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Founded in 2009, Waterloo Global Science Initiative (WGSI) is a non-profit partnership between Perimeter Institute for Theoretical Physics and the University of Waterloo. The mandate of WGSI is to promote dialogue around complex global issues to catalyze the long-range thinking necessary to advance ideas, opportunities and strategies through our Summit Series, Blueprints and Impact Activities.



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2. Fair market

Reshape the financial environment to facilitate energy access

2.1 Overview

The wide gap between energy investments in the Global North and South presents perhaps the most significant challenge to universal energy access. According to the African Development Bank (AfDB), US\$547 billion must be invested to implement its scenario of universal access to reliable and increasingly cleaner electric power in all the 53 countries in Africa by 2030. This averages out at over US\$27 billion per year, yet total funding to the energy sector in sub-Saharan Africa has averaged only about US\$2 billion per year.⁵¹

The SE4ALL 2016 Energy Access Practitioner Network survey cites access to finance as the number one challenge facing energy access efforts worldwide.⁵² Investors that took part in the survey gave a number of reasons for this, including the limited track record of industry players, lack of support from local banks in local currency, insufficient knowledge of investors, and foreign currency risk.

Essentially, energy investments in developing countries are disproportionately low due to elevated risk that is difficult to quantify, and the uncertain regulatory and investment environments in these regions. Novelty is also a problem as investors must prepare to operate in a new and rapidly changing sector with severely limited knowledge and experience. Furthermore, the end-users that make up this market are a largely unknown quantity for business leaders. In sub-Saharan Africa, for example, the 600 million people without electricity are some of the poorest people on the planet and the majority of them live in remote rural areas. Their consumption behaviour and ability to pay for energy services is not well documented.⁵³

Without large scale investments in sub-Saharan African countries and others facing low electrification rates, a transformation of energy systems to achieve universal energy access is simply not possible. Fortunately, there are a number of ways in which access to finance can be

increased through the participation of private actors and international finance institutions. First, though, this financing space must be de-risked by domestic regulatory actions and flexible support from risk-tolerant financial institutions across the globe. By breaking down the barriers to finance that persistently leave energy impoverished countries to fend for themselves, we can bring online the necessary investments through a variety of increasingly proven finance-related actions, highlighted below. The Solutions Spotlight section contains a list of further mechanisms and institutions that can support energy access projects (see page 50).

2.2 Six actions that will deliver finance for energy access

2.2.1 Lead financiers to energy access opportunities

Improving the knowledge that financiers have of the energy access sector is of central importance. Standardization of due diligence processes and project assessments will help to streamline these processes and reduce the time needed for financial analysis of proposed investments. Creation of best practices guidelines for financing off-grid projects and standardizing data collection and data sharing can provide frameworks and information to help financial institutions with little prior knowledge of the sector to increase the speed at which they are able to assess their investment options. A number of investors are already taking action in this regard and openly share their learnings for others to use. One example is Vulcan Impact investing, which owns ten micro-grids in Kenya and is working with their private sector partner Steama.co to generate data and information about these projects which has been collated into a report that is freely available on their website.⁵⁴ Acumen Impact Investing is another forward thinker. Having recently acquired the research arm of a sector leader, SolarAid, they are working

51. UNEP. (2012). Financing renewable energy in developing countries. UNEP Finance Initiative. Retrieved from: http://www.unepfi.org/fileadmin/documents/Financing_Renewable_Energy_in_subSaharan_Africa.pdf

52. Porcaro, J. (2016). State of play and potential for scale in sub-Saharan Africa. SE4ALL Energy Access Practitioner Network – Energy Access "Movers and Shakers" Showcase Webinar. Retrieved from: <https://cleanenergysolutions.org/sites/default/files/documents/movers-and-shakers-jem-porcaro-25-10-16.pdf>

53. Zhang, Y-F., Parker, D. & Kirkpatrick, C.J. (2007) Electricity sector reform in developing countries: an econometric assessment of the effects of privatization, competition and regulation. *Journal of Regulatory Economics* (33)2:159-178.

BBOXX

A company that began as a not-for-profit collaboration between three UK-based engineering students, BBOXX now aims to provide 20 million people with electricity by 2020. BBOXX designs, manufactures distributes, and finances solar panels, batteries and plug-and-play energy efficient DC appliances such as televisions, radios, lighting units, and phone chargers.

Its typical customer lives off-grid in rural areas, and earns US\$150 per month by farming small plots or fishing. Energy, in the form of kerosene, battery and phone charging purchases uses around US\$10 of household income per month.

According to company statistics, BBOXX's customers, which are mostly in Kenya and Rwanda, have saved US\$2.4 million in energy expenses and offset over 40,000 tonnes of CO₂.

Data access through mobile phone networks is central to BBOXX's business model. The company collects real-time data on power generation and usage, system performance and location of its units to within one kilometre via 2G signals and SMS in the case of poor signal availability. It also monitors customer payments and can shut units down remotely in the case of non-payment, reactivating them when payment has been made.

This data traffic is crucial to BBOXX's investors, as it provides understanding of the market potential as well as securing payment adherence and company performance. Funders include private equity funds, merchant banks, foundations and environment-focused finance organizations.⁵⁷

to enhance data collection and sharing about energy access markets and to publish their findings openly for other investors to learn from.⁵⁵

It is worth emphasizing the opportunity afforded by new digital information technologies that can be coupled with the provision of energy – especially electricity. Even in the developed world, energy providers and consumers are only just starting to take advantage of these opportunities. A 2015 report funded by the US Department of Energy, titled Value of Customer Data Access, makes it clear that the benefits run both ways. “Access to data allows customers to evaluate available options and make informed decisions, which in turn empowers them to embrace a new role as active and engaged market participants. Utilities benefit from information availability and evolving technologies. With access to customer data, many utilities have achieved significant cost reduction and operational benefits.”⁵⁶

An example is BBOXX, a solar solutions supplier operating in Rwanda, Kenya, Burkina Faso, Colombia and a range of other locations. Its hardware transmits and receives data and instructions (see sidebar). The company knows immediately if hardware is malfunctioning, disconnected or stolen. Of particular importance to financiers supporting the company is the ability to log customers' energy usage, disable services when payments are missed and to reactivate services when payments are made. For the customer, the application of data-enabled energy services means better after-sales service, which drives further demand.

The importance of data to the emergence of the newly-connected energy market means there is also a huge opportunity here for businesses that source and supply reliable market data. Government agencies and NGOs can and should forge pathways for businesses to establish themselves in this space.

The emergence of the off-grid sector brings another significant and often unappreciated opportunity for financiers. Off-grid technologies can be deployed at whatever scale is most appropriate given market conditions and thus do not need to be as capital intensive as large centralized electricity supply additions. While this space is changing rapidly, a number of companies are having success in building their customer base. Investors who might have once seen investments in developing world energy infrastructure as too costly now have a new and growing set of investment options to consider.

54. Blodgett, C., Moder, E., Kickham, L & Leaf, h. (2016). Powering productivity: Early insights into mini grid operations in rural Kenya. Vulcan. Retrieved from: <http://www.vulcan.com/MediaLibraries/Vulcan/Documents/Kenya-Mini-Grids-White-Paper-VI2.pdf>

55. Acumen. (2016). Acumen acquires Solaraid's off-grid energy research and impact division. Retrieved from: <http://acumen.org/blog/acumen-acquires-solaraid-off-grid-energy-research-and-impact-division/>

56. National Association of Regulatory Utility Commissioners. (2015). Value of customer data access: Market trends, challenges and opportunities. Retrieved from: pubs.naruc.org/pub/536E2C7B-2354-D714-51CE-F035BA50FAA1

57. BBOXX. (n.d.). Impact. Retrieved from: <http://www.bboxx.co.uk/customers/>

2.2.2 Involve financiers early

Involving financiers in the early stages of business model development for aspiring off-grid companies is essential. Not only will it provide an avenue for financiers to gain specialized knowledge of the sector, new entrants to the sector will benefit from the perspective of financiers who ultimately must be engaged in order to bring their solution to market.

This is particularly important in the micro-grid space. Here, one of the biggest barriers to success is the setting of appropriate tariffs that will ensure financial sustainability. Financial experts can help developers to make these decisions – in consultation with local end-users – so that once a micro-grid system is installed there is a robust financial stream and ownership/incentive structure to ensure its maintenance and operation over time.

Partnerships between financial institutions and business accelerators or industry associations that serve the off-grid space may provide a pathway to collaboration. A number of impact investment firms, such as Acumen and Vulcan, are already engaged in such activities and provide a model that may be replicated by other institutions who see value in developing the expertise to take advantage of the growing opportunities presented by this emerging sector.

There is another good reason for financiers to get involved early. For many remote rural energy customers, their purchase of off-grid energy services and systems represents the first time that they have created any record of their status as consumers. A potentially powerful use for this data might be to encourage the creation of credit scores for these individuals which may assist them as they continue to climb the energy and economic ladder. This works for both sides, allowing customers to access financing for additional energy or other purchases more easily, and creating new credit-worthy consumers for financial products.

2.2.3 De-risk investments

There are a number of strategies that can reduce investment risk. One example is bundling. While many investors, especially venture capital firms, try to pick winners, a wiser approach may be to invest in a diverse array of projects and companies across the energy access sector to hedge against the various risks. Besides minimizing investment risks, bundling of projects also serves to increase both the attractiveness and visibility of smaller projects making them more appealing to a wider array of investors. Changes in political circumstances, flawed market analyses or changes to tariff structures within a single country

can severely impact an individual company, but it is unlikely that such shifts would undermine the entire sector. That means diversified investment portfolios will almost always survive, as long as the sector as a whole continues to grow. Offering patient capital is another de-risking solution. By allowing projects time – a decade or more – to generate a return on the investment, strategic investment is more stable through moments of political, social or economic upheaval.

Guarantees and hedging instruments are needed to increase the attractiveness of investments from traditional sources of finance. The Multilateral Investment Guarantee Association and Currency Exchange Fund can be leveraged to mitigate these risks and attract investments to underserved markets in sub-Saharan Africa and elsewhere in the developing world. International finance institutions, also have an opportunity to back power purchase agreements and mitigate risks stemming from unstable policy environments.

While reduction of risks through the creation of stable regulatory environments, knowledge sharing and other actions is important, the large uncertainties regarding how the sector will evolve cannot of course be entirely reduced. The proliferation of risk tolerant investment instruments will therefore be a crucial source of much needed capital.

2.2.4 Pursue public-private partnerships

Financiers should be given the opportunity to jointly fund projects through public-private partnerships. Such partnerships can shift risk from the private sector investors to their public sector partners who are more patient and less risk averse. Aid agencies and national/international development funding institutions have a critical role to play in advancing opportunities for public-private partnerships and de-risking the space by investing in projects that are too risky to attract private sector funds.

Increasingly, development funding institutions are shifting away from the traditional model of charity-style giving and taking a larger role in funding social enterprises and new energy access start-ups. The US Agency for International Development (USAID) runs Development Impact Ventures, which provides a fantastic example of this strategy in action.⁵⁸ Through a staged process that provides increasing amounts of funding to development-oriented enterprises that meet predetermined benchmarks they are able to seed a large number of new ideas and businesses to get them started and ensure that larger investments are funneled toward proven business models.

58. USAID. (n.d.). About DIV. Retrieved from: <https://www.usaid.gov/div/about>

59. Arc Finance. (2014). Crowdfunding in the energy access space. Renewable Energy Microfinance and Microenterprise Program. Retrieved from: http://arcfinance.org/pdfs/pubs/REMMMP_Briefing_Note_Crowdfunding.pdf

Government funders and international aid organizations must be in tune with private sector lenders and aware of the barriers to investment that they face. This will enable them to de-risk the sector and fill gaps themselves. Investing in market-building activities such as consumer awareness campaigns (and consulting with the private sector regarding their implementation) can also act to prime the pump for the future success of market-based solutions.

One way in which development aid institutions have acted to reinforce emerging markets and till the soil for energy access enterprises is by providing results-based financing (RBF). These incentive programs provide funding to entities that serve Base of Pyramid markets. Finance is tied to the results that are engendered – for example, a set fee paid to developers for each household that is electrified through their actions. When properly administered, this guarantee of financial return for services delivered can help to incentivize private actors in regions where they otherwise would not operate.

Find out more in our Solution Spotlight – Results-based funding with EnDev (page 50).

2.2.5 Develop peer-to-peer funding

An increasingly popular source of low-interest capital that is beginning to permeate the social enterprise space is peer-to-peer funding, where many individuals can make small investments in projects or organizations that they wish to support. Projects benefit from interest-free capital of whatever magnitude suits the cause, and a network for advertising and awareness-raising. A number of peer-to-peer financing campaigns, such as Kiva, Milaap and Sunfunder, have been used to generate capital for energy access enterprises and projects, and have even helped to attract larger institutional investors to the sector.⁵⁹

There are a wide variety of financing mechanisms and institutions that can be leveraged to expand access to finance for the energy access sector.

We highlight a number of these in our Solution Spotlight – Innovative financing mechanisms and institutions (page 52).

2.2.6 Stimulate innovation

Development aid agencies and international finance institutions should seek to use their investments and clout to spur innovation in key areas. Funding competitions and awards for innovation and success can draw much needed attention and expertise into the space, creating an engine of technological ingenuity that will open up new markets over time through cost and performance improvements. An active space for this kind of work is in appliance efficiency, one of the lesser known but most promising avenues for reducing cost of off-grid energy services. The Global LEAP awards are an outstanding example in this regard, holding competitions that promote the development of efficient lighting, televisions, fans, and refrigerators.⁴⁷ These initiatives require philanthropic and public funding to maintain their impact and evolve alongside the sector that they serve.

Innovation capital can also help move ideas from research labs into the field. The Blum Center for Developing Economies at UC Berkeley, for instance, funded the transition of energy technology company Gram Power from the lab to rural implementation projects in India.⁶⁰ Many more companies like Gram Power are waiting to be born in the laboratories of universities and colleges across the developing and developed world. What they need more than anything is the financial and institutional support to create a solid foundation for growth in the emerging markets that they ultimately intend to serve.

Without technological innovation and investment in research labs, many of the current opportunities in the energy access sector would not exist. One example comes from ME SOLshare, a small but award-winning energy access company operating in Bangladesh. SOLShare was born in a research lab at the Technical University of Berlin, half way across the world from the markets that it now serves. It uses cutting edge technology to connect solar home systems that have already been sold through a successful government incentive program. The connection allows consumers to share, buy and sell energy with each other, and with their neighbors who may not even have a solar panel themselves.

Find out more in our Solution Spotlight – Connecting Bangladesh's solar home with ME SOLshare (page 54).

60. Lyons, K. (n.d.). Gram Power. Blum Center for developing economies. Retrieved from: <http://blumcenter.berkeley.edu/news-posts/gram-power/>