

Innovative Financing for Humanitarian Energy Interventions

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About the Moving Energy Initiative

The Moving Energy Initiative (MEI) is working to achieve access to clean, affordable and reliable energy among displaced populations by:

- **Working with humanitarian agencies and donors** to change policies and practices based on evidence from practical projects;
- **Working with the private sector** to design and implement innovative market-based solutions;
- **Improving the evidence base** through original research and the demonstration of new approaches tried and tested in camps and host communities; and
- **Cooperating with host governments and national NGOs** to improve energy security among both local and refugee communities.

The MEI is a collaboration between Energy 4 Impact, Chatham House, Practical Action, the Norwegian Refugee Council (NRC) and the Office of the United Nations High Commissioner for Refugees (UNHCR), with funding from the UK Department for International Development (DFID).



Preface

The Moving Energy Initiative (MEI) is an international consortium seeking to sustainably increase access to energy for displaced people and to improve how energy is dealt with in humanitarian situations. It was formally inaugurated in 2015 as a partnership between Energy 4 Impact, Practical Action, the UN Refugee Agency (UNHCR), the Norwegian Refugee Council and Chatham House. Funding for this publication, and for the wider activities of the MEI, has come from the UK Department for International Development (DFID).

When the MEI published the report *Heat, Light and Power for Refugees* in 2015,¹ the consortium felt it had addressed a fundamental gap in analysis about energy needs in humanitarian settings. This was the first publication that attempted to establish the amount of energy used by forcibly displaced people around the world and the amount that they paid for it. Since then, much has been achieved. The consortium is actively enabling market-based energy provision, and improving energy access in refugee camps in Burkina Faso and Kenya, as well as in areas affected by large-scale migration in northern Jordan. This work – and the ‘learning by doing’ that is fundamental to this process – remains the central piece of the MEI.

One area that has repeatedly come up during the MEI’s research is the lack of funding available for humanitarian energy interventions, and the need for innovative approaches to fill the funding shortfalls. As a result of this, the MEI looked into the idea of setting up a dedicated humanitarian energy fund to provide capital to projects aiming to improve energy access and management in displacement settings, with a focus on mechanisms that could attract private-sector participation. While this fund was never actualized, valuable insights were gained from completing the feasibility work. Findings from this process are presented in this research paper, alongside a discussion of the current challenges of financing energy interventions and the associated investment risks. The paper also introduces potential mitigation instruments for the private sector and makes recommendations for their design. The aim of this paper is to inform donors, financiers, practitioners and policymakers interested in better addressing the funding needs of, and understanding the associated support required by, this sector. Other research resources and publications in this series are available online at www.movingenergy.earth.

¹ Lahn, G. and Grafham, O. (2015), *Heat, Light and Power for Refugees: Saving Lives, Reducing Costs*, Chatham House Report for the MEI, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/sites/default/files/publications/research/2015-11-17-heat-light-power-refugees-lahn-grafham-final.pdf>.

Executive Summary

A significant increase in funding is required to ensure that displaced people are included in efforts to meet Sustainable Development Goal (SDG) 7, which aims to ‘ensure access to affordable, reliable, sustainable and modern energy for all’ by 2030. In settings that host displaced and refugee communities, energy can act as an enabler for improved healthcare, education and access to clean water, while more efficient sources of energy can also save money that can be reinvested in life-saving interventions. This paper serves as a primer on financial mechanisms that are needed to encourage increased private-sector participation in the context of humanitarian settings. It is aimed at donors, policymakers, investors and other stakeholders who are interested in increasing the flow of appropriate capital for humanitarian energy interventions.

A range of challenges exist that inhibit the uptake and effective management of cleaner energy solutions in displacement settings. These are magnified by a lack of available and appropriate funding that could target the nexus of energy access and humanitarian interventions. The current funding gap is significant. In many cases, involving the private sector (both enterprises and investors) is viewed as a way to accelerate delivery of sustainable energy solutions, leverage additional capital, efficiency and expertise, and adopt more sustainable and market-based approaches. Projects in displacement settings can be categorized by the type of users they serve: i.e. as ‘consumptive’, ‘productive’ or ‘public’. A number of business models exist to serve these customer segments, which have different financing needs.

In many cases, involving the private sector (both enterprises and investors) is viewed as a way to accelerate delivery of sustainable energy solutions, leverage additional capital, efficiency and expertise, and adopt more sustainable and market-based approaches.

Displacement settings represent an extreme example of complex and unpredictable operating environments, and present a range of risks and uncertainties for private enterprise and potential investors. Traditional approaches to the financing of energy access will not be supported by the risk/return characteristics of this market opportunity, so alternative structures are needed. Such structures will be specific to the risk and type of project, and can include mechanisms such as grants, guarantees, ‘results-based financing’ and ‘impact bonds’. These blended financial instruments should aim to leverage first losses – whereby, in the case of default, the first loss is taken by the ‘impact-first’ investors, or guarantors, thereby fully or partially protecting ‘finance-first’ investors.² This can enhance the attractiveness of investment opportunities for other sources of capital. Examples are emerging of situations in which these alternative mechanisms are being tested. While such examples can provide crucial insights, more data are needed if risks and returns are to be appraised fully and future mechanisms structured appropriately.

² For an explanation of the distinction between impact-first and finance-first investors, see Investing for Good (undated), ‘Blended Finance – A Brief Introduction’, <https://www.investingforgood.co.uk/news/blendedfinance> (accessed 21 Jan. 2019).

Given the very specific constraints of displacement settings, any financing mechanisms at present are likely to fall between the categories of providing ‘more efficient aid’ and ‘more efficient aid through markets’.³ They are likely to constitute a transitional step from grant-making towards the use of commercial investment vehicles. Initial mechanisms should prepare the market for more commercial investment, and should build the necessary evidence to do this. The range of challenges related to displacement settings requires not just the smart mobilization of financing, but also policy and technical interventions to create a more enabling environment for donors, non-governmental organizations (NGOs), the private sector and potential investors.⁴

While a number of financial mechanisms could be applied to attract private-sector engagement, most remain theoretical, with few being implemented extensively or at scale. Furthermore, where such financial mechanisms have been used, access to relevant data is poor, especially in circumstances where the desired outcomes were not achieved. This limits the potential for learning from past mistakes. The Moving Energy Initiative (MEI) completed feasibility work into the concept of a humanitarian energy fund and found that, while a need for this type of facility has emerged, it sits in a difficult position between energy access, climate and humanitarian funding sources. Key donors are needed to drive forward innovative financing vehicles and further testing of these mechanisms, in order to generate market data and evidence for further iterations and additional investments. The humanitarian sector needs to support the call for this funding without fearing that it will divert money from other critical areas. Instead, financing will need to be driven by a desire to reduce operational costs and improve services, which will bring benefits in areas such as healthcare, education and livelihoods.

The paper draws a number of conclusions from the feasibility work mentioned above. These are as follows:

- There is a need to look at energy interventions more holistically and to take a cross-sector approach to both the supply of and demand for capital. Opportunities for investment can be strengthened by considering the needs of the broader region around refugee camps – so as to present more robust markets, increase support from host governments, engage policymakers, reduce investment risks and leverage additional sources of development financing.
- Financial instruments should be coupled with technical assistance to support market data, pipeline development and project implementation. This should run in parallel with platforms to share the knowledge and learning emerging from projects.
- More research is needed into the merits of a global pooled facility (as initially investigated by the MEI) versus more localized and project-specific approaches. Areas that stand out from this study and warrant further investigation include guarantees for energy-as-a-service contracts, the application of impact bonds for energy interventions in displacement contexts, and mechanisms to increase the purchasing power of consumers.
- There is a need for a dedicated vehicle to aggregate projects across humanitarian settings. This would support the development of specialist financing expertise and understanding of the market environment, thus helping risk and uncertainty to be managed effectively.

³ See Table 2 for a summary of the different approaches to sustainable energy provision from which these categories are taken.

⁴ United Nations Institute for Training and Research (UNITAR) (2018), *The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement: Framework for Action* (GPA Framework), http://unitar.org/ptp/sites/unitar.org.ptp/files/uploads/gpa_framework_final-compressed.pdf (accessed 26 Nov. 2018).

With this in mind, the authors recommend the following next steps to advance the design of tailored financial mechanisms:

- Explore more deeply specific consumptive, productive and public energy use cases, and collect existing market data to understand the appropriate blended financing instruments needed.
- For these cases, collaborate with those donors, impact investors and private-sector actors that have an appetite for sustainable energy investments to design financial and risk mitigation instruments that facilitate their participation in the sector.
- Investigate further the application of these mechanisms and what has and has not worked in other contexts and sectors, particularly in respect of mechanisms aiming to incentivize private-sector engagement in areas traditionally handled by the public sector.
- Where uncertainties and risks are too high for such structures to be put in place, design and implement targeted pilot schemes and market research aimed at addressing concerns and generating data that will facilitate their design.

1. Introduction

Currently, more than 87 million people are displaced by conflict, natural disasters, political instability and other drivers.⁵ Of the displaced people living in camp settings, around 90 per cent are without access to electricity and 80 per cent rely on solid fuels for cooking.⁶ A significant increase in funding is required to include such displaced people in efforts to meet Sustainable Development Goal (SDG) 7, which aims to ‘ensure access to affordable, reliable, sustainable and modern energy for all’ by 2030. In settings that host displaced and refugee communities, energy can act as an enabler for improved healthcare, education and access to clean water. Switching from expensive and dirty diesel to cleaner sources of energy can also provide humanitarian operations with financial savings that can be reinvested in life-saving interventions.⁷ Enabling access to improved energy products and services for refugees can improve livelihood, education and health outcomes.

As in the wider energy access sector, private-sector experience and capital are required to deliver energy more effectively and to meet SDG 7. While this has been recognized for some time in the wider sector, it has only recently been acknowledged in the context of displaced people. This paper serves as a primer on financial mechanisms that are needed to encourage increased private-sector participation in energy access in the context of humanitarian settings. Building on work presented under Working Area III (Innovative Finance) of the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA), it undertakes an in-depth review of potential funding mechanisms, delivers case studies and research findings (by the MEI and others), and explores ideas for the design of a financing facility and financial instruments for humanitarian energy interventions.⁸ The paper outlines the current challenges of financing energy interventions and explains the investment risks. It also introduces potential mitigation instruments for the private sector and makes recommendations for their design. The paper draws on research, completed under the MEI’s programme of work, into the feasibility of establishing a humanitarian energy fund, as well as on interviews with a range of stakeholders in the sector. Information for the case studies in this paper was sourced between May and August 2018 and was current as of that period.

Financing mechanisms can help to improve the resources available to the sector; but they cannot work in isolation, and funding alone will not solve all the challenges faced. Instead, a holistic approach is needed which considers the complete value chain of energy products and services, the enabling environment, institutional frameworks and capacity, and local context.⁹

⁵ Grafham, O. and Lahn, G. (2018), *The Costs of Fuelling Humanitarian Aid*, Research Paper for the MEI, London: Royal Institute of International Affairs, p. 8, <https://mei.chathamhouse.org/resources/reports>.

⁶ Lahn and Grafham (2015), *Heat, Light and Power for Refugees* (accessed 26 Nov. 2018).

⁷ UNITAR (2018), *The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement: Framework for Action* (GPA Framework).

⁸ Ibid.

⁹ Ibid.

2. Key Challenges to Adopting Sustainable Energy in Humanitarian Settings

Previous research by the MEI has highlighted a range of structural and contextual challenges that negatively affect efforts to scale up sustainable energy solutions in displacement settings. These challenges give rise to a funding gap that cannot be addressed using traditional humanitarian funding sources.

Programmatic and institutional challenges

Energy's status as an enabler rather than as a priority in its own right. There is currently no 'institutional home' for energy among the clusters of activity covered by humanitarian coordination, and hence no one is in charge of advocating for funding for energy interventions.¹⁰ As a result, such funding is not included in donor priorities for humanitarian aid, and donor contributions are not specifically carved out for this purpose. The focus of humanitarian coordination is on immediate priorities in respect of housing, education, healthcare, food, and water, sanitation and hygiene (WASH); energy is an enabler of these priorities rather than a priority in its own right. Hence, if sustainable energy is to be provided, new mechanisms must be developed to finance it and deliver the necessary technical expertise.

Short-term, political budgeting and scarce resources. Humanitarian funding is often politically motivated and short-term in nature,¹¹ meaning that amounts and priorities can quickly change with new donor administrations and shifts in international relations. This uncertain environment creates a significant mismatch between the funding typically available and the longer-term investment required to meet energy needs sustainably. Where sustainable energy solutions are supported by donor funds, the majority of projects are pilot schemes or give-away programmes¹² lacking scalability and long-term impact. They are designed in accordance with traditional grant-funding models and ignore applicable business models and commercial funding vehicles. While budgets are assigned to the provision of power to humanitarian operations, short-term funding cycles can restrict agencies from investing in energy infrastructure that has long-term economic pay-offs, such as solar or wind systems, or from entering into power purchase agreements (PPAs) that require a multi-year commitment. As a consequence, most humanitarian missions remain reliant on diesel generators to power their operations. Refugee and internally displaced person (IDP) households and businesses are either left with little or no access to energy services, or must access power through informal businesses running inefficient diesel mini-grids.¹³

¹⁰ It should be noted that the GPA Framework launched in July 2018 seeks to bring some coordination to the sector by developing a work plan in conjunction with stakeholders, with the aim of improving the energy situation in displacement settings. The initiative is in its infancy, and innovative financing forms one of the focus areas of the framework.

¹¹ Lahn and Grafham (2015), *Heat, Light and Power for Refugees*, p. x.

¹² The term 'give-away programme' refers to the practice of giving products directly to beneficiaries for free, with a donor covering the full cost of the product. While these programmes can get products to people who need them, there is often little sense of ownership of the product, low understanding of how to use the product properly, and a lack of long-term maintenance provision. Products are often resold below market value, which can distort the market for future initiatives.

¹³ UNITAR (2018), GPA Framework, 'Working Area III – Innovative Finance: Public, Private and Public-private Models of Delivery for Sustainability', p. 31.

Bureaucracy and a lack of technical and commercial expertise. Humanitarian agencies work in a manner that the private sector is not accustomed to. This makes it difficult for the private sector to determine how to size markets and capture value in these settings, and generally prevents it from intervening at any significant scale. Cumbersome, opaque and lengthy procurement and decision-making processes; limited awareness of sustainable energy solutions; and lack of technical (energy) expertise, commercial acumen or comfort working with the private sector – all are challenges that have been identified as inhibiting the working relationship between the parties. Additionally, humanitarian agencies work to the concept of ‘do no harm’. They are often uncomfortable with the idea of the private sector turning a profit from business activities that target impoverished and vulnerable communities.

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Lack of a holistic approach to funding.¹⁴ Funding for energy activities often targets a specific intervention, such as making clean cookstoves available to displaced people or funding a piece of infrastructure for powering operations. In general, these programmes do not consider the whole value chain or take a holistic view of the challenges involved. For example, a programme may train people how to make a cookstove but not look at creating a market for cookstoves. It may fail to consider the supporting business models required, or issues around long-term access to raw materials that may jeopardize the sustainability of interventions. As well as the challenge of short-term funding cycles, many current energy projects lack a plan for follow-on funding, scale-up or continued servicing of products and equipment. A lack of coordination among donors who fund energy interventions means that they often work at cross-purposes – for example, a programme giving away energy products may operate alongside a programme working to create a market for such products.¹⁵

Country-specific challenges

Protracted crises. Many governments may not want to recognize the de facto semi-permanent status of refugees within their countries. They may discourage investment in infrastructure (particularly in projects with long payback periods), fearing that it will encourage refugees to settle for longer periods, or give the impression of permanence to local communities that may oppose this. In crisis situations, people themselves may be uncertain of how long they will be displaced, and hence reluctant to invest in any commodities that they cannot easily take home.

Limited refugee and IDP rights. In many countries, displaced people are limited by controls on movement, employment and resource use. They are prevented from building sustainable livelihoods that could provide them with the buying power to meet basic needs and break free

¹⁴ Ibid., p. 31.

¹⁵ Ibid.

from dependency on handouts.¹⁶ Meagre revenue from informal labour, small amounts of legally permitted work for NGOs, remittances from relatives living elsewhere and vouchers from NGOs are often the only means of gathering funds to meet everyday costs. This limits the willingness and ability of displaced people to pay for goods and services.

Host-community dynamics. Local communities that host refugees are equally impoverished in many cases, resulting from a general lack of infrastructure and sustainable sources of livelihood in the area. When the refugees receive resources that the local communities do not have, the latter can rightfully feel hard done by and become resentful or hostile towards the refugee community. Interventions that consider the needs of the area as a whole – regardless of refugee status or nationality – are needed, but this is challenging when clear divides exist in terms of access and rights. The needs and capabilities of the host community are often not given sufficient attention by those designing and implementing solutions.¹⁷

Maturity challenges in the energy access sector

Insufficient strategic focus. The sustainable energy-focused private sector tends to perceive interventions in refugee camps as too risky, and as a distraction from its core energy access market segments, which in themselves are still being developed due to the young age of many energy access companies. As a result, current involvement is limited to donor-backed pilot schemes, while demonstration projects focus on selling equipment and products rather than on selling energy as a service (which would create longer-term engagement). However, more companies are starting to show interest in this space; this presents an opportunity that can be seized.

Perception of limited market opportunity. The total addressable market of customers in displacement settings is not viewed as large. Nor is it considered to present as ready an opportunity as other rural off-grid areas. Thus, this market is not a priority for commercially oriented sustainable energy finance. The challenge is compounded by the lack of data around current energy spending and purchasing power. As a consequence, displacement settings are still seen as representing a series of isolated projects that companies *could* potentially embark on, rather than as a segment that they could viably focus their entire business model around. Easier-to-reach market segments are already proving challenging for energy access companies, with the result that displacement settings are seen as a lower priority from a risk/return perspective. As there are only limited data on the potential market and business models that work in displacement settings, it will be difficult for energy access companies to convince their existing investor bases.

¹⁶ Vianello, M. (2016), *A Review of Cooking Systems for Humanitarian Settings*, Toolkit for the MEI, London: Royal Institute of International Affairs, p. 20, <https://www.chathamhouse.org/sites/default/files/publications/research/2016-05-19-mei-review-of-cooking-systems-vianello.pdf> (accessed 26 Nov. 2018).

¹⁷ The Comprehensive Refugee Response Framework (CRRF) aims to provide a comprehensive response to any large movement of refugees. It includes the aim of easing pressure on countries that welcome and host refugees.

3. Energy Needs in Humanitarian Settings

Understanding the funding need

There is a lack of reliable, available and systematically collected and reported data on the global energy needs of people affected by displacement, as well as on the energy used by humanitarian actors to run refugee camps and settlements. However, various sources of data and information do exist that can be used to get an indication of the scale of the funding needed. These sources are summarized in Annex 1, drawing on MEI research, the UN Refugee Agency (UNHCR)'s Safe Access to Fuel and Energy (SAFE) country strategies, and global energy access data.

An understanding of the funding needs of individual projects and businesses can be gained from discussions with stakeholders who have already implemented, or are looking to implement, interventions to improve energy access and management. Examples of energy projects already implemented in humanitarian settings, and the funding they required, are given in Figure 1. This shows examples of projects by humanitarian agencies, as well as examples from the MEI. These are being funded through traditional donor sources and show a range of funding needs, from a 'de-risking' grant to the private sector to a grant to electrify a whole refugee camp.

There is already a significant funding gap in the humanitarian sector in terms of meeting the basic needs of a growing number of people affected by disaster and conflict.

The data highlight the fact that significant investment is needed to improve the current energy situation in displacement settings. However, there is already a significant funding gap in the humanitarian sector in terms of meeting the basic needs of a growing number of people affected by disaster and conflict.¹⁸ Only limited funding is available through the humanitarian system for energy interventions. And while increasing amounts of funding are available from the international community for investments in energy access,¹⁹ the majority of facilities focus on rural, off-grid populations and commercially driven models. Hence an increase in funding is needed that can target the nexus of humanitarian interventions and energy access, reinforced by specific expertise and capacity to evaluate and implement sustainable energy interventions in a displacement context.²⁰

¹⁸ The *2018 Global Humanitarian Overview* published by the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) estimates that total funding of \$25.3 billion is needed for providing humanitarian assistance to the most vulnerable people affected by natural disasters and conflict. Only \$10.5 billion of this is currently funded. UNOCHA (2018), 'Global Humanitarian Overview 2018', <https://interactive.unocha.org/publication/globalhumanitarianoverview/#fundingrequirements-position> (accessed 26 Nov. 2018).

¹⁹ Although this is still falling significantly short of what is needed.

²⁰ UNITAR (2018), GPA Framework, 'Working Area III – Innovative Finance: Public, Private and Public-private Models of Delivery for Sustainability', p. 31.

Figure 1: Examples of funding/investment required for different types of energy interventions in displacement settings

Examples of projects implemented through humanitarian agencies

1. Large donor-funded energy infrastructure

UNHCR installed a solar farm at Azraq refugee camp in Jordan – a 2-MW system, with a plan to upgrade to 5 MW in the near future. €8.75 million was needed to install the solar farm, with ongoing savings of \$1.17 million per year for UNHCR giving a payback of around 7.4 years. Grant funding was provided from the IKEA Foundation.

2. Energy infrastructure for humanitarian operations

The World Food Programme (WFP) installed a hybrid wind/solar/diesel-powered system to power its warehouse facility in Herat, Afghanistan. It cost around \$530,000 to install the new hybrid power system, and will cost an estimated \$212,000 per year to keep in operation. The system offers ongoing savings of \$85,000 per year, with full payback in 6.2 years.

Examples of initiatives under the MEI to encourage private-sector engagement

3. Incentives to encourage private-sector engagement

The MEI designed a non-wood cooking concession, with the National Oil Corporation of Kenya, that aims to convert 5,400 households in Kakuma to LPG. The concession paid through a results-based financing mechanism would require £300,000 for an initial two-year period.

4. Grants to de-risk market engagement

The MEI provided a grant of £30,000 to a pay-as-you-go solar home systems company to de-risk its investment in opening a shop in a displacement setting. The company sold 115 units in six months, but still requires bridge financing of approximately £40,000 to reach commercial sustainability.

Sources: Examples 1 and 2 adapted from Grafham, O. and Lahn, G. (2018), *The Costs of Fuelling Humanitarian Aid*, Research Paper for the MEI, London: Royal Institute of International Affairs, <https://mei.chathamhouse.org/resources/reports>. Examples 3 and 4 are taken from the work of the MEI.

The case for engaging the private sector

Energy efficiency and clean energy interventions have so far been financed primarily out of the core humanitarian funding that agencies receive from donors – mainly under operational budgets, or with dedicated funding provided by certain donors for specific interventions or programmes. Additional interventions may be financed separately through NGOs, but this can render funding more fragmented. Initiatives are thus rather donor-driven and typically involve pilot or demonstration programmes. For the foreseeable future, humanitarian agencies will depend on donor funding to implement energy initiatives, although some, such as the World Food Programme (WFP), are already developing innovative internal structures to provide funding and involve the private sector in providing energy efficiency solutions (Box 1).

A case can be built for engaging the private sector to help accelerate delivery of sustainable energy solutions, and to overcome some of the budget and technical constraints to implementing these interventions. Engaging the private sector can help to leverage additional capital and can result in faster resource mobilization, so that energy interventions are not solely reliant on stretched donor funds. It can also bring in private-sector expertise and innovation that can improve the design, management, operation and overall efficiency of energy interventions. Using external assistance to meet energy needs in displacement settings also allows humanitarian actors to focus their limited financial and human resources on their core mandates. Consideration of more market-based approaches, value chains and interventions in terms of wider business models can help to ensure the sustainability of interventions beyond funding cycles and programme periods.

Box 1: WFP Energy Efficiency Programme²¹

Due to its size and scope of operations (logistics in humanitarian emergency settings), the World Food Programme (WFP) is one of the largest emitters of greenhouse gases in the UN system. Flights and diesel power are major contributors to its emissions, which have been rising since 2016 in line with increased global demand for emergency response. WFP is present in 80 countries, with more than 1,100 operating premises. The agency has developed the Energy Efficiency Programme, which finances renewable energy installations through funds collected from an internal carbon tax on its Global Vehicle Leasing Programme. The funds cover up to 75 per cent of project cost via a grant, with the balance funded from the implementing office's annual operating budget. To qualify, a project must demonstrate potential project lifetime mitigation of at least 10 tonnes of CO₂ emissions per \$1,000 of funding sought, and must generate clear cost savings. Payback periods are shorter than the expected lifetime of the project.

A 'Green Kit' for metering energy needs allows the engineering unit to remotely monitor power consumption and thereby design the system appropriately. Based on these data, the environmental engineering team designs and provides a turnkey solution.²² A control unit manages energy production and choice of supply source, switching between grid, wind, solar and back-up diesel as necessary. The systems are designed to generate 80 per cent fuel savings without loss of performance. The focus so far has been on the biggest use cases: located in Afghanistan, Chad, Ethiopia, Ghana, Liberia, South Sudan and Syria.

Through competitive tendering, WFP has entered into long-term agreements with suppliers for provision of technical, installation and maintenance support to individual projects. To date, 59 Green Kits have been installed, 34 energy surveys completed, eight projects planned and four projects completed. Based on the success of the model at WFP, there is scope to expand its operation across all UN agencies.

Current implementation models

Interventions aimed at improving energy access and management in displacement settings can be grouped into three categories: consumptive use, productive use and public use.²³ The following narrative explains in more detail these categories, the typical business models the private sector uses and examples of businesses currently providing these energy solutions. It illustrates the diversity of business models, and therefore financing needs, of companies that may supply displacement settings with sustainable energy solutions.

²¹ Interviewee: Michele Righi, Chief Engineer, WFP.

²² The term 'turnkey solution' refers to a type of system built end-to-end for a customer that can be easily implemented into a current business process. Definition from https://www.investopedia.com/terms/t/turnkey_solution.asp (accessed 8 Dec. 2018).

²³ Categories adapted from the GPA Framework – Working Group III.

1. Consumptive use: household cooking, lighting and small-scale power

Consumers are served by companies that sell products aimed at improving access to sustainable energy at the household level. These products can be broadly split into two categories:

- Cooking – including sustainably sourced and clean cooking fuels and energy-efficient cooking stoves.
- Lighting and power – off-grid solar lighting and power through lanterns, solar home systems (SHS) and green mini-grids.

Currently in displacement settings, consumer energy needs are met in a number of ways:

- Humanitarian agencies or NGOs distribute goods, such as improved wood and charcoal stoves, torches or solar lanterns, for free to displaced people. These interventions often target vulnerable populations or new arrivals, a practice which risks distorting local markets for the private sector.
- Displaced people may access consumer energy goods through local informal markets, but the choice and quality of products available may be limited.
- Informal diesel-powered micro-grids operated by local entrepreneurs may connect households at relatively high tariffs.
- Market-based approaches to engage the private sector have been tested, but these are still heavily reliant on grant funding and are limited in scale.

Within consumptive use, two classes of business model are typically used:

- **Product-driven businesses serving consumers.** Generally the model for solar lanterns and SHS, these businesses have an inventory financing need, with those that might serve displacement settings typically focused on last-mile distribution and after-sales service. Capital is usually tied up according to the working capital cycle of the company involved. Various forms of shorter-term (less than three-year) receivables financing and working capital loans can be used to shorten the working capital cycle and release funds for company growth. Any form of consumer financing is generally limited to periods of one to three years – e.g. pay-as-you-go (PAYG) for SHS – due to rising credit risk with longer-term exposure. Products are at best cost-saving and generally not income-enhancing to the consumer. Alongside this debt need, the companies typically involved require equity funding until they reach the point at which they are able to finance growth internally. Equity investors in such enterprises look for financial projections indicating a strong likelihood that the business will generate enough cashflow to be able to pay a dividend, and/or scope to sell the stake on to a future acquirer (e.g. a larger consumer products distribution company).
- **Power as a service through mini-utility companies.** Power infrastructure could connect individual households in mini-grids, either from an anchor load or on a standalone basis. Here, the key question is the capacity of the customer to pay, and whether the customer's consumption makes the connection economical.

Box 2: Case study – SOLARKIOSK²⁴

SOLARKIOSK is a clean energy solutions company that provides off-grid solar solutions via solar-powered retail centres. The centres sell energy access products alongside other consumer goods, and provide micro-grid extension to nearby shops and households. The company has been active in the humanitarian sector for more than four years. To date its focus has been on small initiatives, as these are easier to implement and finance with in-house resources.

The company's first project was in the Zaatari refugee camp in Jordan, providing solar power and internet connectivity to 1,000 children at a school. The project included donation of laptops and tablet computers, as well as content from the Wikimedia Foundation. SOLARKIOSK played the role of donor as well as project developer, financing the project in-house. The second project was in partnership with the Siemens Foundation and its commercial arm. The parties jointly established a health centre in a host community close to the Syrian border, in order to treat refugees fleeing the conflict. The centre treats 200 trauma patients every day. Siemens financed the project as a donor.

SOLARKIOSK's third project was in partnership with the Danish Refugee Council (DRC), establishing a retail shop in a refugee camp in Ethiopia. The shop, operated by a refugee entrepreneur, sells solar products, efficient cookstoves and other fast-moving consumer goods. The shop operates as a commercial business and is able to finance its costs of operations. Funding was required for the initial set-up costs. DRC played a crucial role in enabling SOLARKIOSK to set up the shop so that the business is compliant and sustainable in the context of the local operating environment. This project was financed by DRC.

SOLARKIOSK sees significant potential to replicate its model by working in partnership with NGOs and community organizations with experience of the humanitarian emergency operating environment. SOLARKIOSK will soon be deploying its solution for humanitarian emergency settings in Southeast Asia. The high concentration of consumers within a small geographic area means that displacement settings can offer a good operating environment for SOLARKIOSK stores, which are run by local entrepreneurs such as displaced persons. The main challenge is in meeting the capital expenditure cost of setting up a cluster of stores that can be cost-effectively served through the supply chain. This presents an opportunity for a concessional investor interested in catalysing the entry of energy products and consumer goods into humanitarian settings.

2. Productive use: commercial and light industrial

The 'productive use' category may include solar-powered businesses in retail and commerce (e.g. for power and cooling) and value addition by light industries (e.g. grain milling, cold storage). Companies providing energy solutions for productive purposes are supporting commercial activity, and allowing the user to generate income. Most typically in displacement settings, energy for productive use is met either by informally operated diesel mini-grids or standalone

²⁴ Interviewee: Andreas Speiss, co-founder and CEO, SOLARKIOSK.

diesel generators. Few formal private-sector players have targeted this market. Due to the small scale of each project, there is a need to standardize and commoditize the offering where possible, by considering either of the following means:

- Having a range of products for different needs, such as solar-powered irrigation systems or agro-processing machines with varying degrees of capacity. In such instances, inventory finance and working capital needs are the primary funding requirement.
- Selling a service rather than a product to the customer, such as via the ‘energy service company’ model wherein a ‘mini-utility’ sells power to one or several commercial/industrial consumers. As solutions are highly customized, the supplier will seek to make the offering more modular in order to enable efficient scale-up based on standard power-generating units.

Any form of customer financing solution could typically extend into the medium term (three to five years), due to the increased credit quality of the borrower (for instance, a shop would have inventory, which would serve as a chargeable asset to offer as collateral to a lender) and the capacity of the asset to be put to productive use and generate income for the customer.

Box 3: Case study – Rensource Energy²⁵

Rensource Energy, based in Lagos, Nigeria, builds micro-grids and captive power plants for urban and peri-urban clusters. Solar power, used in hybrid solutions alongside traditional fossil fuels, is its initial focus technology. The company is piloting the ‘solarization’ of informal commercial markets in Nigeria, typically replacing an underperforming utility provider and/or existing diesel generator infrastructure. The company contracts with the owner of the market to replace existing providers and supply power on an exclusive basis under long-term (10- to 20-year) agreements. Rensource serves as both the generator and distributor of the power, managing the project down to the individual billing and support of retailers.

The business model has the capacity to serve hundreds of thousands of small and medium-sized enterprises (SMEs) operating in captive settings such as markets and other informal trading hubs, with sustainable energy access provided via an aggregated approach whereby several small businesses operating in a shared space (e.g. a marketplace or other trading centre) access a shared power source. To date, Rensource has been financed by a range of impact lenders and venture capital investors. The approach to scaling up financing is to set up a special-purpose vehicle (SPV) for each project. Debt and equity investment from infrastructure investors can be channelled into this SPV, which then becomes the mini-utility company serving the customers.

To date, the company has successfully implemented a project for a market owner in northern Nigeria. Rensource would potentially be interested in entering displacement settings with its solution, but ‘longevity risk’ – e.g. reflecting uncertainty over the permanence of refugee camps – and lack of data on the expenditures of both donors and actual power users (needed to determine a profitable pricing strategy) are key factors preventing it from entering the space today.

²⁵ Interviewee: Ademola Adesina, founder and CEO, Rensource Energy.

3. Public use: infrastructure

Public power infrastructure is typically provided by power project developers and other contractors, with the aim of increasing and/or improving the efficiency of energy supply for public operations. A range of business models exists to involve the private sector in providing energy infrastructure. These include design-and-build arrangements, in which a public body (for example, a humanitarian agency) takes on the operation and maintenance of the infrastructure once complete; and PPAs in which the private sector can finance, operate and maintain energy infrastructure given a sufficient offtake agreement.²⁶ Solutions focus on replacing diesel generators with solar/hybrid solutions to power schools, clinics, community facilities, water pumps, street lighting and agency compounds. There is also scope for power supplied to camp operations to be extended to households and businesses via mini-grids, thereby offering crossover potential with other energy use categories.

Solutions focus on replacing diesel generators with solar/hybrid solutions to power schools, clinics, community facilities, water pumps, street lighting and agency compounds. There is also scope for power supplied to camp operations to be extended to households and businesses via mini-grids, thereby offering crossover potential with other energy use categories.

In displacement settings, public infrastructure is typically powered through diesel generators operated by individual agencies – although, where available, there may be a connection to a national grid. In some cases, the private sector provides renewable energy infrastructure on a design-and-build basis, which can result in the infrastructure being offline for extended periods as funding for diagnostic expertise and spare parts is sought. There are only limited cases of PPAs being used in displacement settings, however.

Infrastructure investments are typically higher in cost than applications for consumptive or productive use, being generally made to serve a greater number of energy users. Each project is highly customized to the specific needs of the site and presents a unique, non-replicable financeable project in its own right. As such, significant upfront work is needed to design and implement a solution that is fit for purpose. This business model therefore involves high upfront costs, as well as long lead times before the first cashflows are generated. Such businesses typically rely on longer-term debt (with maturities of five years or more) in order to make repayments manageable yet still generate an acceptable return on equity.

²⁶ Patel, L. (forthcoming), *Infrastructure Management Contracts – Improving Energy Asset Management in Displacement Settings*, Research Paper for the MEI, London: Royal Institute of International Affairs.

Box 4: Case study – Kube Energy²⁷

Kube Energy, a Norwegian renewable energy services company, powers non-profit organizations currently reliant on diesel generators in displacement settings, with a particular focus on Somalia and South Sudan. To date, the business has financed projects through internal and partner resources. The company notes that there remain major hurdles to the adoption of solar power by such organizations in emergency settings. Those hurdles include: the high upfront costs of solar; a lack of pressing practical need to replace diesel with an alternative fuel source; a lack of experience in tendering under PPA structures; and limited operating expertise. The company has had to spend time and resources educating the market, and this has resulted in long lead times to reach project implementation stage. The key to success in this space is to deliver immediate cost savings and improved reliability, thereby reducing operating risk for humanitarian agencies.

The company has recently won a tender with a major international development NGO (INGO) to sell power under a PPA contract to the INGO's facility in a refugee camp in South Sudan. The solution provided will run on solar and battery with diesel as a back-up, targeting power provision between 85 to 90 per cent of the time from the solar/battery system. With the PPA model, the INGO ends up paying more for power than if financed by cash upfront, but spreads this greater cost over time and transfers all the financial and operating risk to Kube Energy. This mitigates the lack of adequate technical design and operating expertise within the INGO.

The model could be further developed by securing land independently of the INGO and then selling power to multiple development organizations within the displacement setting, as well as to local community facilities. With an anchor tenant for a mini-grid secured, there might be scope to connect households in the refugee camp or host community as well.

To prove the concept, Kube Energy and its international partner, Scatec Solar, are having to finance this project with internal equity and have thus naturally picked the strongest prospect site. To extend Kube's model to smaller sites and/or sites where longer payback periods are anticipated, Kube Energy will require blended finance involving a mix of grants, guarantees and concessional debt. A guarantee mechanism could help attract lenders to take risks on these projects sooner, and would at any rate allow Kube Energy to expand operations more rapidly by accessing capital at greater scale.

²⁷ Interviewees: Mads Uhlin Hansen, co-founder and CEO, Kube Energy; Mikael L. Clason Hook, managing partner, Kube Energy.

4. Financing Private-sector Involvement in Sustainable Energy in Displacement Settings

The risk of investing in refugees

Business thrives on certainty, yet displacement settings such as refugee camps typically offer complex and unpredictable operating environments. Displaced people often represent a marginal, low-income and disadvantaged market segment with little visibility of, or capability to plan for, their economic future. This creates a high degree of uncertainty in their potential to be profitable customers. Limited data are available to the private sector on the current spending of displaced people and humanitarian agencies. As such, cashflow projections for energy access in displacement settings are subject to substantial uncertainty. Nor is it a given that a successful model in one location can be replicated in others, due to the idiosyncrasies of each displacement setting. Consequently, traditional debt and equity investors, project developers and entrepreneurs do not have grounds on which to make rational, economically driven investment decisions. Traditional approaches to energy access finance may not be fully supported by the risk/return characteristics of this market opportunity. Alternative structures of financing that capture these operating realities are therefore needed.

For the private sector to play a role in meeting energy needs in displacement settings, the opportunity must present a compelling risk/return profile to meet the expectations of shareholders and investment partners. However, the challenges of operating in humanitarian settings constrain appetite for investment in private sector-led sustainable energy projects. These challenges present a range of risks and uncertainties, which govern the types of private and public investor prepared to finance sustainable energy solutions. Table 1 categorizes the risks and uncertainties present in humanitarian settings, and matches these to potential financing instruments.

Reducing risk

In displacement settings, debt and equity investors may not have confidence in the projected cashflows of a given project or business and may be unlikely to invest. In such circumstances, additional financial instruments (and additional funders) that provide finance on non-commercial (i.e. concessional) terms are needed in order to calibrate the risk/return profile of an opportunity. This could cover the additional costs associated with operating in displacement settings, and give investors greater confidence that projected cashflows will be achieved, allowing additional finance to be leveraged. Data are also needed to confirm or rule out some of the risks that are perceived in the market, especially around displaced people's ability to pay, transient populations and lack of security, and to understand further the conditions in which these risks do and do not apply.

For projects in displacement settings where commercial finance is not readily available, or is on offer on unviable terms and in insufficient volume, grants are often the only viable alternative for meeting the costs of investing in new business models and learning what works. Such financing

Table 1: Risks and uncertainties associated with energy investment in humanitarian settings – financial implications, and mitigation and management options through financial instruments

Risk theme	Examples	Examples of financial consequences	Investment instrument	Examples of financing solutions
Logistics	Increased cost to deliver solar home systems in remote displacement areas compared to other, better-located market segments.	Customers are expensive to serve; assets and resources are expensive to secure; local operating and maintenance capacity takes time and money to establish.	Grants/ results-based financing (RBF)	Subsidy paid to cover transport costs on an RBF model, with subsidy provided per connection delivered.
Insecurity	Keeping stocks of liquefied petroleum gas (LPG) secure in an area of conflict and insecurity.		Insurance	Theft and political risk insurance.
Longevity	Risk of early camp closure or significant reduction in operations (and therefore demand), exposing private-sector players that provide power as a service to humanitarian organizations.	For any non-cash sales of products or services (e.g. products on credit or as a pay-per-use service), the business providing them may not recoup its investment before the camp is closed down.	Insurance/ guarantee	Partial guarantee in favour of infrastructure project financiers, graduating to insurance where possible.
Demand instability	Capital is tied up in inventory that a household lighting/ cooking company cannot sell due to insufficient demand; defaults by customers sold to on credit. A power plant is sized above expected average demand levels. Therefore, the customer does not pay for all the power produced, and the power producer does not generate the cashflows expected.	Challenges in terms of maintaining appropriate power production/inventory to match in-camp levels of demand from institutions and displaced people (both may fluctuate substantially over short time frames). May lead to missed sales or excessive supply, and therefore economic losses.	Guarantees	Donor-funded guarantee that lenders can cash into in the event the borrower does not maintain debt service repayments.
Lack of data on energy demand		Lack of understanding of demand leads to poorly sized projects and stock-outs/inventory excess, resulting in economic losses. Lack of data on energy economics leads to inappropriate pricing/ credit terms for products. Economic losses result both from limited uptake and challenges with repayment.	Grants	Pilot schemes subject to rigorous data analysis and scale-up feasibility studies (allowing relevant data to be gathered).
Liquidity	Consumer products and services are not affordable at upfront cost to the target market, and incomes are too unstable to service sales on contracted credit terms.	High levels of non-performing loans/ portfolio at risk (NPLs/PAR).	Guarantees, direct transfers, RBF	Donor-funded direct transfers to beneficiaries and/or guarantees that lenders can cash into in the event that customer does not maintain debt service repayments.

should be used to address risks that are within the control of the business to manage and mitigate. For example, grants can be used to gather more market and operations data to better understand how the business model should be structured to serve markets in a displacement setting. Grants can be used to convert some uncertainties into risks that can be managed through other mechanisms: for example, learning activities that enable the collection of data on exposure to, and probability of, financial risk, so that adequate insurance products can be designed.²⁸

Impact equity investors may be attracted to displacement settings on the basis of projects' potential to generate additional environmental and social returns. Such investors may accept longer-term horizons to realize a commercial return compared with traditional equity investors. Where uncertainties concerning the operating environment are high, such as with longevity risk in displacement settings, debt and equity guarantee mechanisms can provide the necessary risk mitigation to attract return-seeking investors, helping to secure at least some – if not all – of their principal in the case of an event such as camp closure. Subordinated debt and debt with quasi-equity characteristics could be useful mechanisms to ensure that debt levels remain sustainable and that the investee has the room to act if unexpected challenges arise.

In the sustainable energy space, blended finance mechanisms have been pioneered to attract commercial debt capital to finance innovative, high-impact businesses.²⁹ These mechanisms seek to leverage 'first-loss instruments' – whereby, in the case of default, the first loss is taken by the impact-first investors, or guarantors, thereby fully or partially protecting finance-first investors³⁰ – to enhance the attractiveness of investment opportunities to both debt and equity investors. Examples include:

- Grants in lieu of, or in combination with, equity funding for service/product delivery companies to expand into displacement settings;
- Subordinated debt at concessional rates in lieu of, or to complement, senior debt for service/product delivery companies;
- Debt/equity guarantees and insurance products to secure cashflows to private-sector investors in service/product delivery companies;
- Carbon, social and environmental credits to enhance the returns of a given project to achieve an attractive return to investors; and
- Direct subsidies delivered through impact bonds and other results-based financing (RBF) mechanisms to reduce investors' risk exposure to customers of poor credit quality.

Specific examples of blended finance applications in energy access include:

- Donor funding to pay for the stove and first fuel cylinder (to reduce barriers to households investing in LPG), combined with commercial funding for an LPG provider to enter the market and provide after-sales support.
- Donor funding to reduce the cost of debt for enterprises in the PAYG household solar systems market. This model could reduce the cost and payback period for the end user, while the enterprise seeks commercial funding (e.g. impact equity) to finance the operating expenditure costs of entering and serving the market.

²⁸ Examples of insurance products being used in energy access contexts are limited, and examples from other sectors warrant further investigation.

²⁹ SunFunder (2018), 'SunFunder shares lessons on blended finance in white paper', 2 May 2018, <http://sunfunder.com/news/blending> (accessed 26 Nov. 2018).

³⁰ Explanation adapted from Investing for Good (undated), 'Blended Finance – A Brief Introduction'.

Table 2: Summary of different approaches to sustainable energy provision³¹

	Aid	More efficient aid	More efficient aid through markets	New markets
Description	Funding energy products and services that don't currently exist	Funding camp operators to install clean, more efficient solutions, or to replace inefficient, expensive systems	Using blended finance to fund camp operators or businesses to provide cleaner, more efficient energy products and services, or to replace inefficient, expensive systems	Funding businesses that serve displaced people and/or camp operators on a commercial basis
	Energy products and services are mostly given away for free	Funding the provision of cleaner, more efficient energy products and services for displaced people	Products and services are (partly) paid for by the end users	Products and services are paid for at cost-reflective prices
Project-level economics	Primary focus is on new services, not on savings or returns	Energy/cost savings are generated, but not necessarily taken into consideration in project-level economics	Clear project-level understanding of savings to be generated and expectation that some of these savings are used to repay funding Revenues from sales of energy products and services can be used to repay (part of) funding	Clear project-level understanding of returns to be generated; expectation that funding will be repaid and that the facility will share in returns
Sustainability	Continuous fundraising required	Sustainable on a quid pro basis: i.e. 'we fund innovations that reduce aid costs, so donors continue to fund us'	Most projects generate some returns which are used to repay funding; repayments are recycled to fund new projects; some grant funding needs to be topped up	Directly sustainable: projects are expected to generate financial returns or at least repayment that can be recycled
	Primarily grant funding: focus on low-cost administration and reporting		Primarily an investment vehicle: requires a full formal structure	

The purpose of any financing facility – i.e. what and who shall be funded – determines the type of vehicle and instruments best suited to achieve the purpose. The different approaches to funding sustainable energy solutions in displacement settings fall into four categories: 'aid', 'more efficient aid', 'more efficient aid through markets' and 'new markets' (as summarized in Table 2). For the first two approaches, primarily grant-making facilities are best suited; for the last two approaches, primarily commercial investment vehicles are most suitable. These different vehicles entail different fund structures, governance structures, management arrangements, set-up costs and timelines. A grant-making facility would, in principle, be potentially easier, quicker and cheaper to design and set up. It would require a simpler and less burdensome governance structure, relatively straightforward management arrangements, and more standardized operating policies and procedures.

The MEI feasibility work into a potential financing facility found that, given the very specific constraints, barriers and risks associated with adopting sustainable energy solutions in displacement settings, it is likely that any financing facilities will operate in the area between providing 'more efficient aid' and 'more efficient aid through markets'. There is an opportunity to deliver aid more efficiently. However, while there are some revenue-generation opportunities, this revenue may be insufficient to recover the full costs of investment and operation. Therefore,

³¹ Table developed for the MEI by Dalberg Global Development Advisors.

grant instruments are likely to be needed to ensure the financial viability of investments and to incentivize private-sector players to get involved, particularly in projects or businesses that serve refugee households and small businesses. Grants could also promote new approaches to delivering clean energy services in displacement settings, and catalyse a shift from a 'procure and distribute' aid model towards more private sector-driven, market-based business models. Returnable grants and guarantees may be suitable for projects or businesses that serve camp operations where there is clearer evidence of current spending on potential cost savings. A formal investment fund structure that allows equity and/or debt investments would require evidence of underlying returns and/or cash generation capability, as yet limited in displacement settings. As such, it is likely that a financing facility would operate in this transitional space between a grant-making facility and a commercial investment vehicle. However, any grant-making facility should be preparing the market for a commercial investment vehicle two to three years down the line, and building the necessary evidence to do this.

Examples of potential financial mechanisms

Guarantees and grants to facilitate debt and equity

Guarantees and grants can be used to mitigate risks associated with uncertain market longevity and demand instability in displacement settings, and can enable the private sector to access additional commercial finance. For example, a company providing energy as a service to the operations of a humanitarian agency could be willing to use commercial finance to fund the project if the humanitarian agency were able to commit to a given offtake and duration (around three to five years). However, due to annual budget cycles, and the uncertainty of future budgets and operational demand, agencies are reluctant or unable to commit to these types of contracts. This inability to commit has been a major hurdle for companies seeking to implement such projects, even though they have the potential to improve the quality and reliability of the energy service and could save humanitarian agencies money on diesel costs. A supporting financial instrument, such as a partial risk loan guarantee, could help to overcome this. These guarantees could be provided through donor funds and enable the funding to stretch further compared to direct funding of infrastructure projects. They would also give commercial investors the confidence to support projects.³²

The inability to commit has been a major hurdle for companies seeking to implement such projects, even though they have the potential to improve the quality and reliability of the energy service and could save humanitarian agencies money on diesel costs.

Another area of uncertainty is around the ability of displaced people to pay on credit for products such as solar home systems (SHS). Again, blended financial instruments could be used to offer guarantees against repayment default to allow companies to leverage other funding sources such as inventory finance through a provider such as Kenya-based SunFunder (see Annex 2, 'Case study: SunFunder' for further details).

³² Patel (forthcoming), *Infrastructure Management Contracts – Improving Energy Asset Management in Displacement Settings*.

The use of grants for market development

Displacement settings are often viewed as high-risk environments for private-sector companies, which are more interested in investing in markets that present readier returns. This is particularly true when considering business models that require revenue to be generated from displaced people themselves: these consumers often have limited purchasing power; and few data are available on their willingness or, perhaps more significantly, ability to pay. In such cases, grants can play a role in allowing companies to test the market for products, de-risking initial engagement in the market or covering the higher costs associated with displacement settings until a sustainable model can be built.

Box 5: The MEI and BBOXX – testing the market for PAYG solar in Kakuma³³

In 2017, the MEI provided support to BBOXX Capital (Kenya) Limited, under its market development activities, with the aim of increasing distribution of high-quality solar products in and around the Kakuma refugee camp. The MEI provided BBOXX with a grant of just over £30,000 to de-risk the Kenyan firm's investment in a retail outlet for its products and in testing the market for solar home systems (SHS). BBOXX offers its SHS on a pay-as-you-go (PAYG) basis, removing the high upfront cost for customers and allowing customers to pay for its products in instalments through mobile money.

The MEI grant covered the acquisition of an initial 75 units, rent and staff costs for an initial six-month period, associated training costs and co-funded marketing materials. The MEI also supported BBOXX in marketing activities such as roadshows and radio advertising. BBOXX launched its retail shop in Kakuma town in February 2018. It sold out of its 75 units within four months, with 66 of these units being sold to residents within the refugee camp complex. New stock, financed by the company, arrived in July 2018; out of the 40 units sent, all have already been purchased.

The company has, however, faced several challenges in setting up its operations – mainly the significantly higher cost of transporting products to Kakuma than to its other retail locations. This means that BBOXX's average revenue per customer per month is lower than in other retail locations. The cost of staff is higher in Kakuma, increasing overheads. As a result, BBOXX's shop needs to secure a larger customer base of around 750 customers to break even, compared with 350 customers at its other locations.

The grant allowed BBOXX to confirm that a market does exist in Kakuma. The company wants to maintain its presence there, and to expand its market in Turkana county beyond Kakuma. However, the funding deficit projected over the short term (less than one year) until the new retail operation breaks even could present a burden across the firm's network; as such, the commercial feasibility of opening satellite shops in remote locations of this sort will need to be carefully weighed against the market potential of other locations where higher revenue could be achieved. Some form of bridging finance, either through an additional grant or working capital loan, would help to ease this financial burden, allowing BBOXX to scale up its operations and making it more willing to include displacement settings in its sales network in the future.

³³ Reproduced and adapted from MEI (2018), *Market development activities – Supporting a solar retailer to test the market in a displacement setting*, <https://mei.chathamhouse.org/resources/market-development>.

Where grants are used, the point of delivery of the subsidy should be carefully considered to avoid disrupting existing or future markets for the same product. The follow-on financing needs of any pilot activities should also be considered, so that the funded activities have the best chance of sustainability.

Topping up returns with environmental credits

Carbon credits and other forms of social and environmental credits have been designed as an effective channel for capital oriented towards the SDGs, corporate social responsibility, and environmental and social governance. The aim is to commit funds to impactful projects either out of regulatory obligation or a desire to have a greater impact on the broader ecosystem in which market players operate. These mechanisms are typically designed to boost the attractiveness of projects that are otherwise not commercially financeable, and to provide opportunities to support auditable environmental and social impacts. As such, they could be appropriate to energy interventions in displacement settings.

Box 6: Energy Peace Partners (EPP)³⁴

Energy Peace Partners (EPP), a US-based non-profit organization, is developing the Peace Renewable Energy Credit (PREC) as a financing solution to help both bridge the renewable energy investment gap unique to fragile settings and, at the same time, meet increasing corporate demand for social impact. The PREC is a new variant of the traditional Renewable Energy Certificate (REC).³⁵ PRECs denote the environmental and social attributes associated with renewable energy generation in conflict settings. As such, they are a virtual, rather than physical, product that can be tracked.

PRECs traded on the voluntary market will monetize renewable energy generation in fragile settings. This will create a new revenue stream that can help decrease risk, increase financial incentives and shorten payback periods for investors/developers in challenging markets. The long-term vision is to create a thriving PREC marketplace, across a dozen or more countries, that supports investment in replicable, scalable, renewable energy solutions and provides a better alternative to the current system of diesel dependence in crisis settings.

PRECs will be issued under the International REC (I-REC) Standard, to provide further verification and assurance to market players. EPP is currently in the process of identifying potential anchor clients to pioneer the PREC in a handful of pilot projects. The PREC architecture and financing models are still being developed and will be affected by a number of variables, including the financing gap for individual pilot projects and corporate objectives.

³⁴ Interviewees: Sherwin Das, managing director, and Dave Mozersky, co-founder, Energy Peace Partners.

³⁵ Renewable Energy Certificates (RECs) offer proof that energy has been generated from renewable sources such as solar or wind power. Each REC represents the environmental benefits of 1 MWh of renewable energy generation. When you purchase RECs, renewable energy is generated on your behalf. Kelly, S. (2015), 'What Is a Renewable Energy Certificate (REC)?', Renewable Energy World, 24 August 2015, <https://www.renewableenergyworld.com/ugc/articles/2015/08/what-is-a-renewable-energy-certificate-rec.html> (accessed 9 Dec. 2018).

EPP's specific expertise lies in bridging the gap between international crisis response and renewable energy deployment and financing. Operationalizing the PREC and developing this new market will require navigating the complex political and operational landscape of crisis settings, and connecting the players in this space that are essential to creating a functioning PREC marketplace (e.g. UN field missions, humanitarian aid organizations, host-country governments, host communities, displaced populations, solar developers, voluntary REC buyers/traders and other industry bodies).

Increasing purchasing power through access to credit and cash transfers

Limited ability to pay and limited access to credit present challenges in any off-grid setting and among low-income populations. In displacement settings, these challenges can be compounded by restrictions on working rights, freedom of movement and access to financial institutions, and by the temporary nature of some populations. Cash transfers to refugees through vouchers and other instruments such as mobile money have been used to stimulate demand, and to direct subsidized funding towards specific outcomes. By increasing a household's purchasing power, this form of subsidy can support the portion of the market that cannot afford to pay for the product or service. It can help to ensure that the most vulnerable people in displacement settings are still included in more market-based approaches. Such schemes often build off cash transfers that are being issued by humanitarian organizations, providing an additional amount for the purchase of an energy product or service (such as a clean fuel). While they can help to bridge the gap in terms of consumer willingness to pay, a reliance on donor funds can leave schemes vulnerable to changes in the funding landscape (there are also challenges and risks around the fact that subsidies can artificially prop up the market for energy goods and services). Increasing the availability of credit to businesses and creating livelihood opportunities for displaced people would help to increase purchasing power.

Limited ability to pay and limited access to credit present challenges in any off-grid setting and among low-income populations. In displacement settings, these challenges can be compounded by restrictions on working rights, freedom of movement and access to financial institutions, and by the temporary nature of some populations.

Box 7: Increasing purchasing power for clean fuel – Inyenyeri in Rwanda³⁶

Inyenyeri is a for-profit renewable energy company that sells cooking fuel pellets in Rwanda. The pellets are sold as part of a package with a high-end gasifier stove. This provides a cleaner cooking experience compared to traditional biomass. End users pay a monthly fee for the solution. Inyenyeri received a grant in 2016 from the US Department of State's Bureau of Population, Refugees and Migration (PRM) to pilot a market-based fuel solution in Kigeme refugee camp in Rwanda. The pilot scheme, which involved end users buying the fuel at market prices but in smaller quantities, was a success, with high rates of retention and stove usage. However, one of the biggest challenges Inyenyeri faced in scaling up its operations was refugees' limited purchasing power, which is extremely sensitive to changes in the cash transfers given in the camp through the UN Refugee Agency (UNHCR) and WFP. Aside from cash allowances, there was little purchasing power inside the camps.

To continue the work, Inyenyeri secured additional grant funding with UNHCR from the Belgian government. Rather than subsidize the price of pellets by providing supplemental funds to Inyenyeri, the grant is being used to increase the purchasing power of the Kigeme customers to pay market rates by providing unconditional cash transfers to refugees for clean fuel alternatives. With this funding, the company is scaling up its operations to reach all 3,900 households in the camp. After the current funding runs out, the value of fuel cash transfers may decrease, which would cause a drop in refugees' spending on pellets. Inyenyeri is using this scale-up phase to determine feasibility and strategies for sustaining the programme in the longer term. However, it is likely that some form of donor funding will always be required, especially for the most vulnerable households. Inyenyeri believes that cost savings associated with the quantifiable benefits of its clean cooking solution (such as time savings and improved health) will offset any increases in spending on cash transfers for clean fuel alternatives.

Incentivizing expansion to new market segments through results-based financing

Results-based financing (RBF) is a mechanism that can be used to incentivize companies to serve market segments that are outside the scope of their normal business. Due to a financing-for-outcomes approach, this mechanism provides a structure within which donors can disburse funding once results are achieved, without the complexity, bureaucracy and inflexibility of traditional grant-giving structures. Commercial financing can then be attracted to opportunities that may not have bankable end consumers, on the basis that the donor will pay out a grant once contracted development outcomes have been achieved and thereby essentially refinance the investor at that point. RBF should free service providers from having to implement predetermined plans, and allow them the flexibility to adapt programmes to achieve outcomes.

³⁶ Patel, L. and Gross, K. (2019), *Cooking in Displacement Settings: Engaging the Private Sector in Non-wood-based Fuel Supply*, Research Paper for the MEI, London: Royal Institute of International Affairs, <https://mei.chathamhouse.org/resources/reports>.

Box 8: RBF for mini-grid development – GIZ support to the Kalobeyei settlement³⁷

GIZ³⁸ and Barclays Bank of Kenya are co-implementing a €1.5 million results-based financing (RBF) programme, funded by the UK Department for International Development (DFID) and hosted by the Energising Development (EnDev) multi-government donor partnership. The RBF project provides private-sector incentives to reduce the cost of investment in electricity generation and distribution in off-grid areas using solar hybrid mini-grids, especially in the northern parts of Kenya. The programme offers up to 50 per cent capital expenditure funding and an additional RBF subsidy for household connections made. The programme has so far awarded seven sites funding for mini-grids in northern Kenya; in 2018 it expanded the programme to include Kalobeyei, a settlement for displaced people in northwest Kenya.

Two sites at Kalobeyei (one within the settlement and one in the host community) were tendered in July 2018 and are due for commissioning by April 2019. The selected developer will design, build, own and operate these mini-grids. It is predicted that the majority of the demand will come from local businesses. Households will also be connected, as well as some institutions, with 60 kWp (kilowatt peak) of capacity being implemented in the first phase. For the Kalobeyei host-community mini-grid, the system size is estimated to be 20 kWp. Pre-feasibility work completed by GIZ showed that 34 per cent of the population in the Kalobeyei settlement can pay more than KES 1,500 (\$15) per month for electricity. This means that 66 per cent of the population are not able to pay this amount, and as such would require some form of subsidy. Additional funding will be sought to further subsidize the end-user tariff to bring costs to the same level as national utility rates and to expand the grid capacity, to ensure that the project operates sustainably over the permit period of 20 to 25 years. UNHCR will work in partnership with GIZ and the selected developer on this.

Impact bonds to leverage additional investment

'Impact bonds' are an example of a structure under which RBF can be delivered at scale. Figure 2 illustrates how impact bond structures work.³⁹ The type of mechanism needed will depend on who is best placed to assume the contractual risk and provide upfront financing for a project. In traditional RBF, the working capital to finance the service provider is sourced from its internal resources (although some RBF schemes now release funds upfront to serve as working capital). By contrast, with impact bonds, working capital finance is provided by third-party investors and is specifically priced in relation to the opportunity presented under the outcomes-based contract. This structure is being piloted in displacement settings (albeit not specific to energy) – for example, KOIS Invest, a Belgian-based impact investing firm, is working on an impact bond, due to launch in 2019, to finance job creation for Syrian refugees.⁴⁰ No impact

³⁷ Patel (forthcoming), *Infrastructure Management Contracts – Improving Energy Asset Management in Displacement Settings*.

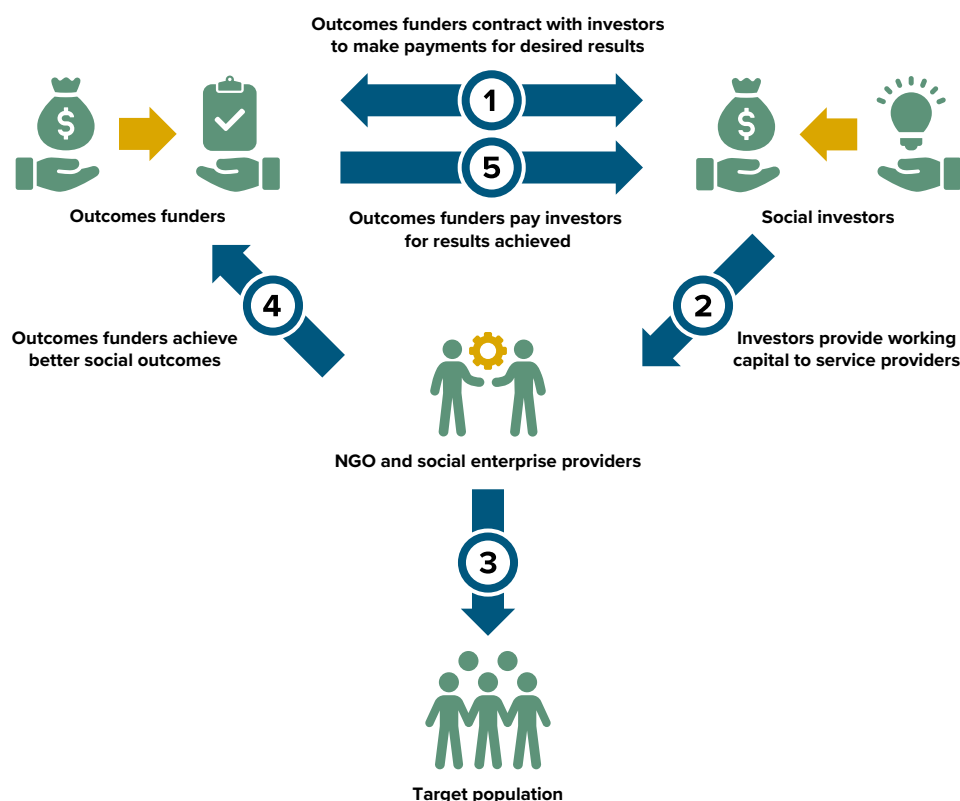
³⁸ Deutsche Gesellschaft für Internationale Zusammenarbeit.

³⁹ Taken from: Social Finance (2016), 'Development Impact Bonds Introduction', <https://www.socialfinance.org.uk/sites/default/files/publications/social-finance-impact-bond-presentation.pdf> (accessed 26 Nov. 2018).

⁴⁰ Convergence (2016), 'Convergence awards grant to Kois Invest for design of development impact bond to fund employment interventions for Syrian refugees', 3 October 2016, <https://www.convergence.finance/news-and-events/news/2yQtrzGRliWWOYOaI2oGSK/view> (accessed 26 Nov. 2018).

bonds have been launched yet for the energy sector. However, RBF has been used to incentivize the installation of energy access products, such as through the EnDev programme in Kenya (see Box 8).⁴¹ Further analysis of RBF and impact bonds is given in Annex 3.

Figure 2: Illustration of how impact bond mechanisms can work



Source: Adapted from Social Finance, www.socialfinance.org.uk.

Box 9: The relevance of impact bonds to humanitarian settings⁴²

In 2017 the International Committee of the Red Cross (ICRC) used impact bond principles to implement a financing mechanism to support the opening of additional rehabilitation centres in conflict settings.⁴³ This was the first time that this outcomes-based funding mechanism had been applied in a humanitarian setting, and it provides a potential springboard for further innovation to trial new approaches to tackle more complex issues. Given the challenges facing the provision of sustainable energy in displacement settings, it is worth taking a closer look at the suitability of this funding mechanism.

⁴¹ GIZ (undated), 'Energising Development (EnDev) Kenya', <https://www.giz.de/en/worldwide/21975.html> (accessed 26 Nov. 2018).

⁴² Interviewee: Rob Mills, director, Social Finance.

⁴³ ICRC (2017), 'The world's first "Humanitarian Impact Bond" launched to transform financing of aid in conflict-hit countries', 6 September 2017, <https://www.icrc.org/en/document/worlds-first-humanitarian-impact-bond-launched-transform-financing-aid-conflict-hit> (accessed 26 Nov. 2018).

Firstly, impact bonds are highly dependent on feedback of data during implementation, to facilitate changes in course and corrections to ensure outcomes are achieved. Because of this, sustainable energy solutions should include data-gathering mechanisms. ‘Smart’ solar home system products typically generate significant amounts of user data relating to ongoing usage. This is crucial to understanding the extent to which the desired outcomes of a particular impact bond are being reached.

Second, in most cases, impact bonds require donors to commit upfront the full amount of funds anticipated for a successful outcome, or to make a binding multi-year commitment. In displacement settings where current donor budgets are determined year by year, this clearly creates a mismatch. Given this, specific donor support set aside for longer-term interventions through the impact bond mechanism would be required to deliver targeted sustainable energy-related outcomes in displacement settings. Use of the existing ‘challenge funds’ infrastructure and capabilities that are set up under alternative, more flexible budgeting rules could be one potential source of such funding. Alternatively, some impact bonds have used a trustee structure, in which outcome funding is parked in a trustee-managed escrow account, to be disbursed on a pay-for-success basis.

Third, impact bonds transfer the delivery and implementation risk to investors. However, the contract should also clearly state how risks will be handled, as these are likely to be uppermost in investors’ minds in respect of humanitarian settings (e.g. the risk that a change in government policy leads to unforeseen closure of a camp). For example, the outcomes funder and investors may agree that capital drawdowns or investment flows will cease in the case of certain external events, or that, under certain scenarios, the payment mechanism or amounts may be adjusted. Alternatively, investors may take out partial risk insurance, or demand a higher return where risks are perceived to be high. The contracting arrangements for impact bonds should clearly lay out responsibility for these risks (e.g. *force majeure*) so that investors can price, monitor and manage their exposures effectively. This is a key consideration in displacement settings, where risks (i.e. those beyond the scope of service providers’ control) are significant.

To manage uncertainties, a further layer of financial risk mitigation can be delivered by guaranteeing principal recovery to certain investor classes. In the case of the ICRC impact bond, 60 per cent of committed payments by outcomes funders were guaranteed even in the eventuality that programme results were not achieved, thereby reducing the risk to investors. Offering guarantees in this way has the potential to widen the investor base, making it easier to raise capital. However, it is important to consider the effect that this has on risk transfer. One of the key benefits of the impact bond model is that risks associated with delivering successful outcomes are transferred to investors, who then have a stake in achieving those outcomes. By eliminating or reducing those risks, guarantees could also diminish the incentives for investors to drive relentlessly towards outcomes.

Addressing non-financial risks

The range of challenges related to displacement settings requires not just the smart mobilization of financing, but also policy and technical interventions to create a more enabling environment for donors, NGOs and the private sector. As well as funding, a wide range of specialist technical assistance (TA) services are needed to bring a shift towards sustainable energy solutions in displacement settings and to de-risk private-sector investment and engagement. A range of TA services to different stakeholders are needed and could include:

- **Clean energy technical expertise** for energy assessments, technical feasibility studies, identification and design of clean energy solutions, project implementation and management etc.;
- **Business development support**, including ability-to-pay and willingness-to-pay studies, development of business plans, financial models, funding proposals and long-term scaling-up strategies; and
- **Facilitation of strategic partnerships** between relevant stakeholders from the humanitarian, energy, development, climate and private sectors; and facilitation of innovative project structures.

Such services could be facilitated through grants, cost-sharing mechanisms, in-kind TA services or through coverage of the costs of experts embedded with humanitarian agencies.

At the policy and advocacy level, energy needs to have a place in the funding profile of both donors and humanitarian agencies. It needs to be viewed as an enabler of more efficient aid and as a facilitator of resilience-building that helps to increase the impact of money spent. Procurement and decision-making processes need to be simplified, streamlined, standardized and made more transparent for the private sector to engage with them. Standardization of emergency response actions, including energy-related interventions, would help to direct funding in these situations. Guidelines and quality standards could be introduced to ensure that solutions are implemented where energy interventions are funded, durable and sustainable.

New ways of working are needed in which interventions are not implemented in silos but can take holistic, cross-sector and cross-discipline approaches – for example, grouping together the energy needs of humanitarian organizations and incorporating host-community economies to create larger and more robust markets and opportunities. Such changes to policy and institutional arrangements could take time to be realized and require coordination across several stakeholders and at both national and headquarter levels of organizations. However, this does not mean waiting until these changes occur. Appropriate financing should be pioneered in the meantime, but in a manner that takes into account these current constraints and provides potential mitigation against them. Early action that highlights the benefits of investing in energy interventions and provides evidence to support this can help to push these changes in the wider enabling environment.

5. Designing a Funding Mechanism – Lessons from the MEI and Beyond

Overview of feasibility work

In light of the challenges and funding needs described in this paper, the MEI completed feasibility work during 2016 and 2017 on the viability of setting up a dedicated facility that could provide long-term financing as well as technical assistance. This would help to drive an uptake in sustainable energy interventions aimed at improving the supply of, and access to, clean, safe, reliable and cost-effective energy in displacement settings. The aim of the proposed financing facility was to operate at the nexus between humanitarian aid and energy access, and to promote innovative approaches and business models that could increase private-sector engagement and market-led solutions. The proposed facility sought to address both the specific constraints and limitations of the humanitarian sector and the specific risks for private-sector energy service providers. It aimed to enable strategic partnerships between the two cohorts for the benefit of displaced populations and host communities.

The MEI completed a number of steps as part of this feasibility work and engaged with a range of stakeholders in the sector, including humanitarian organizations, private-sector companies and potential donors. Its work included seeking to understand the funding needs of these organizations, assessing the additional impact of a proposed new fund, identifying the potential scope and structures of a fund, and understanding donor appetite. Further details of the fund proposed can be found in Annex 4.

Considerations for designing a funding facility

A number of financial mechanisms can be identified that can reduce the risks of private-sector engagement in displacement settings, as highlighted in Chapter 4. In reality, however, besides a handful of pilot initiatives, there are limited examples of such financing mechanisms being implemented or introduced at scale. Hence, the availability of relevant data is limited, especially in circumstances where the desired outcomes were not achieved. This curtails the potential to learn from past mistakes. Some lessons can be learned from the initiatives that are being tested, and from looking at the funds (albeit very small in number) that have operated in other fragile settings; these efforts need to be built on with new iterations and mechanisms. Given the limited data available and the relatively early stage of private-sector engagement in energy provision in this context, the proposed fund had a strong emphasis on grant financing, with the aim of collecting the necessary evidence and data to transition to more commercial mechanisms.

Box 10: AECF – Providing finance in challenging environments⁴⁴

The Africa Enterprise Challenge Fund (AECF) provides catalytic funding to private-sector companies in Africa. Since 2008, AECF has been funding private-sector companies to create resilience and sustainable incomes in rural and marginalized communities in Africa. This includes challenging environments – in the Democratic Republic of the Congo (DRC), Sierra Leone, Somalia and South Sudan – through the South Sudan Window (SSW) and the Post Conflict Window (PCW), launched in 2011 and 2012 respectively with the ultimate goal of promoting pro-poor growth in the transitioning states covered by these windows. The rationale for the fund was to identify, select, fund and monitor projects with potential to positively affect market systems in sustainable ways for the benefit of the most vulnerable sections of the rural population. A key focus of the windows is to assist companies to grow and become profitable, thereby encouraging other private-sector businesses to develop business models that serve similar markets.

To date, AECF has invested \$15 million in 23 private-sector companies and SMEs providing transformative agribusiness and renewable solutions in the DRC, Liberia, Sierra Leone, Somalia, South Sudan and Zimbabwe. The fund has benefited both consumers and suppliers, with 20 per cent of businesses offering goods for consumption and 80 per cent enabling households to supply agricultural outputs to various agribusiness value chains. In 2019, AECF will expand its investment in post-conflict and fragile environments, committing \$21 million for renewable energy businesses (including in the productive use category) in Liberia, Sudan and Somalia.

Operating in these environments requires flexibility, as companies often take longer to implement their projects and may have to change their approach (for example, focusing on a lower-risk customer segment such as development agencies). AECF has learned to adopt a hands-on, adaptive and flexible management approach, particularly when implementing the PCW and SSW, due to the fragile environment in the states involved. External pressures on the investee businesses often hamper implementation, and changes of milestone dates and targets may be required. Yet only two of 23 contracted projects have failed, which shows the resilience of AECF investee companies despite the challenging environments in which they operate.

In 2017, AECF transitioned into a new standalone entity with expanded initiatives across renewable energy and agribusiness. Due to the magnitude of challenges faced by companies in the space, AECF's activities are not limited to finance and technical assistance; the institution also focuses on lessons that can be used to influence policy and regulations in association with its partners. AECF's experience has enabled the co-creation of new funds with donors, rather than focusing on responding to specific donor expressions of interest. This has provided flexibility to innovate in fund design based on bottom-up needs analysis including the current REACT SSA programme.

⁴⁴ Interviewee: Victor Ndiege, sector team lead – renewable energy and climate technologies, AECF.

Box 11: Lessons learned from operating ‘challenge funds’ in fragile states⁴⁵

KPMG’s International Development Advisory Services (IDAS) unit is a manager of ‘challenge funds’ and investments – for private sector-led development across Africa – on behalf of donors. The financing of companies in fragile states entails operating in environments where instability is inherent and where there is a consequent lack of traditional financing options. Such situations have relevance for financing in displacement settings. Businesses operating in these environments meet their operating expenditures from revenues, but struggle to source funding for capital expenditures to finance expansion. Capital expenditure investments require substantially larger sums for single-ticket investments to create a step-change in a company’s operating capacity. However, traditional approaches to mitigating risk by drip-feeding capital in small increments of tens of thousands of dollars do not meet businesses’ expansion investment needs.

Insights into the fund operating structure include the following:

- Attempts to mitigate risk by putting more strenuous reporting and administration requirements on the recipient are counterproductive, as this also stifles execution capacity. Consequently, it is necessary to be both brave and flexible in providing financing (legal compliance being a given), thereby giving the business room to manoeuvre.
- Operating a fund that makes bigger-ticket investments will tend to attract larger, more serious and established players due to their inherent capacity to absorb significant amounts of capital and demonstrate matching funding capability.
- Financing decisions must take into account local political and ethnic considerations, as these may be a source of significant tension and risk if not managed appropriately.
- It is important to be clear from the outset on the objectives of the fund. What are the business goals? What sort of companies does the fund intend to finance? Is the aim to promote energy access or wider business impact? Does the fund intend to build private-sector activity from the bottom up, working with start-ups, or encourage established corporates to enter the space? Do funding recipients need to have a track record in humanitarian settings?
- The entity responsible for administering the fund has a major influence on how the strategy is executed. Very different results can be expected if a development agency or NGO manages the facility, compared to an audit and advisory/consulting firm.

As part of the MEI’s feasibility work, preliminary consultations were held with stakeholders on the funding concept. These highlighted a number of issues relating to financing such a humanitarian energy fund:

- The concept of humanitarian energy is challenging, as it sits at the nexus of energy access, environment/climate policy and humanitarian aid. As a result, it does not fit within any clear funding streams, and no one seems keen to take ownership of the proposition.

⁴⁵ Interviewee: Jenny Lofbom, senior manager at KPMG International Development Advisory Services.

- The energy access community focuses on economic and social development through private-sector investment and market-based business models. It is traditionally not interested in funding humanitarian programmes under its mandates, and less supportive of grant-making facilities; however, the energy access community is interested in private-sector approaches.
- Conversely, for the humanitarian community, the provision of energy to refugees is not a priority. Stretched budgets and huge funding gaps make it challenging for this community to invest in the concept. There could also be some concern that providing money for humanitarian energy funds might reduce humanitarian core funding.
- Due to funding constraints and political pressure, the financial sustainability of any pooled fund will be key. Donors may be reluctant to provide grant funding, especially for market-based, private sector-driven models that will be depleted over time. There is some reluctance to establish new pooled funds in addition to those already existing. It may be better to have at least part of the funding returned and/or recycled into new projects (for example, in a revolving fund structure).
- Such concepts would be helped by having key sponsors on board who could push the development and implementation of the facilities or individual mechanisms. If a key sponsor could be secured, then other donors would follow.

In the case of the MEI's proposed fund, feedback also suggested that the concept could be strengthened by considering the following:

- Starting with a simpler concept, focusing on only one problem or type of project – for example, clean energy solutions for camp operations through energy-as-a-service contracts. It may also be better to focus on a specific region instead of global reach.
- Better demonstrating the benefits of sustainable energy interventions for humanitarian actors to increase the demand for these solutions from within the humanitarian community.
- Ensuring the sustainability of the facility by focusing on returnable grant instruments, revolving funds and other models that will promote better-functioning markets and private-sector engagement – where this is appropriate and where the data support it.

Further design and development of the financing facility proposed by the MEI did not go ahead for a number of reasons. These included the fact that the budgets and timelines for a full fund design and set-up were beyond those available in the scope of MEI Phase 2;⁴⁶ and the failure by the MEI to identify a key sponsor to support the fundraising and design process. Instead it was recommended to refine the funding proposal and explore options for building a humanitarian energy window into an existing fund. One such initiative that has been developed, independently of the MEI, following this work is that being led by the International Finance Corporation (IFC) to establish a challenge fund focusing on the displacement settings of Kakuma and Kalobeyei in northern Kenya (see Box 12). Lessons from this fund could provide additional data on potential project revenues and aid the design of further funding mechanisms for this sector.

⁴⁶ MEI Phase 2 ran from June 2016 to November 2018.

Box 12: IFC – Designing a challenge fund for displacement settings

The International Finance Corporation (IFC) is a member of the World Bank Group and the largest global development institution focused on the private sector in developing countries. In 2018, IFC published the report *Kakuma as a Marketplace*,⁴⁷ which shared findings from a study of the Kakuma refugee camp complex and town looking at the economic potential of refugees and the host community and opportunities for private-sector investment. The study looked at the area from a private-sector rather than development viewpoint. It collected data on consumption levels, consumer patterns and preferences, access to finance, telecoms, employment and business ownership.

As a next step following on from this study, IFC will create the Kakuma Kalobeyei Challenge Fund, with the aim of overcoming the information gap, improving the regulatory environment for refugees and host communities in Turkana county, and increasing access to finance and services. The Challenge Fund will accept applications on a rolling basis from commercial companies, social enterprises and local and refugee entrepreneurs wishing to implement viable and sustainable business projects in the Kakuma/Kalobeyei area. In addition to funding, technical assistance and advisory services will be offered with the aim of facilitating long-term sustainable business service provision for the Kakuma/Kalobeyei area. Energy access will be a focus of the fund, alongside other key areas such as water, sanitation and hygiene (WASH) and livestock value chains.

This initiative is part of IFC's multi-level response supporting displaced populations and host communities, which covers Brazil, Iraq, Kenya and Lebanon.

⁴⁷ IFC (2018), *Kakuma as a Marketplace: A consumer and market study of a refugee camp and town in northwest Kenya*, https://www.ifc.org/wps/wcm/connect/8fb8fab4-af24-4b09-bdff-2109d2c45974/20180427_Kakuma-as-a-Marketplace_v1.pdf?MOD=AJPERES (accessed 29 Jan. 2019).

6. Conclusions and Recommendations

While the private sector has shown interest in engaging in displacement settings to improve the management and implementation of energy solutions and products, a number of challenges have compromised successful and scaled uptake. Current business models and financing instruments and structures need to be adapted to cater for the additional risks and uncertainty that these settings present, and therefore to increase their attractiveness to the private sector. The specific risks and financial mitigation required will vary depending on the project, location, business model and organization. Tailored financial instruments are needed that can offer the required support but still be flexible enough for service providers to adapt their approach to the realities of implementation.

For investors and donors alike, availability of more market data stands out as a key requirement to enable a better appraisal of risk and return in financing sustainable energy solutions in humanitarian settings. This would enable smarter investment instruments to be structured and blended finance approaches to be leveraged. Such data should include consumption levels, segmentation across different settings and within each displacement setting, details of specific energy mix needs, seasonality and other cyclical variations in demand, as well as information on demographics and sociopolitical issues such as security and the 'right to work'. Localized approaches, such as IFC's challenge fund pilot (see Box 12), may be needed to yield the best results and the most reliable data due to proximity to market. Such approaches could also build specific humanitarian sector expertise at a specialist energy access donor agency (or, conversely, build energy project expertise at a humanitarian funding agency), and could make it easier to evaluate interventions and projects.

Opportunities for investment in the energy access space are increasing as the costs of renewable technologies fall, and as innovative business models and partnerships continue to emerge.⁴⁸ The financial mechanisms discussed in this paper are not new. They have been used in other sectors and contexts, where varying levels of success have been achieved and lessons learned. Further investigation is needed into what has worked elsewhere, and where issues are of public-sector concern but with the opportunity and need for private-sector thinking, experience, products and investment. Innovation is required – not to invent new mechanisms *per se* – but to adapt those that exist and apply them in the context of energy in displaced settings. Mechanisms such as RBF and impact bonds are being trialled in displacement settings and in remote areas that are not profitable to serve.⁴⁹ However, the two are yet to be brought together in a sustainable energy context in humanitarian settings. These mechanisms could leverage the existing universe of SDG donors and investors, providing energy access-focused capital and increasing donor interest in the space. However, to drive this forward there is a need for a dedicated vehicle to aggregate projects across humanitarian settings, build the necessary specialist financing expertise and understanding of the market environment, and therefore manage risk and uncertainty effectively.

⁴⁸ Kyte, R. (2018), 'The time to invest in energy access is now', Grantham Research Institute on Climate Change and the Environment Sustainable Finance Leadership series, 19 September 2018, <http://www.lse.ac.uk/GranthamInstitute/news/the-time-to-invest-in-energy-access-is-now/> (accessed 13 Nov. 18).

⁴⁹ Such as in the case of KOIS, which is designing an impact bond for Syrian refugees; and the Kenya Off-Grid Solar Access Project (KOSAP), which is designing an RBF scheme to encourage solar home system providers to expand their market in underserved areas of Kenya.

Funding for humanitarian energy interventions sits in a difficult position between energy access, climate and humanitarian sources. To drive innovative financing vehicles forward, key donors need to step up who understand and can negotiate the cross-sectoral nature of energy access for displaced persons. These donors need to be willing to invest in and test new instruments that will generate evidence for further iterations and make others more willing to follow. The humanitarian sector needs to support the call for this funding without the fear that this will divert funds from other critical areas. Instead, it needs to do so from a desire to reduce operational costs and improve services, so as to bring benefits in other critical areas such as healthcare, education and livelihoods.

In displacement contexts, funding mechanisms will be difficult to implement on a standalone basis, due to the extent of risks and uncertainties and unique operating environments. Instead, strategic partnerships between humanitarian actors and the private sector will be essential. There is also a need to look at energy interventions more holistically, and to take a cross-sector approach to both the supply of and demand for capital. While increased cross-sector coordination may take time, proof-of-concept interventions that can build the body of evidence to push this approach are needed.⁵⁰ Opportunities for investment and private-sector engagement could also be strengthened by considering regional economic development beyond refugee camps and settlements. Greater consideration of the investment needs of the broader regions around camps can result in more robust markets, increase support from host governments, engage policymakers, reduce investment risks and leverage additional sources of development financing.⁵¹

In displacement contexts, funding mechanisms will be difficult to implement on a standalone basis, due to the extent of risks and uncertainties and unique operating environments. Instead, strategic partnerships between humanitarian actors and the private sector will be essential.

Increasing funding alone is only one part of the solution. A holistic approach needs to be taken in which financial instruments are delivered alongside technical assistance to support market data, development of project pipelines and project implementation. This should run in parallel with platforms to share knowledge and learning emerging from projects.

The initial approach taken by the MEI was to look at the design of a global pooled facility that could provide financing and technical assistance to energy interventions with the aim of building the evidence to transition to more commercial approaches. It is likely that this objective was 'too much, too soon' for a topic just gaining traction on the global agenda. However, the need for funding remains, and more work needs to be done on the merits of a broad pooled facility versus more localized and project-specific approaches. Areas that stand out from this study and warrant further investigation include guarantees for energy-as-a-service contracts, the application of impact bonds

⁵⁰ An example of this is the Smart Communities Coalition, which is focusing on three cross-cutting pillars – connectivity, digital tools and energy access – and is implementing pilot projects that demonstrate impact across these. More information can be found at <https://www.tent.org/members/smart-coalition/>.

⁵¹ See the IFC report setting out opportunities for private-sector engagement in and around the Kakuma refugee camp in Kenya. IFC (2018), *Kakuma as a Marketplace*.

for energy interventions in displacement contexts, and mechanisms to increase the purchasing power of consumers. With all this in mind, the authors recommend the following next steps to advance the design of tailored financial mechanisms:

- Explore more deeply specific consumptive, productive and public energy use cases, and collect existing market data to understand the appropriate blended financing instruments needed.
- For these cases, work in collaboration with donors, impact investors and private-sector companies to design financial and risk mitigation instruments that facilitate their participation in the sector.
- Investigate further the application of financing mechanisms, including what has worked (and not worked) in other contexts and sectors, particularly those mechanisms aiming to incentivize private-sector engagement in areas traditionally handled by the public sector.
- Where uncertainties and risks are too high for such structures to be put in place, design and implement targeted pilot schemes and market research aimed at addressing concerns and generating data that will facilitate their design.

Annex 1. Summary of Data Sources Indicating Humanitarian Energy Funding Needs

1. Studies completed by the Moving Energy Initiative

The MEI's study on the global state of household energy consumption of forcibly displaced people, published in 2015, looked at a number of scenarios for introducing more efficient energy solutions.⁵² One of these scenarios (the 'Incremental Change' scenario) estimated that an initial investment of around \$335 million is required to provide all refugees with more efficient (firewood) cookstoves as well as basic solar lanterns for lighting. The introduction of LPG for cooking under a 'Fundamental Change' scenario would require an investment of around \$319 million for LPG cooking stoves as well as \$786 million annually for the fuel.

The 'Incremental Change' scenario estimated that an initial investment of around \$335 million is required to provide all refugees with more efficient (firewood) cookstoves as well as basic solar lanterns for lighting.

Further to this, a survey conducted by the MEI in Kakuma (Kenya) and Goudoubo (Burkina Faso) in 2016 and 2017 looked at scenarios for increasing energy access at the camp level. The survey considered willingness to pay, user preferences and adequate energy access, and showed the level of investment needed in each case.⁵³ For example, realizing the 'User preference' scenario in Kakuma I⁵⁴ for cooking would cost \$16,500 per day, or \$6 million per year.⁵⁵ This is more than double the cost of what households are currently paying, implying that significant additional investment by donor agencies would be required to achieve this scenario.

In a recent research paper on the cost of fuelling humanitarian operations, the MEI found that the total spending on diesel and petrol for seven agencies surveyed in Kenya was \$6.7 million per year.⁵⁶ The paper identifies a number of measures that agencies can take to reduce their diesel dependency and save valuable funds, but it highlights that further resources are needed to do this.

⁵² Lahn and Grafham (2015), *Heat, Light and Power for Refugees*.

⁵³ Corbyn, D. and Vianello, M. (2018), *Prices, Products and Priorities: Meeting Refugees' Energy Needs in Burkina Faso and Kenya*, Research Paper for the MEI, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-30-meeting-refugees-energy-needs-burkina-faso-kenya-mei-corbyn-vianello-final.pdf> (accessed 26 Nov. 2018).

⁵⁴ Kakuma I is a sub-camp of the Kakuma camp complex and consists of roughly 15,000 households.

⁵⁵ 72 per cent of the 'User preference' scenario's cost originates from the 37 per cent of families who desire LPG.

⁵⁶ Grafham and Lahn (2018), *The Costs of Fuelling Humanitarian Aid*.

2. UNHCR's SAFE country strategies

The review of seven SAFE country strategies developed by UNHCR provides proposed sustainable energy interventions for the coming four to five years. It suggests an estimated total capital investment of approximately \$60 million in the seven countries reviewed.

3. Energy access data

The International Energy Agency (IEA) publishes data on electricity access and reliance on traditional biomass through its *World Energy Outlook*. In 2017, the report presents an 'Energy for All' case showing that providing universal access by 2030 would require an investment of \$31 billion per year, equivalent to less than 2 per cent of global energy investment.⁵⁷ While forcibly displaced people are not explicitly represented in international energy access data, the figure indicates the scale of funding required at the global level.

⁵⁷ International Energy Agency (2017), 'Universal energy access by 2030 is now within reach thanks to growing political will and falling costs', 19 October 2017, <https://www.iea.org/newsroom/news/2017/october/universal-energy-access-by-2030-is-now-within-reach-thanks-to-growing-political-w.html> (accessed 19 Sep. 2018).

Annex 2. Case Study: SunFunder

SunFunder,⁵⁸ a solar energy finance business based in Kenya, provides debt financing to solar companies operating in developing countries. Many of the borrowers are distributors of solar products and sell to consumers on credit (largely through PAYG structures); as such, their debt funding needs are largely served through various forms of inventory, working capital and receivables finance.

SunFunder provides inventory finance structures to shorten the working capital cycle for distribution companies and to release cash that otherwise would be locked up in inventory. Inventory finance structures involve a lender (e.g. SunFunder) financing a purchase order to the distributor's supplier, thereby allowing the product to be manufactured and shipped to the warehouse of the distributor. The distributor is then obligated to make repayments based on pre-agreed terms between the parties in one or several tranches until the product is sold to a consumer and leaves the warehouse.

At the point where a sale is made and the product no longer sits in inventory, the distributor books a receivable from a PAYG sale, and the revenue is now subject to credit risk exposure in respect of the consumer who has purchased the asset – typically on a one- to three-year repayment plan. In order to release this cash, companies in the home solar space have opted to finance receivables through structures that separate the risk of bankruptcy of the distributor from the loan receivables. Here the lender finances a special-purpose vehicle (SPV) that buys the receivables from the distributor's balance sheet. Thereafter the lender collects loan repayments directly from the proceeds of collections from consumers making payments on a PAYG basis.

In displacement settings, there is limited information on the ability of consumers to meet repayments for energy products, resulting in significant uncertainty. Therefore, providers of blended finance would need to either guarantee repayments, or provide cash coverage for a fraction of repayments based on an assumed default rate. This fraction could be decreased over time as repayment performance is better understood, but would typically require a pilot scheme to apply for the term of the consumer asset finance loan. With such mechanisms in place, commercially oriented impact lenders such as SunFunder would be in a better position to consider offering debt financing in this space.

⁵⁸ Interviewee: Surabhi Mathur Visser, senior investment officer, SunFunder.

Annex 3. An Analysis of RBF and Impact Bonds

Results-based financing (RBF) through impact bonds and the challenges of service provider selection: an analysis by Social Finance⁵⁹

Under traditional grant programmes, financial incentives focus on hitting project milestones as planned, in order to facilitate the disbursement of funding as contracted. However, to achieve results, most projects need to deviate from the initial plan as realities of implementation emerge and demand a change of course. ‘Results-based financing’ (RBF) is designed to overcome this challenge by focusing donor incentives on results delivery by the service providers. In order to perform, service providers must adequately cost their offer and be given the flexibility to change tack in implementation towards achieving the desired development results.

RBF should, in theory, free service providers from having to implement predetermined plans and allow them to focus on adapting programmes to achieve outcomes. However, in practice it is often the case that results-based approaches fine-tune the implementation of an already structured programme rather than improve the programme structure itself.

The working capital for programme implementation often comes from the service providers themselves. Funders see programme design as being outside the providers’ remit or capacity. This means that the service provider in an RBF programme usually has limited room to design and implement programmes that actually work on the ground – but still bears the financial risk if the predefined programme results are not achieved.

The impact bond model aims to address these shortcomings. By agreeing a set of defined and measurable outcomes to be achieved, but not specifying the detailed implementation modalities, donors step out of their ‘central planning’ role. Instead, investors – through an impact bond manager – manage design and implementation, while taking on the risk of the project failing to deliver agreed results. As the primary interest of investors is the achievement of returns, investors have proven willing to quickly adapt the requirements of service providers based on empirical data showing what is and is not working well, in order to achieve the pre-agreed outcomes. Thus, investors are able to give service providers more flexibility to adapt and change their approach in implementation as circumstances demand – a crucial advantage of impact bonds.

Of course, an impact bond is only as good as the quality and performance of the contracted service providers. To date, the majority of impact bonds have been built around pre-identified service providers. In such instances, service providers are not expected to quantify risk or determine the pricing required to deliver a desired outcome. In some of the larger outcomes-based funding interventions launched to date, a ‘rate card’ approach has been adopted. This is where an outcome funder publishes a list of outcomes that it wants to achieve – and the monetary value (i.e. price or rate) that it is willing to pay for those outcomes. The rate card thus forms the basis for a procurement process that is contestable: that is, not limited to

⁵⁹ Interviewees: Rob Mills, director, and David Hutchison, CEO, Social Finance.

pre-identified providers. Moreover, with a single rate card, governments can launch multiple pay-for-success interventions, rather than undertaking repeated (and time-intensive) impact bond contracting processes.

The idea of contestability in selecting service providers under an outcomes-based funding framework can be taken further. Social Finance, a not-for-profit organization based in London, has developed a new approach in the off-grid energy sector, where the market for modern solar photovoltaic (PV) energy products is growing fast but very unevenly. For example, while solar home system (SHS) distributors have made rapid progress in building a for-profit market in peri-urban and urban areas, 97 per cent of off-grid households in sub-Saharan Africa remain without access to a modern energy source. The challenge here is to nudge the market for modern solar PV products towards poorer, rural areas where establishing a profitable SHS business is currently very difficult. This 'public good' requires public funding, but delivered in a way that leverages the power of the private sector and avoids creating market distortions. Specifically, this means packaging donor and philanthropic support so that it is as 'lean' as possible, tapers out quickly so that the market becomes self-sustaining, and is enterprise-specific (rather than following a 'one size fits all' approach). The best means to achieve this is through a 'sealed bid' (i.e. anonymous) reverse auction that allows enterprises themselves to determine the level of support they get, tailored to each enterprise's circumstances. In other words: a competitive auction of grants to enterprises (using, for example, dollars of subsidy per watt-peak of SHS delivered as the basis for bidding). This ensures a lean, 'just enough' allocation of grant funding that nudges enterprises towards operating in lower-income areas which they currently view as financially non-viable.

97 per cent of off-grid households in sub-Saharan Africa remain without access to a modern energy source.

This approach differs from an impact bond: it is outcomes-based but there is no pre-financing element. A first example of competitive bidding as a mechanism to allocate grant money in the SHS market can be seen in the recently launched, World Bank-financed Kenya Off-Grid Solar Access Project (KOSAP). One of KOSAP's components has been designed to ensure funding is delivered on a results basis. It uses an auction to determine the level of funding that is most cost-effective, yet provides adequate incentive to entice SHS distributors to serve hard-to-reach customers in remote parts of northern Kenya. A limited number of service providers will bid for the right to operate in each locality, allowing enterprises themselves to price the risk associated with different localities. Service providers bid based on an incentive amount per household connection, with the lowest incentive requirements winning the bid.

The results from KOSAP will be instructive for further development of this innovative mechanism. An inherent risk in any auction process – where service provider selection is done on price alone – is that a company less knowledgeable about quantifying and correctly pricing risk may, due to inexperience and the desire to get the work, outbid a more experienced competitor but then fail to deliver on the ground. So the key to success will be the degree to which enterprises accurately undertake their own financial analysis to assess the subsidy needed to support the scaling of their sales networks. This is highly specific (and proprietary) to each company, reflecting its existing product cost, operating costs and estimates of customer willingness to pay. This approach will likely need a few iterations to get right, but the results will be worth watching as a means to get the off-grid energy market really working for the poorest.

Annex 4. Details of the Proposed MEI Humanitarian Energy Fund

The proposed MEI facility aimed to address the lack of technical expertise and capacity to identify, develop, implement and manage sustainable energy solutions in the displacement context by providing comprehensive, targeted technical assistance services and funding. In addition, a knowledge-sharing and learning component of the facility was proposed to add value to the concept and provide tools for sharing lessons learned and best practice from sustainable energy interventions and new business models supported by the facility. It was envisaged that the MEI would play an active role in initiating and facilitating approaches, developing potential solutions in close collaboration with the private sector and humanitarian actors, and providing guidance and coordination to the process.

Table 3: A summary of the interventions the MEI facility targeted and the different components

The financing facility will support sustainable energy interventions that:	The financing facility will provide:
1. Improve/increase access to clean, safe, reliable and affordable energy for displaced people, host communities and/or humanitarian operations, in a significant and sustainable way.	<ul style="list-style-type: none"> • Technical assistance to humanitarian actors and private-sector developers for the identification, design, implementation and management of clean energy solutions in displacement settings.
2. Lead to a significant reduction in (fossil) fuel/energy consumption, and hence contribute to climate change mitigation through reduced greenhouse gas emissions.	
3. Address deforestation and environmental degradation through alternative cooking solutions for displaced people.	
4. Demonstrate new, innovative approaches and business models for the provision of clean energy products and services and the management of energy assets in displacement settings.	<ul style="list-style-type: none"> • Long-term funding to help close the funding gap, and de-risk and encourage commercial viability of sustainable energy solutions. Funding will focus on grants with additional concessional loans for larger projects and scale-up.
5. Promote increased private-sector engagement and facilitate strategic partnerships between humanitarian actors, local NGOs, community-based organizations and the private sector.	
6. Offer sustainable solutions through strong local ownership, robust long-term management and maintenance arrangements, and high potential – and strategies – for scalability.	<ul style="list-style-type: none"> • A knowledge-sharing and research generation platform which offers a range of tools and activities for sharing lessons learned and best practice from supported projects, allowing the facility to improve and evolve through its learning.
7. Demonstrate high social and environmental impact, are transformative, and have a strong demonstration effect for other actors in the humanitarian sector to adopt new approaches and models for energy service provision in displacement settings.	

Funding from the financing facility would be open to all applicants meeting the eligibility criteria, including humanitarian organizations, NGOs, community-based organizations, public-sector entities and private-sector companies, with strategic partnerships between different stakeholders encouraged. A summary of the type of projects and components of the facility is given in Table 3. The proposed facility would take a global view and support interventions at different funding stages, as described in Table 4. An initial fundraising round was envisaged to secure commitments in the range of \$50 million to \$60 million to cover:

1. A funding component to provide grants and long-term loans to eligible projects (approx. \$40 million)
2. A technical assistance component (approx. \$10 million)
3. Fund management and administrative costs

Table 4: Overview of proposed funding stages for the financing facility

Project stage	Project size, \$	Funding as % of total project cost	Financial instrument
Pilot/testing stage	50,000–200,000	100%	Grants
Implementation of proven technology/ business model	100,000–500,000	90%	100% grants only for non-commercial organizations (with limitations on borrowing), e.g. humanitarian agencies; otherwise a combination of grants and concessional loans
Scaling up of successful interventions	500,000–2,000,000, exceptional cases up to 5,000,000	80%	

About the Authors

Yaron Cohen is a financial and business development consultant based in Kenya. He has been in the financial services industry since 2002; and since 2009 has primarily focused on the intersection of agriculture, renewable energy and finance in East Africa. He has served as a strategy consultant to a range of international development agencies supporting the growth of private-sector activity. He has also advised renewable energy and agriculture projects and businesses on raising early-stage capital. He is the co-founder of Viktoria Ventures – which operates VBAN, East Africa’s leading angel investment network focused on technology start-ups. Prior to moving to Kenya, he worked in the asset management industry in London, rising to the position of vice-president at Merrill Lynch. During that time, his primary focus was risk management and the evaluation of portfolios of hedge fund investments. He has an MBA in general management from IE Business School in Madrid, and a master’s degree in planetary science from University College London.

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