, pressure cookers, blenders and irons, on credit across 22 sites in Kenya, Tanzania and Nigeria.³⁵ The loans were on commercial terms, with a 20% upfront deposit, a 14% Annual Equivalent Rate (AER), a 12-month loan term and monthly repayments. Customer contracts included provisions that failing to meet loan repayments could result in their electricity being switched off, or appliances being repossessed.³⁶ However, few mini-grid developers chose to apply these measures because of high logistics costs and concerns around the risk of damaging their reputation within communities.

29 IFC. 2014. Inclusive Business Case Study: Promigas. International Finance Corporation. <https://www.ifc.org/wps/wcm/connect/31d3f99f-9dbc-4a86-98a8-c3a63e3eb78b/Promigas.pdf?MOD=AJPERES&CVID=IJY4Iwi>.

30 CGAP and CLASP. 2020. Electric Bankers: Utility-Enabled Finance in Sub-Saharan Africa. <https://www.cgap.org/research/publication/electric-bankers-utility-enabled-finance-sub-saharan-africa>.

31 ESMAP. 2022. 2022 Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/38082>.

32 USAID. 2018. What Productive Uses Can Mini-Grids Power? <https://www.usaid.gov/energy/mini-grids/economics/productive-use/#:~:text=On%2Dbill%20Financing%20for%20Productive,on%20the%20monthly%20electricity%20bill>.

33 CrossBoundary. 2023. Mini-Grid Innovation Lab. <https://www.crossboundary.com/labs/>.

34 CrossBoundary. 2023. Mini-Grid Innovation Lab. Our Prototypes. <https://www.crossboundary.com/labs/our-prototypes/>.

35 CrossBoundary. 2021. Appliance Financing 1.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2021/04/CrossBoundary-Innovation-Lab-Appliance-Financing-1.0-Innovation-Insight-29-Apr-2021.pdf>.

36 CrossBoundary. 2019. Innovation Insight: Appliance Financing. <https://www.crossboundary.com/wp-content/uploads/2019/08/CrossBoundary-Innovation-Lab-Innovation-Insight-Appliance-Financing-Final-07-Aug-2019-1.pdf>.

Default rates varied significantly across the Lab pilots, between 13% and 27% of the total loan, depending on the country and the average power consumption per month.³⁷ For comparison, in Kenya and Tanzania, the average default rate was 18% which was lower than average default rates for mobile credit loans (26%) but higher than agriculture loans (9%). In Nigeria, the average default rate was 23%, which was higher than mobile credit loans (10%) and agriculture loans (3%). Despite the relatively high default rates, the pilots clearly demonstrated that electricity demand could be stimulated through appliance financing. The most recent report highlights that average consumption per user was 48% higher on sites where appliance financing was offered.^{38, 39}

The Lab study concluded that wider appliance adoption in mini-grid settings is predominantly hindered by high upfront costs and credit constraints faced by potential customers.

The pilots provided appliance financing to customers who were already among the highest electricity consumers before they participated in the programme.⁴⁰ Consumers with higher consumption also had lower than average default rates.⁴¹ One way to reach lower-income, lower-consuming households without increasing the default rate could be through end-user subsidies to reduce the total amount households and businesses have to pay. An alternative way could be through a more concessional form of consumer financing, which might involve reducing the upfront deposit, reducing the interest rate, or extending the repayment period.

Appliance financing via mini-grid developers can also be delivered without the on-bill financing structure. Husk Power Systems (“Husk”)⁴², one of the world’s largest mini-grid developers and the first profitable mini-grid company in Asia and Africa,⁴³ has provided financing to thousands of their mini-grid customers in India and Nigeria who were able to pay an upfront deposit and repay the remaining balance in three to six months. To date, the appliances financed via this innovative model have included a range of moveable assets including refrigerators, televisions, washing machines, air coolers and milling machines. Appliance financing has been provided to mini-grid customers at zero-interest.⁴⁴ Until recently, Husk collected monthly repayments in-person by using cash or mobile money. However, customers are now able to opt in to use their new direct debit mechanism, which simplifies the repayment collection and lowers the transaction costs. The repayments are separate from the recharge and top up payments for the customers’ electricity supply from the mini-grid.⁴⁵

A proprietary credit rating algorithm is at the core of Husk’s appliance financing model, since most of its customers do not have a formal credit history.⁴⁶ Husk’s credit rating system is based on up to 50 financial and non-financial parameters that are continuously improved based on existing customer data. In contrast with utility-led programmes in the Global North, which have been able to rely on formal credit checks or utility bill history for credit assessment, Husk has developed its own proprietary system tailored to the needs of its customers, which has proven essential for sound credit risk management. Husk also places a careful limit on the amount of financing it provides off its own balance sheet.

37 CrossBoundary. 2021. Appliance Financing 1.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2021/04/CrossBoundary-Innovation-Lab-Appliance-Financing-1.0-Innovation-Insight-29-Apr-2021.pdf>.

38 CrossBoundary. 2023. Appliance Financing 3.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2023/01/CrossBoundary-Innovation-Lab-Appliance-Financing-3.0-Innovation-Insight-10-January-2023.pdf>.

39 It is unclear whether the high default costs were covered by the additional revenue generated by the increased power consumption. This consideration is key to evaluate the appliance financing feasibility and its impact on profitability.

40 CrossBoundary. 2023. Appliance Financing 3.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2023/01/CrossBoundary-Innovation-Lab-Appliance-Financing-3.0-Innovation-Insight-10-January-2023.pdf>.

41 CrossBoundary. 2021. Appliance Financing 1.0 Innovation Insight. <https://www.crossboundary.com/wp-content/uploads/2021/04/CrossBoundary-Innovation-Lab-Appliance-Financing-1.0-Innovation-Insight-29-Apr-2021.pdf>.

42 Husk Power Systems. 2023. <https://huskpowersystems.com/>.

43 Energy & Utilities. 2023. Nigerian mini-grid developer reports profit. <https://energy-utilities.com/nigerian-mini-grid-developer-reports-profit-news119962.html>.

44 Interview with Husk Power Systems.

45 Interview with Husk Power Systems.

46 Interview with Husk Power Systems.

1.2.2. Concessional Consumer Financing through Third-Parties

a) Development Banks

CCF is a key part of Germany's Energiewende, one of the world's largest renewable energy and energy efficiency programmes. The loan scheme is administered by KfW, which is a state-owned development bank providing low-interest financing to accelerate the transition towards renewable energy uptake and adoption of / improved energy efficiency.⁴⁷ The bank provides a wide-ranging portfolio of promotional instruments including grants, venture capital and risk sharing, as well as low-interest loans to customers to finance renewable energy and energy efficiency measures.

Interest rates vary depending on the intervention pursued but they are still well below the commercial market rate. For example, refurbishment of existing residential buildings qualifies for a less than 1% interest rate loan and up to 20-year repayment period, with a fixed interest rate for ten years and up to three years interest free.⁴⁸ The scheme has the following main steps:

1. Property owner finds information on the KfW website.
2. Approved energy consultant creates a concept/plan for refurbishment activities and checks if the property is suitable via a dedicated online tool.
3. The owner's bank conducts credit checks and reviews the online application form.
4. KfW provides loan commitment and disbursement.
5. The refurbishment is carried out.
6. Approved energy consultant provides ongoing supervision and confirms energy efficiency level reached.
7. The owner's bank confirms that the promotional loan has been used in compliance with the conditions.
8. KfW provides partial debt relief according to energy efficiency level reached.

The scheme incentivises end users to adopt the most efficient products, through preferential lending rates and higher grant components.⁴⁹

This encourages people to select products that often incur higher upfront costs but deliver more significant cost savings over their lifetime.

Between 2006 and 2017, the combined impact of KfW construction and refurbishment schemes avoided nearly 10 million tonnes per year of CO₂ emissions and created or secured nearly half a million jobs.⁵⁰ The CCF refurbishment scheme alone was able to reach 9% of the existing housing stock in Germany, accounting for 3.6 million housing units. However, given the significant investment required from households, the credit check process and the collateral requirement, it is likely that wealthier households benefited more than low-income households from the scheme. The following design features are considered to have been critical to the successful delivery of the lending scheme:⁵¹

1. **Government backing:** Government mandate plays an important role in implementing the scheme through the state-owned bank.
2. **Capacity building:** A broad network of business and financing partners is leveraged to conduct capacity building and product development.
3. **Customer awareness:** Customer awareness is raised by maintaining a tailored, ongoing stakeholder dialogue and provision of information across the entire spectrum of stakeholders, with the aim to make the eligibility criteria simple and transparent.
4. **Impartial customer advice:** Mandatory involvement of an energy expert is required to receive the loan. In 2017, 13,000 energy experts were involved.⁵²
5. **Standardisation:** There is a high degree of standardisation within the scheme. The predefined energy standards for residential buildings are used to determine the financing product offered, depending on the building category, age and efficiency.

47 Hanna Kuittinen, Daniela Velte. 2018. Case Study Report – Energiewende (Germany). European Commission.

48 KfW. 2023. <https://www.kfw.de/>.

49 BASE. 2019. Manual of Financing Mechanisms and Business Models for Energy Efficiency. Basel Agency for Sustainable Energy for UN Environment. https://www.buildup.eu/sites/default/files/content/manual-financing-mechanisms_25-06-19_web.pdf.

50 Bettina Dorendorf. 2020. KfW Promotional programs for energy efficiency in buildings. Main elements and success factors. KfW.

51 Bettina Dorendorf. 2020. KfW Promotional programs for energy efficiency in buildings. Main elements and success factors. KfW.

52 European Energy Network. 2020. Dena – German Energy Agency. <https://enr-network.org/wp-content/uploads/Factsheet-2-DENA.pdf>.

6. **Digital tools:** The application process is fully digital. Customers find application eligibility and criteria on the KfW website, receive consultation advice via a dedicated tool and submit their application through the website.⁵³
7. **Ongoing monitoring:** The uptake and impact are monitored to fulfil the goals of the national government.⁵⁴
8. **Long-term commitment:** Committing to the long-term availability of public funds enables promotional programmes to create and maintain a stable offering for end users, in terms of products, services and financing.

CCF supported by development banks has also been pursued by the Government of India to increase the affordability and uptake of rooftop solar. One example is the recently announced Grid-Connected Rooftop Solar Programme extension in India, which includes support to the residential sector with the aim to finance 450 megawatt of rooftop solar capacity.⁵⁵ The programme extension was approved in 2022, with financing from the World Bank and the International Bank for Reconstruction and Development. The programme aims to reduce greenhouse gas emissions by 13.9 million tonnes.⁵⁶ Residential rooftop solar in India has already been supported by 30% capital subsidy by the Government of India since 2015, as well as international lines of credit from various multi- and bilateral institutions to provide CCF to the residential sector, including Green Climate Fund's concessional loan assistance programme launched in 2018.⁵⁷

b) Microfinance Institutions

One of the only examples of large-scale CCF within the off-grid energy sector is the Infrastructure Development Company Ltd (IDCOL) solar home system (SHS) programme in Bangladesh.⁵⁸ The programme enabled the sale of more than four million solar lights and home systems over 15 years⁵⁹ by structuring repayments to be equal to, or lower than, customers' previous spend on kerosene for lighting (based on data from household surveys) and setting up CCF as a revolving fund to reach more customers over time. In contrast with the home improvements financed through many other CCF case studies, IDCOL financed moveable assets, which are arguably higher-risk.

Interest rates were lower than market rates, at 12–16% AER. Customers made repayments to microfinance institutions (MFIs) monthly, rather than weekly, which lowered transactional costs with cost savings passed on to the borrowers through lower interest rates.⁶⁰ For comparison, MFI lending rates in Bangladesh were capped at 27% AER in 2010 and reduced to 24% AER in 2019.⁶¹ In addition to consumer financing, MFIs also provided basic customer advice based on content prepared by IDCOL.

In addition to CCF, the IDCOL programme used end-user subsidies to bring down the cost of SHSs for end users. Only lower-cost SHSs were eligible for the end-user subsidy and the subsidy as a percentage of retail price was also weighted toward the lowest value systems. This benefited lower-income households who were more likely to buy lower-value systems. As technology costs continued to fall and economies of scale kept rising, the end-user subsidy was gradually reduced.

53 KfW. 2022. Existing Properties. <https://www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilie/>.

54 Bettina Dorendorf. 2020. KfW Promotional programs for energy efficiency in buildings. Main elements and success factors. KfW.

55 Prior to the extension to include the residential solar sector, the programme was focused mainly on commercial and industrial rooftop solar.

56 The World Bank. 2022. World Bank Provides \$165 Million to Support Renewable Energy in India's Residential Sector. <https://www.worldbank.org/en/news/press-release/2022/06/28/world-bank-provides-165-million-to-support-renewable-energy-in-india-s-residential-sector>.

57 PWC. 2018. Rooftop Solar in India: Looking back, Looking ahead. https://www.cif.org/sites/cif_enc/files/rooftop_solar_pv_in_india_ctf_pwc_v8pdf_0.pdf.

58 GOGLA. 2021. How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh's Solar Home System Program. https://www.gogla.org/sites/default/files/resource_docs/case_study_-_lessons_from_bangladeshs_solar_home_system_program.pdf.

59 Cabraal, Anil; Ward, William A.; Bogach, V. Susan; Jain, Amit. 2021. Living in the Light: The Bangladesh Solar Home Systems Story. World Bank, Washington, DC. World Bank. <https://openknowledge.worldbank.org/handle/10986/35311>.

60 GOGLA. 2021. How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh's Solar Home System Program. https://www.gogla.org/sites/default/files/resource_docs/case_study_-_lessons_from_bangladeshs_solar_home_system_program.pdf.

61 MicroCapital. 2022. <https://www.microcapital.org/microcapital-brief-committee-in-bangladesh-considering-cutting-microcredit-interest-rate-cap-below-24/>.

A thorough monitoring and verification process was a key part of the IDCOL programme's success. This was achieved by setting up three divisional and 12 regional offices with more than 100 technical inspectors, who were able to inspect more than half of the SHSs financed in-person, averaging 350 SHSs inspections per inspector per month.

IDCOL enabled one-quarter of previously unelectrified households in Bangladesh – around 20 million people – to gain access to electricity.

According to World Bank analysis, the programme had a net financial benefit in excess of 1.5 billion USD, with half flowing to households (745 million USD), and the government being the next biggest beneficiary (364 million USD in taxes generated, 90 million USD in kerosene subsidies saved). Nearly ten million tonnes of CO₂ emissions from burning kerosene for lighting were avoided.⁶² IDCOL has now evolved to provide grants and

CCF for a wide range of energy products and services, including productive use systems such as solar irrigation.⁶³ In addition to CCF, IDCOL provides country-wide support for feasibility analysis, training, capacity building and awareness campaigns.⁶⁴

In the IDCOL SHS Program, CCF was the main mechanism to address affordability, rather than end-user subsidy. Concessional lending from multilateral agencies to the Government, from the Government to IDCOL, from IDCOL to MFIs and from MFIs to end users enabled a high proportion of funds to be recovered and re-used through new consumer loans. *Figure 3* shows how the business model, built around a CCF offering for end users, enabled millions of dollars in loans to flow from international sources to end users, in the form of microloans to millions of rural customers living in remote areas.

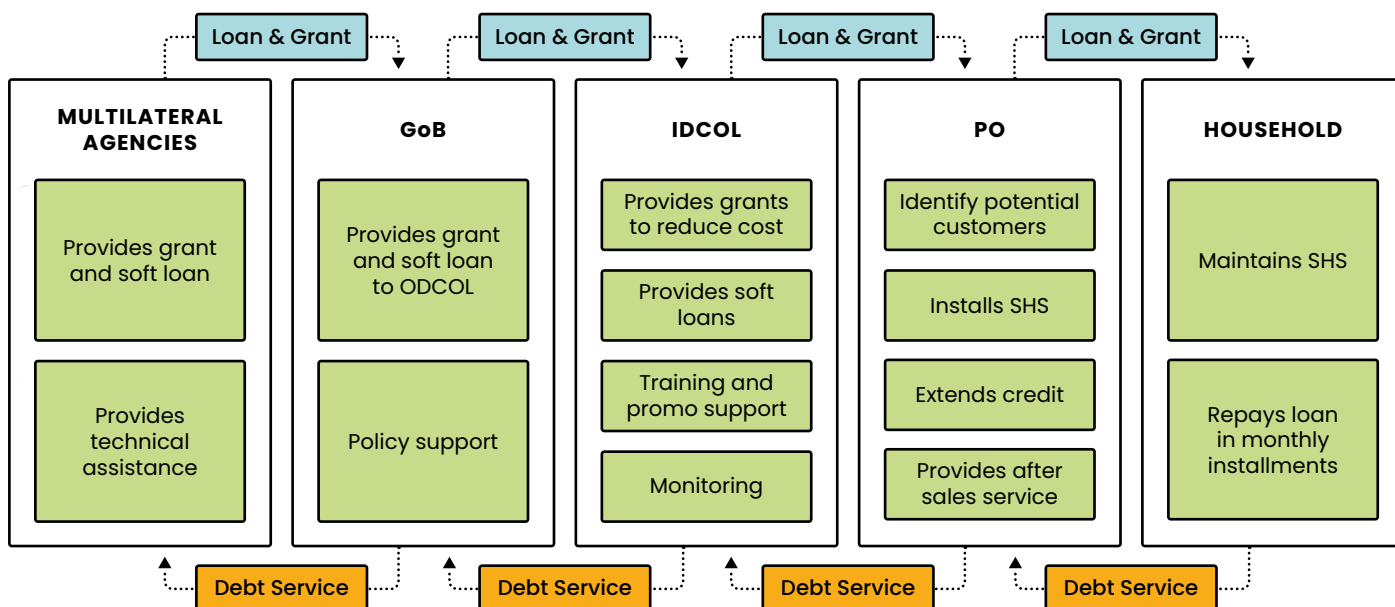


Figure 3. IDCOL fund flow and role of partners.^{65, 66}

62 GOGLA. 2021. How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh's Solar Home System Program. https://www.gogla.org/sites/default/files/resource_docs/case_study_-_lessons_from_bangladeshs_solar_home_system_program.pdf.
 63 The World Bank. 2013. Project Signing: \$10 Million Grant for Solar Irrigation in Bangladesh. <https://www.worldbank.org/en/news/press-release/2013/09/30/project-signing-10-million-grant-for-solar-irrigation-in-bangladesh>.
 64 IDCOL. 2014. Renewable Energy. <https://idcol.org/home/energy>.
 65 GOGLA. 2021. How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh's Solar Home System Program. https://www.gogla.org/sites/default/files/resource_docs/case_study_-_lessons_from_bangladeshs_solar_home_system_program.pdf.
 66 GoB = Government of Bangladesh, PO = Partner Organisation, SHS = Solar Home System

c) Non-Profit Organisations

CCF financing administered by a non-profit organisation allows a government or donor to delegate the administration of a loan scheme to a trusted organisation, and to leverage their existing relationships with end users.

The non-profit manages the application process, loan repayments, and relationships with both end users and service providers.

This model was used by the Scottish Government to enable its citizens to implement energy efficiency improvements, install renewable energy systems and buy electric vehicles.

Most of these schemes are managed by Energy Saving Trust, with funding from the Scottish Government to fulfil Scotland's ambition to become net zero by 2045.⁶⁷ One of the largest is the Home Energy Scotland (HES) Grant and Loan programme,^{68, 69, 70} which provides grants and interest-free loans to help households in Scotland reduce their bills and carbon emissions by making the adoption of energy efficiency and home renewables systems more affordable. The HES Grant and Loan scheme is supported by free, impartial customer advice provided by Home Energy Scotland.⁷¹

The HES Grant and Loan programme allows customers to overcome high upfront costs, which is a critical barrier to uptake. The loan element enables customers to repay the upfront cost over time, while the grant reduces the overall intervention cost. The scheme provides a combination of grants and loans to increase affordability and uptake. The key steps in the HES Grant and Loan programme are as follows:⁷²

1. Householder contacts the HES advice centre.
2. A free property survey is scheduled and conducted by a specialist advisor.⁷³
3. Householder gathers quotes from installers.

4. Householder submits the application for funding which, when applying for a loan, includes a credit check.
5. The HES Grant and Loan service delivery team conducts due diligence of the application and if criteria are met, funds are offered.
6. Accredited installer implements the improvement.⁷⁴
7. Householder gathers evidence of installation and provides it to the HES Grant and Loan service delivery team.
8. The HES Grant and Loan service delivery team disburses the funding.
9. Householder repays the loan over the agreed period.⁷⁵

The 0% interest rate offered by the HES Grant and Loan scheme has been a critical driver of uptake. Looking at the renewables loan as an example, 89% of funded actions were at least partly attributed to the loan and 56% would not have happened at all without the loan.⁷⁶

The repayment rates of the HES Grant and Loan scheme have been consistently high. Failed direct debit payment rates (which can be considered as payment defaults, including non-intentional causes such as card expiration) are consistently very low. Anecdotal evidence suggests repayment rates may be high because some customers, who have chosen to participate in the scheme to obtain financing for energy efficiency improvements on favourable terms, are relatively wealthy.

67 Scottish Government. 2023. Climate change. <https://www.gov.scot/policies/climate-change/>.

68 Home Energy Scotland. 2023. Energy Saving Trust. <https://www.homeenergyscotland.org/>.

69 Interviews with Energy Saving Trust.

70 Energy Saving Trust. 2022. Home energy programmes delivered by Energy Saving Trust on behalf of the Scottish Government. https://energysavingtrust.org.uk/wp-content/uploads/2022/01/Energy-Saving-Trust-programmes-in-Scotland-Report-2021_FINAL_24Jan22.pdf.

71 Home Energy Scotland and the Home Energy Scotland Grant and Loan scheme are two separate services. Home Energy Scotland is a customer advice provider whereas the Home Energy Scotland Grant and Loan scheme provides funding to improve energy efficiency. Home Energy Scotland provides customer advice to various Scottish Government funded schemes in Scotland.

72 Interviews with Energy Saving Trust.

73 Customers with a pre-existing energy performance certification report can access funding for certain improvements without the need for a survey.

74 Accreditation is managed by MCS in the case of renewables, and either TrustMark or The Green Deal Oversight and Registration Body for insulation.

75 The latest revision of the HES Grant and Loan scheme includes a separation of the grant and the loan. Therefore, customers can have one without the other which means that sometimes there is no loan to be repaid.

76 Energy Saving Trust. 2022. Home energy programmes delivered by Energy Saving Trust on behalf of the Scottish Government. https://energysavingtrust.org.uk/wp-content/uploads/2022/01/Energy-Saving-Trust-programmes-in-Scotland-Report-2021_FINAL_24Jan22.pdf.

The loan agreement is between the HES Grant and Loan scheme provider (i.e. Energy Saving Trust) and the end user. This is a core tenet of the scheme and means that repayment of the funding is not contingent on the installed product working. There is no contractual agreement between the lender and the supplier or installer, but customers must use installers who are accredited by Microgeneration Certification Scheme (MCS) in the case of renewables, and either TrustMark or The Green Deal Oversight and Registration Body for insulation as this provides them with recourse to support in the case of disputes with installers or faults with installed products.

In Scotland, the CCF model has also been used to accelerate uptake of electric vehicles through the interest-free electric vehicle (EV) loan scheme⁷⁷ launched in 2011. The lending scheme is part of the wider Low Carbon Transport Loan portfolio and has been through various iterations over the years. The first phase was primarily focused on best-in-class, electric and plug-in hybrid vehicles. As the e-mobility market developed, the scheme started to focus only on EVs and enabled individual applicants (in addition to businesses) to apply for the loan. In 2015/16, the zero-interest loans (up to £50,000 repaid in six years or less) enabled everyone in Scotland to purchase a new EV. The most recent iteration of the programme (launched in October 2020) provides interest free loans for the purchase of second-hand EVs. The application process for the Used EV loan follows nine steps:⁷⁸

1. Customer gets in touch with Home Energy Scotland to request an application form. Customer fills out an online application form and submits it to Energy Saving Trust for review.
2. Credit checks and affordability checks are conducted. Credit checks are handled by a third-party provider and affordability checks are based on self-declaration of monthly income and outgoings (including potential fuel savings after buying the EV).
3. If successful, a loan offer letter is sent to the customer which includes terms and conditions of the loan, legal requirements, and a repayment calendar clearly outlining monthly instalments.

4. Customer has two weeks to decide whether they want to proceed.
5. Claim documents as outlined in the loan offer letter must be provided.
6. Claims are processed and money disbursed in ten working days or less.
7. Proof of purchase must be submitted by the customer within 30 days of loan disbursement.

The Used EV loan scheme is set up as a revolving fund, where collections are re-invested into the scheme. Each year, the budget historically consisted of repayments and new funding from Transport Scotland (a Scottish Government agency), which increases the overall budget, while covering repayment delinquency and inflation. Due to the long-term duration of the scheme, all available budget now comes from recycled repayments rather than new funding. The Low Carbon Transport Loan programme has disbursed more than £190 million since 2011, and has received approximately £60 million of repayments to date (repayments for existing loans are projected to continue until 2029/30).⁷⁹

Similar to the other Scottish CCF schemes, repayments have been high. Failed direct debit payment rates are consistently very low, demonstrating low default rates.⁸⁰ The temporary repayment holidays and gradual return to full repayments introduced during the Covid-19 pandemic also proved to be effective to keep customers engaged.

⁷⁷ Home Energy Scotland. 2023. Used Electric Vehicle Loan. <https://www.homeenergyscotland.org/funding/electric-vehicle-loans/>.

⁷⁸ Interviews with Energy Saving Trust.

⁷⁹ Energy Saving Trust. 2023. Energy Saving Trust Low Carbon Transport Loan Statistics.

⁸⁰ Energy Saving Trust. 2023. Energy Saving Trust Low Carbon Transport Loan Statistics.

1.3. Lessons Learned

Based on the above case studies, we have identified the following key lessons learned which are relevant for designing a CCF scheme in an energy access setting.

CCF can be used to accelerate uptake of emerging technologies amongst early adopters.

Both IDCOL in Bangladesh (aiming to replace kerosene lamps with SHS) and the Used EV loan scheme in Scotland (aiming to replace internal combustion engine vehicles with EVs) benefited early adopters first. Early adopters tend to be people with higher incomes, higher technical awareness and higher risk appetite. This approach stimulated the market, making it easier to reach lower income households in the longer term. In both cases, subsidies became progressively more targeted towards lower income households as market stimulation objectives were met and target customer profiles transitioned from early adopters to early / late majority – see *Figure 4*.

In Bangladesh, only the smallest SHSs, likely to be chosen by the lowest-income households, were subsidised as the IDCOL SHS programme evolved. In Scotland, only second-hand EVs costing less than £30,000 were eligible for the Used EV loan.

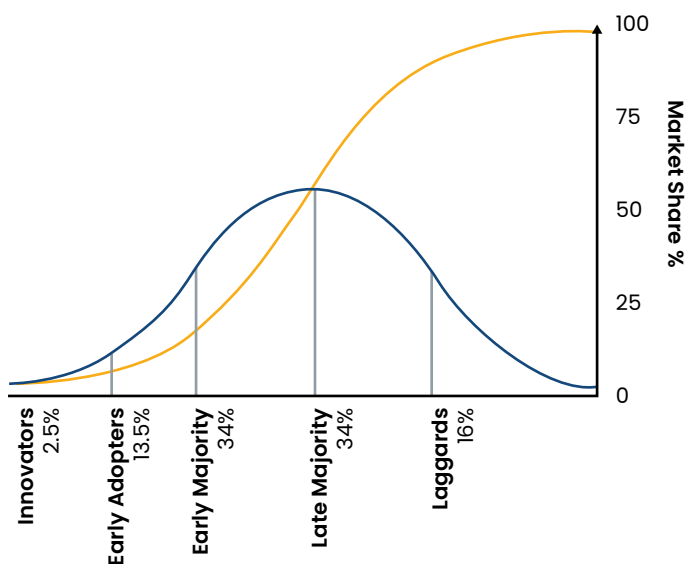


Figure 4. Five customer segments of technology adoption and market share trajectory to complete adoption.⁸¹

CCF schemes have typically achieved relatively high repayment rates, particularly in the Global North case studies. High repayment rates have been driven by a range of factors, including:

- **Credit checks:** The use of credit checks to confirm a customer’s ability to pay. In an energy access setting this is more challenging since end users lack credit history, although not impossible as demonstrated by Husk’s credit rating mechanism or Nithio⁸² who use artificial intelligence for credit risk assessment.
- **Negative consequences of non-payment:** Customer credit ratings could be negatively affected if they did not repay loans, and they could even be taken to court or have their electricity cut off for non-payment of debts or bills. In an energy access setting most customers do not have credit ratings and there is little chance of legal recourse. Mini-grid developers and utilities can cut off customers for non-payment of bills, but are often reluctant to do so in practice.
- **Targeting early adopters who tend to have high incomes:** The case studies targeted early adopters, which tended to be wealthier households. In an energy access setting it is likely that early adopters of nascent technologies such as solar water pumps or solar generators will also be people with relatively high incomes.
- **An attractive financial offering for a beneficial product:** High repayment rates may be supported by low interest rates and long repayment periods, making monthly payments affordable. Customers may also be more willing to pay knowing that they are participating in a subsidised programme and getting a ‘good deal’, or because the asset they have acquired is saving them money or boosting their income.
- **Asset risk:** Many of the assets supported through CCF in the case studies are immovable, reducing the risk of resale or theft – whereas many energy products in access settings such as solar home systems, solar water pumps and solar refrigerators are moveable.

⁸¹ OnDigitalMarketing. 2023. The 5 Customer Segments of Technology Adoption. <https://ondigitalmarketing.com/learn/odm/foundations/5-customer-segments-technology-adoption/>.

⁸² Nithio. 2023. <https://www.nithio.com/>.

- **Payment flexibility:** One strategy to minimise default risk is payment flexibility, especially if end users have seasonal incomes or suffer from an external shock such as a drought, a macroeconomic crisis or a pandemic. Emergency grants and repayment holidays as part of the HES Grant and Loan programme and the Used EV programme proved very effective during the Covid-19 pandemic, when borrowers were able to bridge the short gap and continue with the long-term repayments of the loan.

As outlined in Section 2.2.2, any CCF pilot in an energy access setting would need to closely monitor consumer perceptions and behaviour, in particular regarding late payment and default, and be able to adopt a range of strategies to maximise repayment. Default rates are typically higher in the energy access sector, compared to the single digit default rates in the Global North case studies, and anecdotal evidence suggests extending repayment risk increases the likelihood of ‘payment fatigue’.

CCF schemes are unlikely to negatively affect commercial lending. In the Global North case studies, commercial lenders would never have offered loans on the same terms to the same end-users, because of risks associated with the nascency of new market segments (e.g. electric vehicles) and the very long repayment periods required to make monthly payments affordable (e.g. home refurbishment). In energy access settings, energy service providers and third-party lenders are similarly reluctant to offer loans for new technologies that are perceived as high-risk, or to extend loans to lower-income households, given the higher risk of default. Commercial lenders are also unlikely to offer loans over long repayment periods given the risk of ‘payment fatigue’. With appropriate targeting, CCF can enable energy service providers and third-party lenders to offer affordable finance to acquire higher-risk technologies or serve higher-risk customer segments, without crowding out commercial lenders who would not offer these kinds of loans.

Impartial advice can help to ensure that end users select the most appropriate solution for their individual needs, before they sign up to a loan. Some CCF programmes have relied on an independent advisory body, with no vested interest in selling a certain brand or type of product or service, to provide advice to the customer. Advice can be provided remotely, over the phone or online, or through site assessments for more complex products that need to be customised to the needs of the site. Although impartial advice has not been widely offered in energy access settings to date, it could have a role to play, particularly for more complex or higher-value products such as productive use systems.

Supporting a wide range of products and suppliers helps to ensure competition, and enables the participation of smaller, local companies. Most CCF schemes have allowed end users to choose from a wide range of products and suppliers, helping to keep prices down through competition and maximising consumer choice. Allowing any company to participate, if their products and services meet minimum standards, can help to ensure the participation of smaller, local companies. Smaller suppliers or installers are often preferred by customers given their geographical proximity, local market knowledge and established reputations in their area.

Product and supplier accreditation can help to ensure quality. CCF programmes typically ensure the quality of products and services through a process of product and supplier accreditation, which is managed independently of the loan provider to avoid conflict of interest. Products usually need to meet specified national or international quality standards, whilst suppliers can only be accredited if they provide warranties and offer high-quality after-sales services. End users provide feedback through surveys, or grievance redress mechanisms, with supplier accreditation revoked in case of repeated non-compliance.

Implementation over a long timeframe, combined with flexibility to adapt to evolving market conditions, is critical. A long timeframe is needed to make the most of the opportunity to reduce monthly payments through lengthening repayment periods. If CCF is funded through concessional lending to companies, or MFIs as in the case of IDCOL, a long timeframe helps to facilitate the recycling of repaid funds into new loans, thus minimising the need for injections of additional (external) financing. The most successful CCF programmes have operated continuously in a stable, predictable way for more than five years. The design of these programmes has evolved over time to reflect technology innovation, product cost reduction and changing economic context.

2. Concessional Consumer Financing in Energy Access



2. Concessional Consumer Financing in Energy Access

2.1. Potential Concessional Consumer Financing Models for Energy Access Settings

We considered six CCF models that could be appropriate in energy access settings.⁸³

Three involve direct lending by the energy service provider, which could be a utility, mini-grid developer or PAYG company. Another three involve lending by a third party, which could be a development bank, a commercial bank or MFI, or a non-profit organisation. These stakeholders could also work together in various ways to provide CCF alongside awareness campaigns and impartial consumer advice. This section reflects on the potential of each of these models.

Third-Party Lending through Development Banks

Development banks are active in the Global South but are not engaged in directly providing financial services to unconnected households, most of whom are currently 'unbanked'.⁸⁴

They typically work through intermediary banks, MFIs or Savings and Credit Cooperatives (SACCOs) to provide credit and risk mitigation instruments to energy access companies. In some cases, they also work through intermediaries to finance end users, or lend directly to energy companies, but do not directly finance end users.⁸⁵ If development banks in Sub-Saharan Africa were to lead a CCF programme focused on energy access, they would most likely need to work through partners such as local commercial banks, MFIs, SACCOs or PAYG companies, rather than engaging with end users directly.

Third-Party Lending through Banks, MFIs or SACCOs

Financing provided by banks, MFIs or SACCOs could work well in areas where these financial institutions are already established and have strong customer relationships. Banks, MFIs and SACCOs could be well-placed to provide CCF to SMEs or wealthier households that are already 'banked', for higher-value energy products or services, such as productive use systems, but could struggle to provide CCF for lower-value energy products or services, or to lower-income, unbanked households that they do not currently serve. The MFI model, which was leveraged so successfully by IDCOL in Bangladesh, would be challenging to replicate in many parts of Sub-Saharan Africa where MFIs have limited coverage or do not operate at all, because of the high costs and risks of making large volumes of micro-loans to households with low, fluctuating incomes in sparsely populated rural areas.

Third-Party Lending through a Non-Profit Organisation

CCF via non-profit organisations could be suitable in contexts where non-profit organisations are already operating and have established relationships with communities. For example, a delivery model via a non-profit organisation could be relevant for energy access in displacement settings,⁸⁶ where it could be added to a suite of interventions already deployed to provide basic goods and services.

⁸³ In this report, we primarily focus on energy access settings related to household use - household access to a minimum level of electricity, and productive use - access to modern energy that enables productive economic activity (IEA, 2020).

⁸⁴ GSMA. 2022. Pay-as-you-go utilities: Innovations and opportunities in Asia. <https://www.gsma.com/mobilefordevelopment/blog/pay-as-you-go-utilities-innovations-and-opportunities-in-asia/>.

⁸⁵ ESMAP. 2022. Designing Public Funding Mechanisms in the Off-Grid Solar Sector. Washington, D.C. World Bank Group. <http://documents.worldbank.org/curated/en/099300005162263450/P17515006776e102308e980bb2d798ca5c3>.

⁸⁶ "Energy access in displacement settings: Ensuring reliable, sustainable and affordable energy access for all displaced people, including household cooking and electricity solutions, energy for enterprises and community services, and decarbonising energy for humanitarian facilities." (Al-Kaddo, H. and Rosenberg-Jansen, S. 2021.).

Incorporating CCF as part of their service offering could be one way to reduce the staggering electricity access gap in these settings – 94% of displaced people in refugee camps currently do not have access to electricity.⁸⁷ This model could only be deployed in host communities where refugees are legally allowed to participate in income-generating activities, which is often not the case.⁸⁸ Non-profits would also need to build the capacity, systems and processes needed to be able to offer credit, if they did not already have this in place.

Non-profit organisations could also support others to provide CCF, by delivering awareness campaigns and helping to clearly communicate to end users how a CCF scheme works. They could help potential customers understand what is required to apply for a loan, what it can be used for, what the repayment schedule looks and what happens if they do not repay.

Non-profit organisations are also well-placed to offer consumer advice, because of their impartiality. They can help to define the product and service standards used for accreditation and provide independent consumer advice to help end users choose the right product, supplier and financial offering for their needs.

Box 1. Third-Party Lending through partnerships with Energy Service Providers

As highlighted in the case studies in Section 1.2, partnering with a third-party lender can enable an energy service provider to shorten their working capital cycle, and reach more customers more quickly. A third-party lender such as a bank, can offer a loan and a mobile money payment mechanism, whilst the energy service provider can provide the product, alongside any after-sales services needed. This approach was pursued by PAYG companies in Nigeria, where Zola Electric partnered with Stirling Bank,⁸⁹ and Azuri partnered with First Bank of Nigeria.⁹⁰

Once the energy service provider identifies an eligible customer and reaches an agreement with them, they can work with the customer to apply for credit from the third-party lender. This way the energy service provider gets paid in full as soon as the product is sold/installed, and the third-party lender takes the credit risk. The energy service provider could also take payments from the customer and pass them on to the third-party lender through on-bill financing or similar approaches.

In cases where the energy service provider remains the main point of contact for the customer and manages repayments on behalf of the third-party lender, a risk sharing agreement needs to be reached between the energy service provider and the third-party lender regarding how to handle non-payments.

87 Global Platform for Action. 2022. The State of the Humanitarian Energy Sector: Challenges, Progress and Issues in 2022. Global Platform for Action on Sustainable Energy in Displacement Settings. UNITAR Publishing. Geneva, Switzerland. <https://www.humanitarianenergy.org/assets/resources/SOHES.pdf>.

88 Global Platform for Action. 2022. The State of the Humanitarian Energy Sector: Challenges, Progress and Issues in 2022. Global Platform for Action on Sustainable Energy in Displacement Settings. UNITAR Publishing. Geneva, Switzerland. <https://www.humanitarianenergy.org/assets/resources/SOHES.pdf>.

89 The Guardian. 2019. Zola, Sterling Bank seal pact to bridge energy gap in Nigeria. <https://guardian.ng/energy/zola-sterling-bank-seal-pact-to-bridge-energy-gap-in-nigeria/>.

90 First Bank. 2019. FirstBank and Azuri partner to bring solar to millions and deepen financial inclusion in Nigeria. <https://www.firstbanknigeria.com/firstbank-and-azuri-partner-to-bring-solar-to-millions-and-deepen-financial-inclusion-in-nigeria/>.

Direct Lending by Utilities

Direct lending by utilities in the energy access context is technically possible, but unlikely to happen in most sub-Saharan African countries, given that most utilities are loss-making and would struggle to raise the capital needed to provide financing directly.⁹¹

However, utilities could potentially help to enable others to provide financing, for example by allowing third-party lenders to use utility payment channels and distribution, or through partnering with financial institutions that can underwrite appliance loans using consenting customers' data.⁹² Utilities could also play a role in raising awareness and / or providing consumer advice to support the uptake of energy efficient products.

Direct Lending by Mini-Grid Developers

Direct lending by mini-grid developers is not commonplace, although there have been a handful of pilots as outlined in Section 1.1.2.

Some mini-grid developers are reluctant to provide appliance financing, perhaps given the financial burden this places on their balance sheets and the risk of diverting the developer from their core business, whereas others are more open to it. Appliance financing implies managing software systems for appliance loans, and potentially even lockout systems in parallel with maintaining a billing system.⁹³ Similar to utilities, mini-grid developers could also partner with others such as government agencies, MFIs or non-profit organisations, to promote productive uses of energy through awareness campaigns or allowing third-party lenders to receive payments through on-bill financing.⁹⁴

Direct Lending by PAYG Companies

While PAYG helps address affordability, it alone is insufficient to reach all currently unelectrified households. According to the 2022 Off-Grid Solar Market Trend Report (MTR), a typical PAYG business model features repayment over 12-24 months⁹⁵ at 40% AER, helping to spread what would otherwise be an upfront cost of 100 USD or more for a Tier 1 system.⁹⁶ If consumer finance, including PAYG, was available to everyone, the report estimates those currently unconnected and unable to afford a Tier 1 system could fall from 733 million to between 177 to 277 million people.⁹⁷ However, the relatively short repayment periods and the high interest rates charged limit the ability of PAYG to bring energy access products within the reach of the poorest households. Indeed, many PAYG customers are likely to be relatively wealthier members of their communities. PAYG is also not available, or viable, in all settings. In particular, PAYG business models are more likely to achieve scale in settings where mobile, smartphone and mobile money usage rates are high, and where mobile coverage is reliable.⁹⁸ In areas where PAYG is viable and available, CCF can potentially help to make it more affordable and further accelerate uptake through reducing monthly payments, extending repayment periods or both.

PAYG companies are particularly well-placed to offer CCF to end users, given their established systems and processes for providing both off-grid solar products and end-user finance, often to low-income households in remote, rural areas. The off-grid solar sector is now estimated to provide energy services to 493 million people globally, and the share of solar energy kit sales that were sold on PAYG globally has steadily increased from 22% in 2018 to 37% in 2021.

91 Wood Mackenzie. 2022. Utility evolution in Africa to reshape global electricity demand. <https://www.woodmac.com/press-releases/Utility-evolution-in-Africa-to-reshape-global-electricity-demand/>.

92 CGAP and CLASP. 2020. Electric Bankers: Utility-Enabled Finance in Sub-Saharan Africa. <https://www.cgap.org/research/publication/electric-bankers-utility-enabled-finance-sub-saharan-africa>.

93 Factor[e]. 2020. Looking Beyond Appliances: Systemic Barriers to Minigrad Demand Stimulation. [https://www.factor\[e\].com/systemic-barriers-to-stimulating-electricity-demand-in-african-off-grid-energy](https://www.factor[e].com/systemic-barriers-to-stimulating-electricity-demand-in-african-off-grid-energy).

94 ESMAP. 2022. 2022 Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/38082>.

95 12 months for relatively smaller multi-light systems, 18 months for small and medium solar home systems, and 24 months for larger systems.

96 ESMAP. 2023. Multi-Tier Framework for Energy Access. https://www.esmap.org/mtf_multi-tier_framework_for_energy_access.

97 Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

98 GSMA. 2021. What we've learned about the role of mobile network operators in pay-as-you-go solar. <https://www.gsma.com/mobilefordevelopment/blog/the-role-of-mobile-network-operators-in-pay-as-you-go-solar/>.

The share of products sold on PAYG has increased more quickly for more basic product categories, for example the share of solar lanterns with phone charging increased from 12% in 2019 to 38% in 2021.⁹⁹ By making larger systems more affordable, PAYG is enabling households to access a higher level of energy service than they would otherwise be able to afford.

CCF via PAYG is the most promising delivery model, in terms of its potential contribution to the achievement of universal energy access.

PAYG companies could either offer CCF directly themselves or work in partnership with non-profit organisations as part of a broader offering including consumer awareness, and impartial advice. The off-grid solar sector is already reaching hundreds of millions of people globally, and PAYG companies already have the capability to deliver both products and financing to end users at scale. Although much work remains to be done to make PAYG available everywhere, the off-grid solar sector continues to grow and the share of solar energy kits sold on PAYG, is increasing.¹⁰⁰ *Section 2.2* explores CCF models for PAYG, and *Section 2.3* explores the potential impact these approaches could have on affordability.

2.2. Exploring Concessional Consumer Financing Models for Pay-as-you-go

In this section, we compare the traditional PAYG model to five CCF models. We start with the traditional PAYG financing model, and progress along a spectrum towards more ambitious but also higher-risk models. These models would require higher subsidies but could potentially have a significantly higher impact with regards to increasing affordability. The key design features of the financing models are summarised in *Table 1*.

Traditional PAYG Model (“PAYG”)

In the traditional PAYG model, companies raise debt to provide loans to customers. They face significant costs when establishing the infrastructure to manage credit, and high risks in areas such as customer default, and foreign

exchange (forex) if their debt is hard currency denominated but revenue collected in local currency. They must lend to customers at interest rates that are high enough to cover these costs and risks, while also being sufficient to repay working capital loans with interest and allow for a profit margin.

Zero-Interest Financing for On-Lending (“0% working capital facility”)

If PAYG companies had access to a zero-interest financing facility, which could only be used for the purposes of on-lending to end users, they would still need to lend at interest in order to cover their own costs and risks. However, the consumer financing interest rate would be lower than a traditional PAYG model to reflect the fact that companies did not have to repay their working capital loan with interest.

Interest Rate Buy Down RBF Grant (“0% consumer loan”)

Going a step further, a facility could be designed to work through PAYG companies to offer end-users loans at zero interest. In this case, the facility would need to cover the companies’ cost of providing credit and reimburse the company for taking these risks. One potential way of structuring such a facility would be to offer companies an ‘interest rate buy down RBF grant’. The RBF would need to be sufficient to cover the interest on any working capital loans used for on-lending, if any, and to cover the costs and risks that companies incur when providing credit. Governments or aid agencies providing RBF might be reticent for their funding to be used to pay interest on a loan from a private investor, in which case they might consider providing the working capital the facility requires themselves, alongside the RBF. Either way, an interest rate buy down RBF would enable a company to serve customers that they would otherwise be unable to serve, in effect paying for the impact of lower-income households getting access to PAYG.

99 GOGLA analysis of data collected for the Global Off-Grid Solar Sales and Impact Reports 2016–2021. <https://www.gogla.org/global-off-grid-solar-market-report>.

100 GOGLA, Efficiency for Access, Lighting Global. 2022. Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data: January – June 2022. https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth1-2022_def_2.pdf.

Interest Rate Buy Down RBF Grant + 5-Year Repayment Period (“0%, 5-year loan”)

Going another step further, if end users do not pay interest on their loans and the costs and risks of providing credit are covered by the facility, then it might be possible to extend repayment periods from the current average of around 18 months to the typical lifespan of an SHS of around five years. This would dramatically reduce monthly repayments, which could reduce default rates and enable companies to lend to customers who would otherwise not be able afford the repayments. Extending the repayment period would increase the amount of RBF required, both to repay working capital loans over longer timeframes and to cover the higher costs and risks faced by PAYG companies lending to end users over longer timeframes.

Forex risks would also be greater, if hard currency working capital loans were used to finance local currency on-lending. Transaction costs would be higher as there would be a larger number of smaller payments, and both warranties and after-sales service would need to be provided over a longer period (although service would also be guaranteed over a longer period). There would be an increased risk of ‘payment fatigue’, although potentially this could be mitigated through more affordable monthly payments, and through ensuring that customers knew they were benefiting from a subsidised, zero-interest loan. Finally, there would also be greater risk of non-payment as a result of customers switching to new providers or upgrading to more advanced products, although again this could potentially be mitigated, for example through a trade-in or upgrade programme.

Interest Rate Buy Down RBF Grant + 5-Year Repayment Period + End-User Subsidy







An option to reach households on the lowest incomes could be to blend an interest rate buy down RBF grant and a five-year repayment period with end-user subsidies to further reduce the price paid by the end user. By removing consumer finance interest, and extending the repayment period over five years, the level of end-user subsidy required to reach the lowest-income households could be reduced. However, this would depend on how much RBF was required to cover the costs and risks of lending over five years, and whether a combination of 0% consumer loans, extended repayment periods and end-user subsidy worked out cheaper, from a public funding provider’s perspective, compared to providing an end-user subsidy on its own.

Service-Based RBF

In a service-based RBF, companies would be paid for providing a given level of service to a household, SME, or public institution indefinitely over time, instead of being paid based on verification of sales. The service provider would retain ownership of the asset, meaning there would be no loan to the end user, and the service provider would be responsible for its maintenance. Subsidies could be targeted towards households consuming the lowest amounts of electricity, in a similar structure to the ‘lifeline tariffs’ commonly found in on-grid settings.¹⁰¹

¹⁰¹ CPCS. 2021. Policy Guidelines for the Development of Pro-Poor Electricity Tariffs and Charges. <https://terasadc.com/wp-content/uploads/2021/07/Draft-Lifeline-Tariff-Policy-Guidelines.pdf>.

Table 1. Funding models to reach low-income customers

Model	Description	Consumer Financing Costs and Risks	How it works	Company lending	Consumer lending
 PAYG	Traditional PAYG Model	Companies face high costs and risks over 12-18 months	Company lends to customers at interest rates sufficiently high to cover high costs and risks, as well as lender repayments.	Company borrows at commercial rate	Company lends to customers at ~40% AER
 0% working capital facility	Zero-Interest Financing for On-Lending	Companies face high costs and risks over 12-18 months	Company lends to customers at interest rates sufficient to cover their own costs and risks, but does not need to cover repayment to a lender.	Company borrows at zero interest	Company lends to customers at ~20% AER
 0% consumer loan	Interest Rate Buy Down RBF Grant	Companies face high costs and risks over 12-18 months	Company receives a working capital loan and an interest rate buy down RBF grant to cover any lender repayments, as well as their own costs and risks. This enables them to lend to the end user at 0%.	Company borrows at zero interest, concessional or commercial rate	Company lends to customers at 0% over 12-18 months
 0%, 5-year loan	Interest Rate Buy Down RBF Grant + 5-Year Repayment Period	Companies face high costs and risks over 5 years	Company receives a working capital loan and an interest rate buy down RBF grant to cover any lender repayments, as well as their own costs and risks over five years. This enables them to lend to the end user at 0% over five years.		Company lends to customers at 0%, over 5 years
 0%, 5-year loan with end-user subsidy	Interest Rate Buy Down RBF Grant + 5-Year Repayment Period + End-User Subsidy	Companies face high costs and risks over 5 years	Company receives a working capital loan and an interest rate buy down RBF grant to cover any lender repayments, as well as their own costs and risks over five years. This enables them to lend to the end user at 0% over five years. Additional end-user subsidy is used to further reduce the total price paid.		Company lends smaller amount to customers at 0%, over longer period
 Service-based model	Service-Based RBF	Risk that revenue from providing services is insufficient to cover capital and operating expenditures over long term	Company receives a working capital loan and a service-based RBF grant, to bridge the gap between what customers can afford and the cost of providing service over the long term.		No loan to customer. Service provider retains ownership of the asset and responsibility for maintenance

2.3. Assessment of the Impact of Concessional Consumer Financing on Pay-as-you-go Affordability

This section analyses the impact of different CCF models on the affordability for a variety of off-grid solar PAYG products, for Sub-Saharan Africa and Malawi as a case study. Acting on the terms and cost of PAYG repayments could have a significant impact on affordability, as shown in *Figure 1* which reprises the affordability analysis presented in the Off-Grid Solar Market Trends Report (MTR) 2022,¹⁰² for Sub-Saharan Africa.¹⁰³ The methodology for this is described in *Box 2*.

The analysis does not seek to estimate the costs and risks of implementing CCF, given limited data. Both the participating companies and the CCF provider would face costs and risks in implementing a CCF approach. These costs and risks would be greater over a longer-term repayment period. There may also be implementation and behavioural challenges that would need to be closely monitored in any CCF pilot. For example, spreading payments over five years may result in ‘payment fatigue’, and/or be poorly suited to agricultural settings where incomes over a five-year period are likely to be volatile. Both of these factors may increase the risk of non-repayment of loans, increasing the cost of providing CCF.

¹⁰² Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

¹⁰³ For the purposes of this analysis, we use the MTR 2022 “bottom of the pyramid” conservative approach, which assumes the remaining energy access gap is concentrated among the lowest income profile households in each country.

Box 2. Methodology for assessing affordability impacts of CCF

Here we explain how the methodology for assessing affordability used in the Off-Grid Solar MTR 2022 has been adapted to analyse the potential impact of CCF on affordability. In broad terms, ability to pay curves for each country in

Sub-Saharan Africa are built using data on the consumption expenditure distribution of each country, assuming 5% of monthly expenditure can affordably be allocated to off-grid energy payments (or 10% 'at a stretch'). It is assumed that the remaining energy access gap is concentrated among the poorest communities in each country. For more details, see Annex 4 of the Off-Grid Solar MTR 2022.¹⁰⁴

In line with the MTR, the starting assumption is that interest rates on PAYG are typically around 40% AER. This is based on a wide range of experience working in the sector and is consistent with previous research findings.¹⁰⁵ The major further step taken in this analysis is to consider how the 40% AER breaks down across several factors associated with offering PAYG. These include:

1. **The cost of working capital** – as PAYG companies incur the full cost of installing systems upfront, but only recover revenues from sales over time, they incur the cost of bridging loans to cover the difference in timing of costs and revenues.
2. **Foreign exchange risks** – with costs incurred in hard currency and working capital loans also often provided in hard currency, exchange rate fluctuations create a risk that revenues collected in local currency may be worth less (or more) than the original hard currency costs.
3. **Default and late payment risk** – PAYG providers also need to factor in the risk of some customers defaulting on their payments or taking longer to repay than planned.
4. **PAYG technology costs** – the solar home system now needs to have the hardware, firmware, and software to enable remote activation, smart metering and usage monitoring, and mobile payments etc., which are additional costs not incurred for a simple cash over-the-counter sale.
5. **Transaction and other costs of providing consumer financing** – this includes the ongoing costs of administering the loans, provision of after-sales services and customer call centres relating to PAYG and following up on payment collection. Companies may also recover a margin on top of these transaction costs, however it is not clear whether any extra margin is made through the consumer lending part of PAYG, or whether margin is made on the cost of the solar home system.

As a working assumption, it is assumed that working capital and forex risk account for around half of the cost of offering end-user finance. That is, of the 40% AER observed in PAYG market offerings, 20% driven by the cost of accessing and repaying working capital loans and managing forex risk. This is loosely based on industry experience and previous reports such as the Funding the Sun report by ESMAP, which indicates a typical cost of hard currency loan of 10%–15% plus another 10% for forex hedging.¹⁰⁶ This implies that the remaining 20% of the 40% PAYG AER is explained by bullets (3) to (5) above.

Making PAYG more affordable could accelerate access to Tier 1 electricity. With the traditional PAYG business model, 56% of unconnected households in Sub-Saharan Africa would be able to afford a 3–11 Watt peak multi-light and mobile charger, as shown in *Figure 1*.

CCF could accelerate a faster move up the energy access ladder. More households would be able to stretch beyond an entry level (3–11 Watt peak) Tier 1 multi-light and mobile charger, and move up to a SHS. Based on the MTR 2022 methodology and datasets, only 24% of unconnected households in Sub-Saharan Africa can afford an 11–21 Watt peak SHS with the traditional PAYG business model.

¹⁰⁴ Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

¹⁰⁵ CGAP. 2018. Strange Beasts – Making Sense of PAYGo Solar Business Models. *Box 1*. <https://www.cgap.org/sites/default/files/publications/Forum-Strange-Beasts-Jan-2018.pdf>.

¹⁰⁶ ESMAP. 2020. Funding the Sun: New Paradigms for Financing Off-Grid Solar Companies. Washington, DC: World Bank. <https://openknowledge.worldbank.org/server/api/core/bitstreams/e5c4808d-c23c-5ca0-94a6-d1816aca2694/content>.

Our CCF modelling shows that affordability would rise to 32% with a zero-interest working capital facility, 41% with a zero-interest consumer loan, and 93% if the zero-interest loan is extended over five years. It could also accelerate a shift up the ladder for households that already have access and may be able to upgrade to a larger system.

CCF could also accelerate access to larger SHS and systems which would boost self-sufficiency for households, such as those able to power productive uses of electricity. As shown in the bottom panel of *Figure 1*, a larger SHS between 50-100 Watt peak or an entry-level solar water pump, each at a cost of around 750 USD,¹⁰⁷ would be unaffordable for most households

currently lacking energy access. It is reasonable to assume that households may be able and willing to stretch to a larger share of their expenditure for these products which could support income generation, or higher food production for consumption in the home. If they were able to devote a higher share of their expenditure (up from 5% to 10% of total monthly expenditure) – represented by the “at a stretch” bars – CCF increases the share of households who could afford these larger systems from 28% up to 48% for a zero-interest consumer loan, and up to 90% for a zero-interest consumer loan over five years.

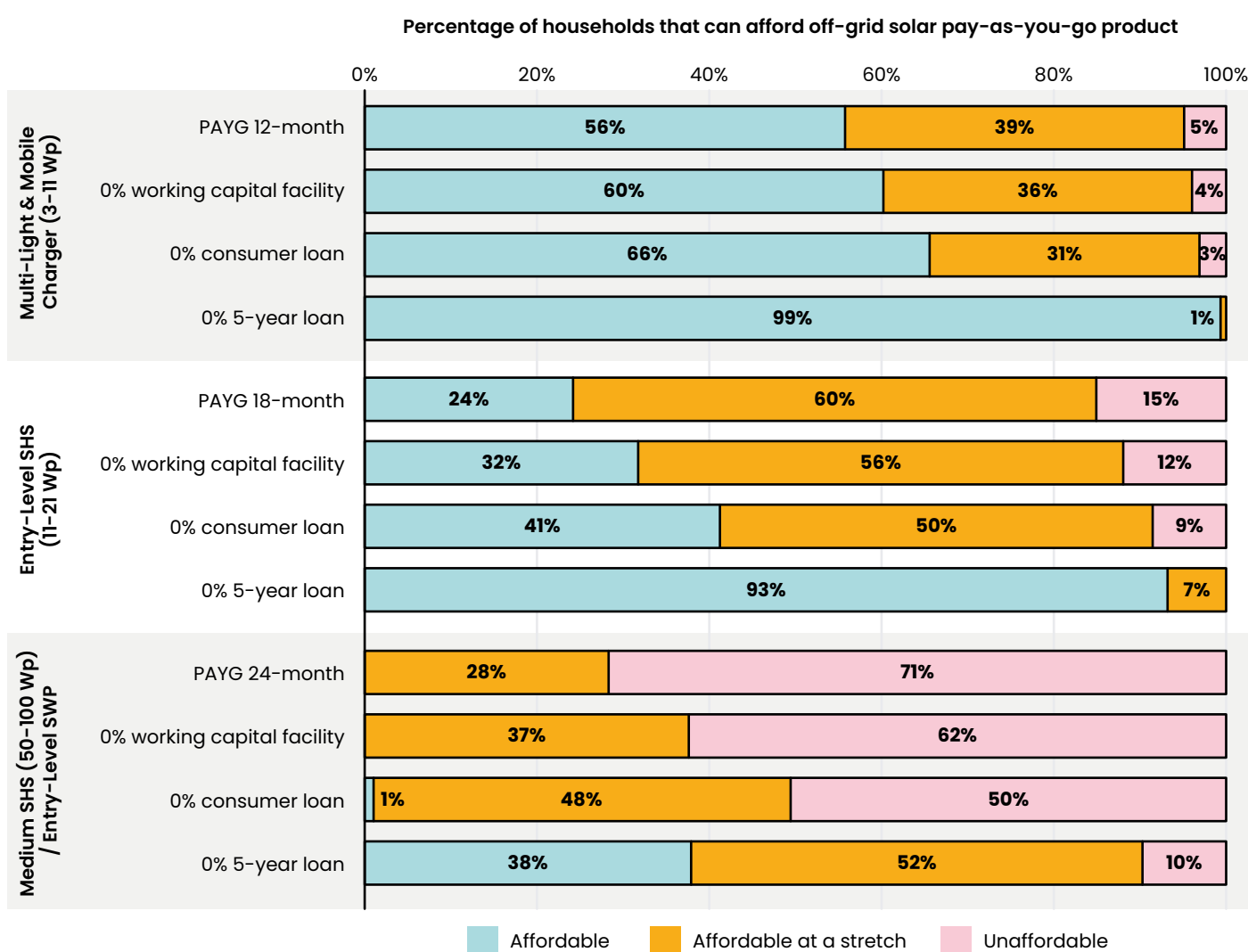


Figure 1. Impact of concessional consumer financing on affordability of pay-as-you-go solar systems across sub-Saharan Africa (methodology and datasets derived from the *Off-Grid Solar Market Trends Report 2022*).

¹⁰⁷ Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. *Off-Grid Solar Market Trends Report 2022: State of the Sector*. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

Offering a zero-interest working capital facility for lower-interest on-lending would require some non-reimbursable grant funding, but most of the funding could be recycled into new loans.

Working capital is one of the key costs associated with offering PAYG to customers, as companies need to finance the distribution of their solar systems upfront, and only get repaid over time. Here, we assume that a 0% working capital facility could lower the on-lending annual equivalent rate of interest on consumer loans from 40% to 20% AER. This in itself is not costless, as there is an 'opportunity cost' associated with the CCF offering 0% working capital loans, as it could, for example, place this money in an interest bearing, risk-free account. However, this may be relatively cost effective if the CCF can achieve a high repayment rate, with funds then recycled into further loans. This assumption would need to be validated through a CCF pilot.

Extending the offer to a zero-interest end-user finance loan would require more grant funding and more careful risk management. Offering a 0% loan to customers effectively negates the 'poverty premium', where poorer customers who can only afford energy access products through PAYG pay more in total than wealthier counterparts who can buy for cash over-the-counter. Offering a 0% consumer loan would require a grant to cover not only the USD working capital financing cost, but also all the costs associated with offering consumer finance, including collection, repossession, and allowing headroom for write-offs. It would also cover the risk of forex rate fluctuations which can represent an important risk for PAYG consumer finance, with revenues collected in local currency and working capital loans reimbursed in USD.

The most effective lever to increase affordability is extending the repayment period, but this would require a significantly higher grant funding component to implement. Assuming that extending the repayment period was cost-neutral, extending the repayment period to five years would reduce monthly repayments by 40-60% or more. However, doing this would also require extending after-sales services to maintain products beyond their initial warranty period, employing repayment collection teams over a longer period of time, which may impact default rates, and could increase forex risks. These costs would need to be built into the total overall cost paid over the longer timeframe. Longer term repayment periods are unlikely to be appropriate for conflict affected settings where people are highly mobile and it is challenging to track and recover payments over a period of many months or years. Further research is needed to understand how consumer behaviour, costs and risks, would vary with a longer repayment period. The findings from this modelling exercise highlight the significant potential impact of CCF offering longer timeframes, providing a compelling rationale for further research and piloting of the approach.

Using Malawi as a case study of a country with a low energy access rate and low ability to pay, modelling shows that CCF could substantially move the needle. As shown in *Figure 5*, only 16% of unelectrified Malawian households can afford a Tier 1 multi-light and mobile charger under PAYG. CCF could make substantial inroads, for example bringing a multi-light and mobile charger within the reach of 20% of households, if a zero-interest consumer loan was offered, and reaching 82% of households if this could be extended from 12 months to five years.¹⁰⁸ While ability to pay for larger solar home systems or entry-level solar water pumps remains very constrained, a zero-interest CCF may help create a market for these products among 13% of currently unconnected Malawian households, rising to 35% if spread over five years.

¹⁰⁸ For Malawi, we base the ability to pay demand curve on a World Bank 2019 study, ECA/MARGE 2019 Malawi Off-Grid Solar Products and Mini-Grids Market Assessment, which is more specific and built for purpose than the PovcalNet approach used for consistency across all countries in the MTR 2022.

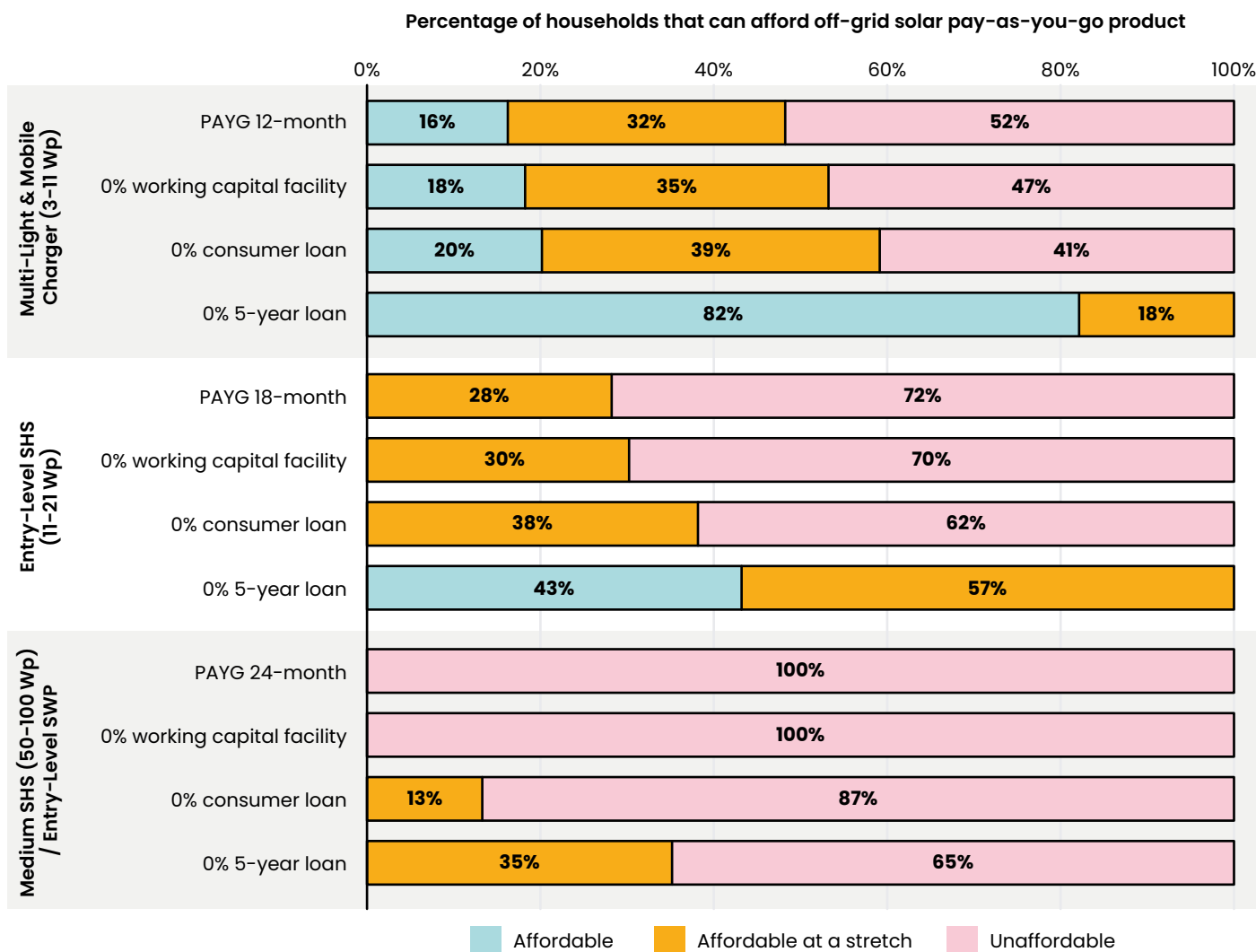


Figure 5. Impact of concessional consumer financing on affordability of pay-as-you-go solar systems - Malawi case study.

The application of CCF would also significantly reduce the remaining subsidy requirement to close the affordability gap. The MTR 2022 estimated a subsidy requirement to achieve universal access to a Tier 1 standalone solar system of 4.5 billion USD on the basis of PAYG accounting for 30% of new connections.¹⁰⁹ However, if CCF helped to increase the penetration of PAYG by making it more viable to reach a greater proportion – say up to 70% – of poorer customers, it could reduce the remaining affordability gap to just 2.4 billion USD for a zero-interest consumer loan, and to 1.8 billion USD if the PAYG term was extended to five years.

As a further example, the affordability gap in Malawi could be reduced from 111.1 million USD to 39.7 million USD, and would be removed entirely if PAYG combined with a zero-interest, five-year-tenor consumer credit facility could reach all currently unconnected households as shown in *Figure 6*.

¹⁰⁹ Lighting Global/ESMAP, GOGLA, Efficiency for Access, Open Capital Advisors. 2022. Off-Grid Solar Market Trends Report 2022: State of the Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099235110062231022/pdf/P175150063801e0860928f00e7131b132de.pdf>.

2.4. A New Tool in the Off-Grid Solar Public Funding Toolbox

2.4.1 The Public Funding Toolbox

Public funding mechanisms in the off-grid solar sector are typically thought of as being either ‘supply-side’ or ‘demand-side’. Supply-side mechanisms channel funding to companies or investors and are designed to reduce the cost and risk of supplying products to end users. These mechanisms include upfront grants, supply-side results-based financing (RBF), tax exemptions, credit lines and risk mitigation instruments such as guarantees. They focus on reducing upstream costs and risks for business, without affecting consumer price expectations.¹¹⁰

Demand-side mechanisms are designed to make energy access products more affordable for end users, with funding channelled either direct to end users or through companies. These mechanisms include end-user subsidies, and public procurement. They help to overcome affordability challenges, while still enabling companies to operate on a commercial basis. Funds can be disbursed to end users in cash or in kind, for example through vouchers that provide a discount. Funds can also be disbursed to companies, which use the funds to offer products at lower prices, that are independently verified once sales are achieved. RBF programs, although broadly categorized as supply-side mechanisms, can also act as demand-side mechanisms if they directly reduce end-user prices.¹¹¹ The World Bank notes that, in general, supply-side mechanisms should be considered before demand-side mechanisms, helping to bridge the gap between initial market prices and initial willingness to pay, before demand-side approaches are deployed to address the remaining affordability gap, as outlined in *Figure 7*.

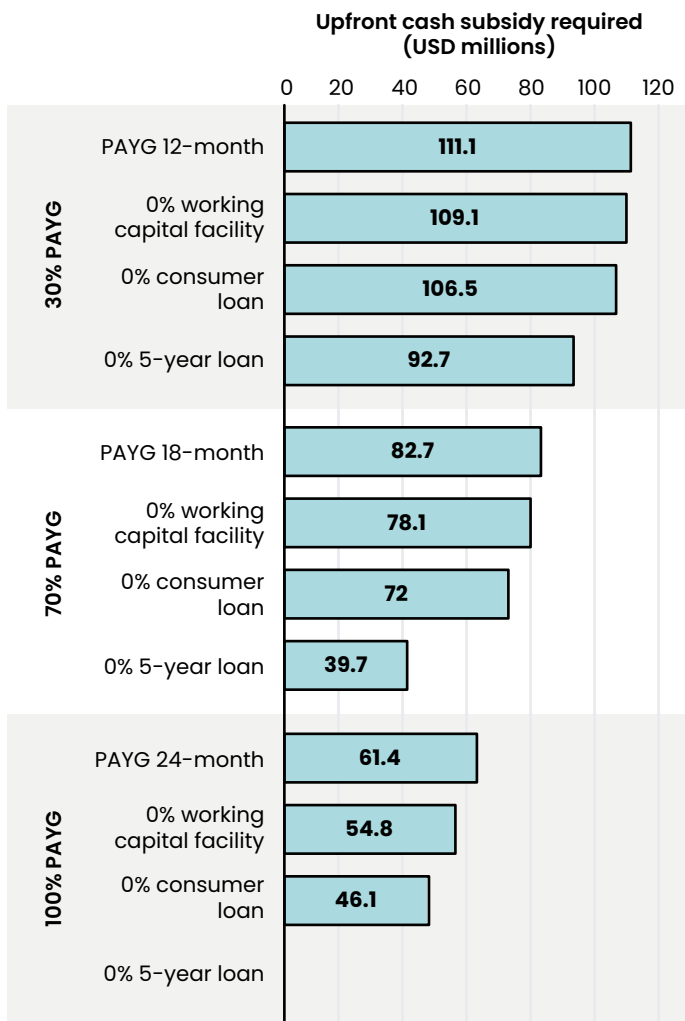


Figure 6. Impact of concessional consumer financing on the remaining subsidy requirement to achieve Tier 1 energy access – Malawi case study.

¹¹⁰ ESMAP. 2022. Designing Public Funding Mechanisms in the Off-Grid Solar Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099300005162263450/pdf/P17515006776e102308e980bb2d798ca5c3.pdf>.

¹¹¹ ESMAP. 2022. Designing Public Funding Mechanisms in the Off-Grid Solar Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099300005162263450/pdf/P17515006776e102308e980bb2d798ca5c3.pdf>.

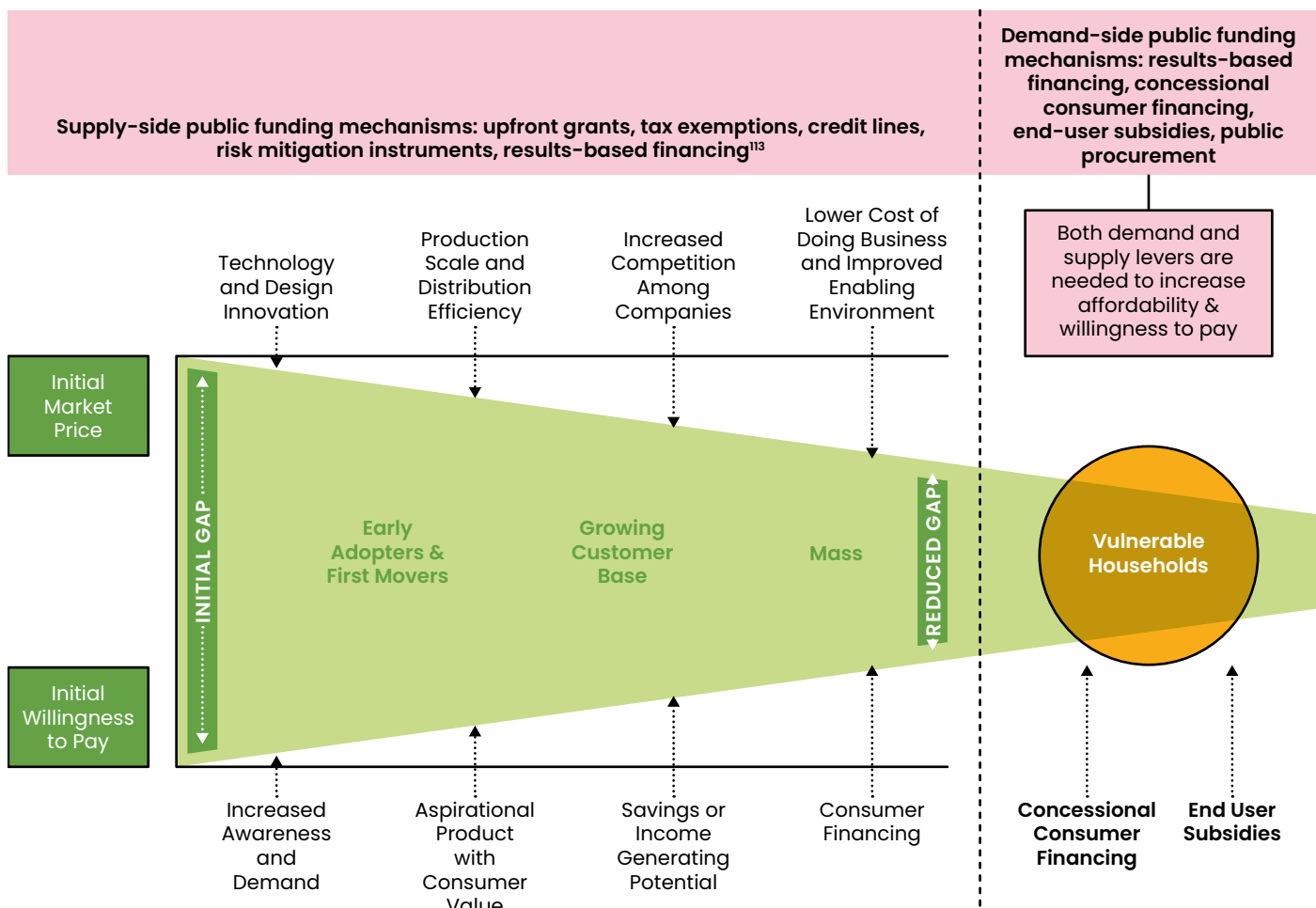


Figure 7. How supply-side and demand-side public funding mechanisms can be used to bridge the affordability gap.¹¹³

2.2.1. Comparing End-User Subsidy and Concessional Consumer Financing

Like end-user subsidies, CCF is a demand-side funding mechanism since its primary objective is to reduce the prices paid by end users. End-user subsidies aim to reduce end-user prices in general, whilst CCF specifically aims to reduce the interest consumers pay on loans and extend repayment periods to make monthly payments more affordable, or both. Both mechanisms can help to address supply-side challenges, for example if lower monthly payments helped to accelerate uptake of consumer financing through PAYG. This section outlines key similarities and differences between how the two funding mechanisms could be designed.

Targeting to minimise market distortion: Both end-user subsidy and CCF mechanisms need to be targeted to ensure the efficient use of scarce

public funds and minimise the risk of subsidies going to those who are able to afford unsubsidised commercial prices. Targeting can be geographic, based on income level or other socio-economic characteristics. If data is not available, sometimes proxies for income or other characteristics can be used. In the IDCOL program, targeting of poorer households was achieved by focusing price reductions on smaller SHSs, which were more likely to be purchased by poorer households.¹¹⁴

Consumer awareness: In both end-user subsidy and CCF programmes, customers need to be aware of how the price they are paying is being reduced through government support, to reduce the risk of 'payment fatigue'.

Setting product categories: In both cases, product categories can be set based on system capacity (e.g. Wattage or Watt hours for solar generators or productive use systems), or level of service

¹¹² Results-Based Financing can be used for both, supply-side or demand-side.

¹¹³ ESMAP. 2022. Designing Public Funding Mechanisms in the Off-Grid Solar Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099300005162263450/pdf/P17515006776e102308e980bb2d798ca5c3.pdf>.

¹¹⁴ ESMAP. 2022. Designing Public Funding Mechanisms in the Off-Grid Solar Sector. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/099300005162263450/pdf/P17515006776e102308e980bb2d798ca5c3.pdf>.

provided (e.g. availability of lighting, phone charging or televisions for solar home systems sold with bundled appliances). Subsidy amounts are then set for each product category.

Setting RBF amounts: In end-user subsidy programmes, RBF amounts are typically set as a % of average unsubsidised PAYG retail prices for each product category.¹¹⁵ In the '0% consumer loan' CCF model, RBF amounts could initially be set to cover the difference between average cash and PAYG retail prices in each product category. In the '0% working capital' CCF model, RBF amounts could initially be set to cover half of the difference between average cash and retail price.¹¹⁶ If repayment periods were extended, RBF amounts would have to take account of company costs and risks over the long-term, based on data shared by companies (see below). In both cases, RBF amounts need to be periodically reviewed and updated based on pricing data and other market intelligence.

What RBF can be used for: There is little difference between end-user subsidies and CCF models that do not seek to extend repayment periods. In both cases, companies would be required to show how they had used the RBF to reduce the total price paid by end users, but how exactly they do so would be up to them. They could choose to do so through reducing upfront payments or reducing the size of regular monthly payments. Their initial applications to participate in the RBF would show how they intend to use the subsidy to reduce prices, and their claims would show how they had in fact done so, by sharing actual subsidised pricing data alongside nominal 'unsubsidised' prices for comparison.

If CCF schemes sought to extend repayment periods, companies would be required to show how they had used the RBF to extend the repayment period. Public funders could set a minimum repayment period or invite companies to show how they propose to use the RBF to extend the repayment period. Companies would be expected to provide warranties and/or after-sales service over the duration of the repayment period. In the Togo CIZO programme, for example, the CIZO cheque is a monthly subsidy that complements

household payments for a period of three years.¹¹⁷ Off-grid solar companies can either offer a fee-for-service model covering the whole three-year period, or a lease-to-own model with repayments over any period up to three years. If the lease-to-own repayment period is less than three years, companies are required to offer their customers service and maintenance contracts after repayments are completed.¹¹⁸

Structuring RBF payments: Typically, 100% of an agreed RBF amount is paid once a sale has been verified. In some cases, a small proportion of RBF is paid in advance, to assist companies with upfront costs they face in order to achieve sales, or is withheld until a year or two after a sale has taken place to incentivise companies to honour warranties and provide adequate after-sales service. If CCF models extended repayment periods, there would be value in linking a small proportion of RBF to verification of adequate after-sales service over the extended repayment period. Alternatively, RBF payments could be linked to customers making their monthly payments, as in the case of the Togo CIZO programme.

Claims and verification: In both end-user subsidy and CCF programmes, sales need to be verified by an independent verification agent. In end-user subsidy programmes, claims typically verify that a customer is eligible (e.g. they live in an eligible geographical area; they have not already bought a subsidised product etc.). They also collect information regarding the product purchased, the price paid (including agreed upfront payment, monthly payment and repayment period), and the location of the customer. Independent verification agents also check that customers have been provided with sufficient information at point of sale, for example around how they are benefiting from a subsidy, and what to do with the product at end-of-life. For productive use systems, verification agents can also check system sizing is appropriate (i.e. all components work well together) and the system has been installed properly.

Data sharing: In both cases, product prices need to be monitored through companies sharing pricing information when they submit claims. This pricing information then informs periodic

115 An exception to this is the 'reverse auction' approach, whereby companies are invited to bid for the amount of RBF they need to deliver a given number of new connections. The public funding provider then provides bespoke RBF amounts to those companies that can deliver eligible new connections as efficiently as possible.

116 Alternatively, a credit line could be used to provide a loan to companies at 0% interest.

117 When a customer pays the company, the company gets a matching payment from the Togolese Government. The matching payment is unlocked automatically, since payments are made using mobile money and the mobile money providers have systems in place to automatically recognise eligible off-grid solar repayments.

118 GOGLA, African Clean Energy, EnDev, Lighting Global. 2022. Togo CIZO Cheque Program Case Study. End-User Subsidy Lab. https://www.gogla.org/sites/default/files/resource_docs/case_study_-_togo_cizo_cheque_program.pdf.

review and revision of RBF amounts. With CCF offered over extended repayment periods, there would be value in asking companies to share additional data to inform the review of RBF amounts. The PAYGo Perform KPIs^{119, 120} could be used to collect data in areas such as the cost of working capital (using the Financial Expense Ratio indicator); late payment and default (using the Collection Rate, Receivables at Risk, Write-Off Ratio and Repossession Ratio indicators); and Servicing and Maintenance (using the Unit Servicing and Maintenance Cost indicator). Collecting this additional data from companies would help public funders track how the CCF scheme was affecting PAYG company costs and risks, as well as the overall financial health of the businesses. Given the commercially sensitive nature of this information, public funders would need to put in place robust systems and processes to ensure confidentiality.

Quality assurance: In both cases, quality standards are needed which cover both products and services. Product standards, which ideally are in line with international standards such as those developed by Verasol¹²¹ or by the International Electrotechnical Commission (IEC), can either be set by the project or aligned with national standards if they exist. Service standards could build on the GOGLA Consumer Protection Code,¹²² and in CCF models that extend repayment periods, could outline what is expected from companies in terms of extended warranties, maintenance and after-sales service. They could then build this into their extended repayment period pricing, and report on actual costs through the Unit Servicing and Maintenance Cost indicator mentioned above.

Environmental and social safeguards: In both end-user subsidy and CCF programmes, companies need to be supported to develop robust environmental and social safeguards, including systems & processes for sound e-waste management including product takeback, reverse logistics and either repair, refurbishment, recycling or safe disposal.

These key similarities and differences are summarised in *Table 2*.












119 FinDev Gateway. 2023. PAYGo PERFORM KPIs. <https://www.findevgateway.org/paygo-perform-kpis>.

120 PERFORM = Performance, Reporting and Measurement; KPI = Key Performance Indicator.

121 VeraSol. 2023. <https://verasol.org/>.

122 GOGLA. 2023. GOGLA Consumer Protection Code. <https://www.gogla.org/consumer-protection>.

Table 2. Comparison of concessional consumer financing and end-user subsidy

	End-User Subsidy	Concessional Consumer Financing
 Targeting	Targeting is needed to minimise the risk of market distortion and ensure efficient use of scarce public funds. Targeting can be geographic, based on income levels or based on other socio-economic data.	
 Consumer Awareness	Consumers need to be aware of how the price they are paying is being reduced through government support, to reduce 'payment fatigue'.	
 Setting Product Categories	Product categories are set based on system capacity (e.g. Wattage or Watt hours for solar generators or productive use systems), or level of service provided (e.g. availability of lighting, phone charging or televisions for solar home systems sold with bundled appliances).	
 Setting RBF Amounts	Subsidy amounts are typically set as a % of average unsubsidised PAYG retail prices in each product category.	<p>In the '0% consumer loan' CCF case, RBF amounts could initially be set to cover the difference between average cash and PAYG retail prices in each product category.</p> <p>In the '0% working capital' model, RBF amounts could initially be set to cover half of the difference between average cash and retail prices. Alternatively, a credit line could be used to provide a loan to companies at 0% interest, with a requirement that it is used to on-lend to end users at lower interest.</p> <p>If repayment periods were extended, RBF amounts would have to take account of company costs and risks over the long-term, based on data shared by companies.</p>
 What RBF Can Be Used For	Reducing end-user prices.	Reducing end-user prices and/or extending repayment periods.
 Structuring RBF Payments	Typically, 100% of RBF is paid upon verification of sale, but sometimes a small proportion is paid in advance or withheld until verification of adequate after-sales service at a later date.	CCF over extended repayment periods would particularly benefit from small RBF payments linked to verification of adequate after-sales service over the extended period.
 Claims & Verification	In both cases, companies provide information regarding customer name, contact details, location, product bought and price paid (including agreed upfront payment, monthly payment and repayment period).	
 Data-Sharing	Companies share pricing information through claims.	With CCF over extended repayment periods, there is value in asking companies to share additional data beyond pricing.
 Quality Assurance	The PAYGo Perform KPIs could be used to collect data in areas such as the cost of working capital (using the Financial Expense Ratio indicator), late payment and default (using the Collection Rate, Receivables at Risk, Write-Off Ratio and Repossession Ratio indicators), and Servicing and Maintenance (using the Unit Servicing and Maintenance Cost indicator).	
 Quality Assurance	In both cases, quality standards are needed which cover both products and services.	
 Environmental and Social Safeguards	In both cases, companies need to be supported to develop robust environmental and social safeguards, including systems & processes for sound e-waste management.	

2.2.2. Towards a Concessional Consumer Financing Pilot

Our model suggests that extending repayment periods could dramatically improve affordability.

With long repayment periods monthly payments are lower, which can decrease the risk of late payments and default. With lower default rates, lenders might be willing to charge lower interest rates on working capital loans, since company receivables would be seen as lower risk and higher quality. However, if companies used CCF to extend their reach into more remote rural areas, or to serve lower-income households, then this could increase the risk of late payment and default again. With extended repayment periods there might be an increased risk of 'payment fatigue', although this could be mitigated through robust consumer awareness campaigns to ensure customers know they are benefiting from a subsidy and encourage people to think of SHS (for example) as a service to be paid for over time rather than as a product to be paid for at once. There may also be a risk of people switching to new products or providers, although potentially this could be mitigated through a trade-in scheme that enables people to upgrade without defaulting. Further research is needed to understand the potential impact of extended repayment periods on late payment and default rates.

The total cost and risk of providing products over longer repayment periods is unknown.

While the impact of extended repayment periods on late payment and default rates is uncertain, transaction costs would certainly be higher over longer repayment periods, as a result of having to handle a larger number of smaller repayments over a longer timeframe, and foreign exchange risks would also be higher if working capital loans were in hard currency. This would make it difficult for companies to price appropriately, at least until they had more experience with CCF schemes. Similarly, public funders would struggle to set RBF amounts at an appropriate level without access to more business performance data than is currently available to them, ideally from companies participating in a CCF programme.

CCF can be considered a success if it proves to be a more efficient way of using public funding to overcome energy access affordability barriers compared to simpler end-user subsidies. A higher

proportion of the total cost of service would need to be recovered from the end user over time, thus reducing the amount of public funding required to deliver the service. While this has been proven to be the case in many projects in on-grid settings, in the Global North, and with lower-risk product categories, it is yet to be proven in off-grid settings, in the Global South, with moveable assets such as solar home systems or solar water pumps.

In order to understand the impact of extending repayment periods, the CCF approach would need to be piloted with a focus on:

- Understanding its impact on affordability:
 - Extent to which CCF enables companies to offer customers lower monthly payments.
 - Extent to which CCF enables companies to expand into new geographical areas and/or serve lower-income customer segments.
 - Impact of lower monthly payments on uptake, including PAYG adoption rate and service level accessed.
- Understanding its influence on consumer behaviour:
 - Consumer perceptions of the product, service and subsidy mechanism.
 - If, when and how people consider switching to a new product and supplier.
 - Key drivers of late payment and/or default such as 'payment fatigue'.
- Understanding the costs and risks:
 - Cost and currency of working capital used for on-lending.
 - Late payment and default risk.
 - PAYG technology costs – such as hardware, software and firmware.
 - Transaction and other costs – such as mobile money transaction costs, loan administration costs, after-sales service, warranties, maintenance and e-waste management.
- Comparing with end-user subsidy:
 - Ideally CCF would be directly compared with end-user subsidy through running pilots using both funding mechanisms in parallel, in similar contexts,¹²³ to compare results.

¹²³ If the pilots are conducted in the same country, the geographical boundaries would need to be far enough from each other to avoid market leakage and cultural risks.

3. Conclusions



3. Conclusions

The track record of CCF in energy access has been limited to date, but it has the potential to become a useful tool in the toolbox of public funding mechanisms. Case studies from the Global North demonstrate how impactful the model can be when it comes to the deployment of new technologies and the promotion of energy efficiency improvements. In the Global South, the largest CCF in an energy access setting was the IDCOL SHS programme in Bangladesh, which enabled millions of previously unelectrified households to gain access to electricity.

Based on the models explored, providing CCF via PAYG was identified as having the greatest potential to contribute to universal energy access in Sub-Saharan Africa. The financing mechanisms we identified provide a menu of options to governments and programme implementers interested in piloting a CCF via PAYG approach, from a relatively conservative option - zero-interest working capital facility, to a more risky and experimental option - zero-interest consumer loans over a repayment period of five years.

CCF could become a versatile public funding mechanism to address affordability. CCF could either be integrated into an existing energy access programme or designed as a stand-alone project. The CCF mechanism is technology neutral which means that a pilot / demonstration of the approach could include low-tier lighting systems, household or productive use systems, as well as solar generators.

There is a need to test CCF approaches in energy access settings before they can be rolled out at scale. The most significant impact of CCF on affordability would be achieved with extended repayment periods but consumer behaviour, as well as company costs and risks, are all highly uncertain in this model. If successful, a CCF pilot in this area could provide governments and other public funding providers with an attractive, cost-efficient and sustainable solution to the affordability challenge in energy access.

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Relevant Literature

The authors would recommend reading the following papers which shaped the content of this report:

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IIED and Hivos. 2020. Energy for all: Better use of subsidies to achieve impact. Nipunika Perera, Kevin Johnstone, Ben Garside. <https://pubs.iied.org/16677iied>.

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