SUMMARY REPORT OF THE FINAL DISSEMINATION EVENT HELD ON 16th FEBRUARY 2024 at Holiday Inn, Guildford Surrey (UK)

SIGMA Project Report 4

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DISCLAIMER

The views expressed in this report are those of the authors and do not necessarily represent the views of the institutions they are affiliated to or those of the funding agencies.

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FEEDBACK

If you have any comments, suggestions, or feedback, please send them to the SIGMA project lead by email: s.c.bhattacharyya@surrey.ac.uk

Introduction

The team behind the SIGMA project (**S**ustainability, **I**nclusiveness and **G**overnance of **M**ini-grids in **A**frica) held its Final Dissemination event on 16 February 2024. The hybrid event was held at the Holiday Inn hotel in Guildford (Surrey) which was attended by around 50 participants (online and physical combined). The agenda for the event (see Annex 1) included formal presentations by the project team in the morning session, followed by invited guest presentations in the post-lunch session. SIGMA Principal Investigator Prof Subhes Bhattacharyya from the University of Surrey gave an overview of the project, and representatives from each of the country teams – Nigeria, Senegal, Tanzania, and Keyna – presented results. Team representatives then discussed key cross-cutting issues in a high-level panel, and guest speakers presented on the role of energy democracy and politics in African country energy transitions and the technical, economic, and social aspects of solar mini-grid infrastructures. The conference attendees, including those joining online, were engaged in three thematic discussions: productive uses, inclusivity and leaving no one behind, and beyond mini-grids. A sample of key outputs and a set of ten posters were displayed physically during the event (see Annex 2 for details).

This report provides a summary of the event and directs the readers to the repositories where the presentations, posters and other relevant outputs from the project can be accessed from. The event marked the culmination of a four-year long journey of the project. The project officially ended on 1st March 2024 but the team is working towards publication of a few more outputs beyond this date.

Summary of the morning session

Prof. Bhattacharyya opened the event by welcoming the participants (see https://www.academia.edu/115549886/SIGMA_Presentation_SIGMA_Project_Overview_Introduction_and_main_insights). He reminded the audience that the project began on the 2nd of March 2020 when he was with De Montfort University, Leicester. During the project lifetime, several UK colleagues changed their jobs, which resulted in an expansion and adjustments to the UK teams collaborating in the project. He also outlined the difficult journey of the project through the COVID and funding cuts that required significant adjustments to the work plan and work arrangements, including two no-cost extensions that ultimately pushed the completion date to its third anniversary. He also mentioned the main tasks undertaken by the project and the main insights from the project, which were further elaborated by other presenters subsequently.

Dr Sesan's presentation on the SIGMA work in Nigeria (https://www.academia.edu/115550083/SIGMA_Presentation_Sustainability_Inclusiveness_and_Governance_of_Mini_Grids_in_Nigeria_key_findings) focused on the dimensions of sustainability of mini-grids in the country and evidence on productive uses of energy and the success of these programmes, as well as situating mini-grids in the wider rural electrification context of Nigeria. The agriculture-energy nexus in particular has been touted as a route to greater productive use and

demand stimulation, but current evidence shows interventions earlier in the agricultural value chain are needed to enhance profitability. Sustainability and inclusiveness need to be promoted in concert. Dr Sesan's recommendations are for harmonisation of the regulatory environment to match the capabilities of small and medium developers alongside the larger electricity distribution companies, review regulatory provisions to unlock latent rural electrification subsidies for mini-grids, situate the role of mini-grids within broader rural electrification policy, and learn from the promising approaches currently in use by private sector developers in Nigeria.

Dr Baker's overview situated mini-grids in the Senegal context, including the institutional structures of electricity governance, trends in the rural electrification model and developments in energy access strategy and policy arenas (https://www.academia.edu/115550158/SIGMA_Presentation_Mini_grids_in_Senegal). Mini grids are set to play a small role in the national operational plan for universal electricity access by 2025; there is a greater focus on electricity grid expansion and solar home systems. The universal access target is unlikely to be met. The future of mini-grids is likely tied to how projects are defined under the successor to L'Electrification Rurale d'Initiative Locale (ERIL), the Decentralized Rural Electrification, or d'Electrification Rurale Décentralisée (ERD) framework. Challenges remain, including with accountability related to the significant influence of development finance institutions, contradictions between the ROI expectations of private investors and the unprofitability of reaching low-income often dispersed electricity consumers, and the ambiguity of some parts of the government towards mini-grid development.

SIGMA Tanzania team representatives Eng. Maneno Katyega, Estomih Sawe and Shukuru Meena shared insights from their work (https://www.academia.edu/115550190/SIGMA_Presentation_Insights_from_the_Tanzanian_study) focused on the Tanzanian context, framing the background, status of mini-grids in the country, and current challenges based on interaction with stakeholders, site visits, and other field work conducted throughout the study. The work produced a number of conclusions. Tanzania's comprehensive small power project regulatory framework has been key to the accelerated deployment of mini-grids in the country; however, political factors, high tariffs, along with limited knowledge and access to financing still hinder mini-grid development reaching its full potential. Effective business models, such as mini-grids anchored by commercial customers, are key to financial sustainability whereas very small power producer (VSPP) models do not appear to be sustainable. Their recommendations are that regulators should undertake monitoring and evaluation of the supply quality and tariff rates of VSPPs, consider direct subsidies of electricity services from VSPPs to make services more socially equitable (as women and children benefit most from access), and ensure metering systems are convenient to both suppliers and customers (e.g., via smart metering).

Dr Onsongo from the International Centre for Frugal Innovation (ICFI) shared insights from their work in the Kenyan context

(https://www.academia.edu/115550219/SIGMA_Presentation_Minigrids_in_Kenya). The Kenyan National Electrification Strategy is prioritising mini-grids and solar home systems through the Kenya Off-Grid Solar Access Project (KOSAP): 34,000 connections are projected through 121 new solar mini-grids in the country. The Kenyan SIGMA team have conducted extensive fieldwork in eight separate counties in Kenya, visiting 15 current mini-grid projects. SIGMA team research in Kenya has identified a number of challenges with current models of provision: regulatory transparency, the policy-level exclusion of remote communities and coordination issues between national and local governments hinder mini-grid growth at a policy level. Economically, the sector is still reliant on external financing, and developers often focus on anchor consumers to break even on domestic supply. Underutilisation of electricity keeps costs high for consumers in Kenyan mini-grids. Innovative financing models and patient capital are required to keep tariffs affordable for poorer, rural consumers. Socially, inclusiveness is often a challenge, and the benefits of electricity access are often realised more by men than women. Men and wealthier community members have higher levels of participation in mini-grid projects, and inclusive co-development of projects is costly for government and developers, without a clear value proposition for these organisations. Continuous stakeholder engagement is needed to understand regulations and, where possible, find a solution for ongoing challenges.

A panel discussion followed the presentations where questions from the audience were taken by the presenters. There were questions about technological neutrality, indebtedness of the households due to electricity appliance use, productive use as well as a discussion about failure and success of mini-grids. Mr Barnett, a member of the SIGMA Advisory Committee noted that "I found the discussion about the nature of "failure" to be particularly important. Many of the SIGMA teams found a large proportion of mini grids that were no longer working, and this gives the sense of realism to the reports. The presentations often noted that the technology has "limited sustainability", "limited business viability", many mini grids "were no longer working", systems were often "underused" while others (a smaller proportion?) were overloaded." (see the full commentary here https://www.sigma-gcrf.net/blog/thoughts-arising-from-sigma-final-dissemination-event-16-february-2024).

Summary of the presentations by invited guest speakers

The post-lunch session included two talks by invited guest speakers. Dr Lemaire's presentation on the ENR-Demos project (www.enrdemosproject.net) began by describing the precursors to energy democracy (https://www.academia.edu/115550244/SIGMA_Guest_Presentation_ENR_Demos_The_politics_of_energy_transition_in_African_countries). He traced its movement from a mid-20th century concept of environmental justice to the later concept of energy justice, to the modern conceptions of energy democracy, that is, a dynamic approach of participation in energy decision-making, shared knowledge and contesting the power of established stakeholders. ENR-Demos examines the implicit assumption that renewable energy technologies (RETs) are "more democratic", as well as examining how small scale decentralised renewable energy projects are

implemented, and the barriers to citizen participation that exist in status quo project development. Highlighting cases of community resistance to RET and fossil fuel developments, the project proposes informed community decisions, embedding community decision-making in the heart of project development, and moving towards policy frameworks to promote energy communities, as recommendations to address this ongoing challenge.

Emilie Etienne's PhD research was the topic of our final guest presentation (https://www.academia.edu/115550385/SIGMA_Guest_Presentation_The_reliability_of_off_grid_solar_mini_grids_in_Kenya_and_Senegal_an_accountability_dissolved_among_stakeholders_and_systemic_constraints), focusing on solar mini-grids and their sustainability in Kenya and Senegal, specifically reliability and improving long-term outcomes. From extensive fieldwork, four major themes of reliability and accountability were identified. Reliability monitoring systems are often not working as intended, and informal communications are preferred to formal institutional channels. In addition, there are limited incentives for comprehensive maintenance provisions for mini-grids, and insufficient penalties to disincentivise energy supply failures. Increasing electrification rates often comes at the expense of creating reliable long-term solutions, and new installations are often prioritised over ensuring existing mini-grids are reliable and productive. Emilie concluded that while chains of accountability exist, they are overshadowed by systemic constraints, and responsibilities are dissolved among stakeholders.

Summary of the thematic discussions

Three topics were identified in advance for thematic discussion and both online and participants in the room were involved in the discussion of these themes. A sequential approach to the discussion of the themes was taken, with theme 1 being the opening theme and theme 3 being the closing theme. The discussion was facilitated by the project team.

Theme 1: Productive uses of energy for mini-grids and enhancing the mini-grid value chain

The first thematic discussion in the afternoon roundtable session focused on productive uses of energy in mini-grids, and how the value chain of mini-grids can be enhanced by including productive uses. The discussion was wide-ranging, covering enhancement of domestic demand to improve revenue recovery through electric cooking or household entrepreneurship (e.g., micro-enterprises), as well as the challenges that integrating high-intensity loads from energy-intensive activities such as cooking can have on peak loads for mini-grids, and the high cost of energy storage to manage such peak loads. Demand-shifting is proposed as an alternative, should loads be available in the system that are suited to this kind of demand side management, such as electric water pumping or charging electric vehicles. Examples from SIGMA research were also brought up, such as the Nigerian case of milling machines and agricultural value chain enhancement, as well as the challenges of

developers focusing on affluent user groups to enhance their cost recovery, leading to the following discussion on inclusivity.

Theme 2: Inclusivity and leaving no one behind: Approaches for the Bottom-of-the-Pyramid users

The challenge of inclusive development and leaving no-one behind was the subject of our second panel. Streams of academic literature are divided on solutions to inclusive development: many articles vilify development aid interventions and top-down approaches, while the market-based approach is criticised for focusing on profit over services. Bottom-of-pyramid (people in extreme poverty) users are very heterogeneous, and there are diverse inclusivity challenges facing developers who are interested in co-producing interventions. In Kenya, for example, inclusive development can take the form of feasibility studies and community consultations, but processes may not be inclusive: the example of women in groups being less likely to speak in front of elderly men was cited, and external parties often do not know how to overcome these entrenched power relations/cultural dynamics. Political will and accountability are fundamental for enabling citizens to escape the "poverty trap". The challenges of the donor-funded provision model were also highlighted, including the lack of community "buy-in" to donor-funded equipment distribution. Digitisation may offer a route forward in this case, through creating equitable digital platforms for consultation, but needs to be implemented in an accessible and equitable manner.

Theme 3: Beyond mini-grids: Micro-scale systems or regional integration

Our final session focused on future developments, and the potential for recent developments in "third-generation" mini-grids, which are cross-compatible with the main grid, to address challenges with mini-grid development. Recent developments in India and Bangladesh have shown mini-grids being usurped by the main grid due to government policy on grid extension, which presents challenges to developers, particularly in the private sector where stranded assets are an issue. Standardised procurement processes and equipment installations are a potential route to reducing mini-grid installation costs, and recent World Bank modelling suggests mini-grids are a viable least-cost electrification measure. Mini-grids offer an alternative to unreliable grid provisions in some contexts, and in some SIGMA cases where mini-grids and the main grid exist in tandem, mini-grid provision is preferred as the more reliable option. Many national grids, with Kenya cited as an example, are grappling with low consumption as an issue to cost recovery, in a similar manner to mini-grids. Options exist for investigating the economies of scale of larger, distribution-scale renewable energy installations and distribution networks, providing services where the main grid has not reached, but able to be interconnected to the main grid or operate as an island in periods of main grid unreliability.

Prof. Bhattacharyya thanked all the participants for their support and contributions, which made the event lively, meaningful and successful. The discussions and engagements made the event richer and the networking opportunity allowed the participants to discuss issues of mutual interest that went beyond the project.

Annex 1: Agenda of the final dissemination event

SUSTAINABILITY, INCLUSIVENESS & GOVERNANCE OF MINI-GRIDS IN AFRICA (SIGMA) FINAL DISSEMINATION EVENT - AGENDA

All times GMT. Registration from 08:30 AM

Opening Plenary

09:00 – 09:15	Plenary – Introduction to the Sustainability, Inclusiveness & Governance of Mini-Grids in Africa Project	Prof. Subhes Bhattacharyya, University of Surrey
09:15 – 09:45	Results Overview – Mini-Grids in Nigeria	Dr Temilade Sesan, University of Ibadan
09:45 – 10:15	Results Overview – Mini-Grids in Senegal	Dr Lucy Baker, Open University
10:15 – 10:30	Coffee Break	
10:30 – 11:00	Results Overview – Mini-Grids in Tanzania	Eng. Maneno Katyega, TaTEDO
11:00 – 11:30	Results Overview – Mini-Grids in Kenya	Dr. Elsie Onsongo, ICFI
11:30 – 12:00	Panel Discussion – SIGMA Outcomes and Mini-Grid Sustainability	SIGMA Team

Afternoon Plenary

13:15 – 13:45	Guest Presentation – Energy Democracy and the Politics of Energy Transition in African Countries	Dr Xavier Lemaire, UCL Energy Institute
13:45 – 14:15	Guest Presentation – Sustainability of Solar Mini-Grids in Kenya and Senegal	Emilie Etienne, University of Grenoble
14:15 – 14:30	Coffee Break	

Afternoon Sessions

14:30 – 15:45	Productive Uses of Energy for Mini-Grids & Enhancing the Mini-Grid Value Chain
14:30 – 15:45	Inclusivity and Leaving No-One Behind: Approaches for Bottom-of-Pyramid Users
14:30 – 15:45	Beyond Mini-Grids: Micro-Scale Systems or Regional Integration?

Closing Plenary

15:45 – 16:00	Summary of Findings and Next Steps	Prof. Subhes Bhattacharyya, University of Surrey
16:00 – 16:30	Thanks & Networking	

Annex 2: Details of project posters (available from https://independent.academia.edu/SIGMAGCRFProject and https://www.sigma-gcrf.net/blog/the-sustainability-inclusiveness-governance-of-mini-grids-in-africa-sigma-team-holds-final-dissemination-event)

Poster title
On the technical sustainability of mini-grids in developing countries – an assessment framework
Linking mini-grids electrification and rural development (Tanzania)
Exploring the connections between mini-grid market regulation and energy access expansion: The case of Nigeria
Beyond Man-power: How can electricity from mini-grids be harnessed to boost productivity for women in agricultural value chains?
Navigating the Path to Sustainable Electrification: Examining Business Models for Large-Scale Mini-Grid Developments in Sub-Saharan Africa
Mini-grid performance analysis with DEA
Mini-grid performance analysis with Data Envelopment Aanlysis
Retooling the KeyMaker business model for productive uses at the agriculture-energy nexus: Insights from Nigeria
Understanding Business Models and Access to Finance for Mini-Grid Development in Sub-Saharan Africa
Are mini-grids socially inclusive

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