POLICY DIALOGUE

Sustainable and scalable mini-grid business models

10th, 11th & 12th September 2024

Announcement

The African School of Regulation (ASR), in collaboration with the Mini-Grid Partnership (MGP) and its secretariat hosted by Sustainable Energy for ALL (SEforALL), and GET.Transform organises an Expert Policy Dialogue on the regulatory conditions, business model designs, and financial approaches that are necessary to attain a sustainable and scalable development of the mini-grid industry in an African country.

The event will be hosted by Makerere University in Kampala, Uganda, on September 10th, 11th and 12th, 2024.

Background

Sub-Saharan Africa (SSA) had 1152 million people in 2022, and it is estimated that by 2050 SSA will have 2094 million people, that is, 942 million more than in 2022.

Today, about 600 million people in SSA have no access to electricity at all. At the present electrification rate, it is projected that SSA will still have 560 million unelectrified people by 2030. Today, less than a fifth of African countries have targets to reach universal electricity access by 2030. An additional 45% of the continent has set access to electricity targets, yet these are less ambitious than the goals under SDG7.[1]

The IEA in its Net Zero Emissions by 2050 scenario shows a pathway to achieve universal electricity access by 2030 where the remaining electrification to be done in SSA – mostly in rural areas – with the mix of least-cost technologies consists of 44% grid extension and connection of consumers close to the existing grid (densification) and of off-grid solutions such as mini-grids and stand-alone systems, representing 31% and 25% respectively. Almost 90% of new connections are based on renewables in the scenario.[2]

According to recent reports, there are approximately 3,000 mini-grids currently operating in sub-Saharan Africa. These mini-grids are primarily funded through grants and non-commercial capital, with the private sector investment still nascent. To achieve universal electricity access by 2030, it is projected that up to 160,000 mini-grids would be needed to

[1] IEA (2024), Tracking SDG7: The Energy Progress Report, 2024, IEA, Paris
https://www.iea.org/reports/tracking-sdg7-the-energy-progress-report-2024
[2] Ibid.

provide electricity to an estimated 380 million people in SSA. To meet these goals, the sector will require about $91 billion – only in investment – by 2030.[3]

Completing the off-grid electrification picture, GOGLA estimates that just the investment cost of providing the tier 1 level of electrification with solar home systems would cost USD 20 billion and USD 50 billion for tier 2 level. As of 2024, approximately 45 million people in SSA have access to electricity through solar home systems.

This means that solar home systems now provide electricity access to 4% of SSA households. Mini-grids provide access to 2% of people in SSA, while main grids provide access to more than 40%. Around 18% of the population without access in SSA now benefits from a solar lantern or multi-light system.[4]

Recent initiatives, like the partnership of the World Bank with the African Development Bank that aims to provide electricity to 300 million people in SSA,[5] try to overcome the present gap in ambition but, so far, they lack guidance on how this could be achieved, only mentioning global figures of the required investment. An honest debate on the regulatory, business and financial models for rural electrification in SSA is of the essence to turn these initiatives into reality.

The debate in this Policy Dialogue will focus on mini-grids, although most of the conclusions could be extended to all modes of rural electrification.

The topic for discussion

The gap between the objective of the SDG7.1.1 (full electrification by 2030 or another reasonably close time, depending on the country) and reality speaks for itself. Substantial private investments will be needed, and this will only be possible if we can define business models for mini-grids that are financially viable and can maintain this condition permanently, i.e., if private investors can get an attractive return on their investment and the business models are sustainable. In addition, to achieve universal electricity access, it is necessary that these business models can be scaled up to the necessary dimension, both in terms of the required financing and the technical and managerial capability, allowing to install all the mini-grids identified in the electrification plan.

Attaining a sustainable and scalable development of the mini-grid industry in an African country must overcome several important difficulties:

1. Mini-grid investors must receive a remuneration for their services that must cover the efficient cost of supplying electricity reliably, including a rate of return covering the cost of capital. The level of risk involved in the adopted financial scheme must be acceptable for private investors and in line with the expected level of return.

[3] World Bank. (2023). "Solar Mini Grids Could Sustainably Power 380 million People in Africa by 2030 – if Action is Taken Now." https://www.worldbank.org/en/news/press-release/2023/02/26/solar-mini-grids-could-sustainably-power-380-million-people-in-afe-africa-by-2030-if-action-is-taken-now

[4] https://www.iea.org/commentaries/access-to-electricity-improves-slightly-in-2023-but-still-far-from-the-pace-needed-to-meet-sdg7

[5] https://www.worldbank.org/en/news/press-release/2024/04/17/new-partnership-aims-to-connect-300-million-to-electricity-by-2030

2. This conflicts with the affordability of the beneficiary communities for the electricity price that results from a cost-reflective remuneration of the mini-grid investor. A small fraction of the necessary mini-grids in the least cost plan of some SSA country may be financially viable because of a suitable mix of residential, commercial and industrial customers benefiting from some kind of cross-subsidisation and a rigorous design, operation and maintenance. However, this will not be the case for the majority of the mini-grids that will lead to the least cost universal electrification. Therefore, a self-sufficient mini-grid business model cannot be scalable - rendering universal access impossible - unless the gap between the cost of service of each one of these mini-grids non-viable individually and what its customers can afford is somehow filled over the horizon of a financially viable integrated electrification plan and beyond, on a permanent basis.
3. Sustainability requires a long-term commitment of the mini-grid investor, which must become "like a utility", and a mindset change by the government, the regulator and the customers themselves to be ready to accept and to implement in the future whatever adaptations will be necessary to keep the supply of electricity indefinitely, by whatever means.
4. Mini-grids do not happen in isolation from other modes of electrification. From a country's perspective, the electrification process must integrate the three electrification modes and their interaction and potential overlap. The business model must be financially viable for each electrification mode , and the entire electrification plan must be financially viable from a governmental perspective.
5. The business model, regulation and financial strategy must incentivize efficient delivery and the satisfaction of reasonable levels of performance in reliability, quality of service, losses, revenue collection and the incorporation of productive and communal uses of electricity.

In view of these challenges, an answer to the following questions must be found: **Is achieving sustainable and scalable business and regulatory models for mini-grids in SSA countries an impossible quest? Does a solution exist? Focusing on a specific situation, what can be proposed for Zambia?**

Logistics

Several entities have put together approaches that try to address this question. Representatives of these entities will be invited to participate. The approaches are listed in Annex 1 with the links to the original references. Each one of them probably contains elements of the "Goldilocks approach". The objective of the proposed Policy Dialogue among a reduced group of experts is to arrive at the specification of the approach – physical design, regulation, business model, financial plan – that will do the trick.

The meeting will be in person and will not gather more than 25 people.

The event will last three days, starting on Tuesday, 10th September at 9:00 AM EAT and ending on Thursday, 12th September at 13:30 PM EAT. The detailed structure of the sessions is described in a separate agenda for the event. The first half day can be devoted to individual presentations of the different approaches and the identification of their strong and weak

points and potential contribution to a plausible recommended approach. The reminder of the first day and the second day could be structured by the several aspects of the problem. Each aspect would be discussed first by a small panel and then open to everyone to intervene. A small team would be in charge of preparing a draft proposal of the conclusions as they unfold. The goal is to agree on a draft proposal with the largest consensus possible as well as on the next steps to be taken, during the third day of the meeting.

Outcomes

In order to arrive to actionable conclusions, it is proposed to focus on a concrete case example with specific characteristics, which is a program for a massive deployment of mini-grids in Zambia, without forgetting that the objective of the meeting is to arrive at a proposal that, with suitable adaptations, could be applicable to any SSA country. Annex 2 describes the relevant characteristics of the proposed case of Zambia.

In a nutshell, the outcomes of this policy dialogue should be:

1. A detailed business model and a deployment strategy proposal for the Zambian case.
2. A general-purpose regulatory, business and financial approach for mini-grids, consisting of an essential core and a toolbox of options that can be tailored to the reality of every country or region and to future changing situations.

Annex 1. A collection of approaches deserving consideration

African Development Bank (AfDB) Mini-Grid Training

https://greenminigrid.afdb.org

African Forum of Energy Regulators (AFUR), AFUR Mainstreaming Mini-grid Tariff Settlement Tools and Methodologies

https://afurnet.org/news/afur-mainstreaming-mini-grid-tariff-settlement-tools-and-methodologies-baseline-gap-analysis-final-report/

See also GET.Transform below, in collaboration with AFUR.

African School of Regulation (ASR), the Integrated Distribution Framework (IDF)

Reference: Ignacio Pérez-Arriaga. "Sustainable and scalable minigrid business models". African School of Regulation. December 2022.

https://africanschoolregulation.org/event/online-conference-sustainable-minigrid-business-models/

Africa Minigrid Developers Association (REPP/AMDA)

"How to unlock financing for mini-grids in Africa at scale through multi-stakeholder collaboration" (2023)

https://africamda.org/wp-content/uploads/2023/05/How-to-unlock-financing-for-mini-grids-in-Africa-at-scale-through-multi-stakeholder-collaboration.pdf

"Unveiling Africa's Minigrid Evolution" (2024)

https://africamda.org/wp-content/uploads/2024/06/BAM-Report-2024-teaser-EN-.pdf

CrossBoundary

Project finance model (2023). https://crossboundary.com/mini-grid-financial-model-open-source/

Mini-grid Innovation Lab. https://crossboundary.com/advisory/mini-grid-innovation-lab/

Engie Energy Access

"Towards universal access to energy: Enabling A Multi-Technology Approach In A Mini-Grid Environment" (2024)

https://www.esi-africa.com/wp-content/uploads/2024/04/Read-Towards-universal-access-to-energy.pdf

GET-Transform in collaboration with AFUR

The African Model Mini-Grid Regulations Tool.

https://www.get-transform.eu/showcasing-african-model-mini-grid-regulations-at-eaif-2024/#:~:text=The%20African%20Model%20Mini%2DGrid%20Regulation%20Tool%20was%20specifically%20designed,“Click%20Your%20Regulation”%20tool.

Global association for the off-grid solar energy industry (GOGLA)

Lighting Global/ESMAP, GOGLA, Efficiency For Access, Open Capital Advisors (2022), “Off-Grid Solar Market Trends Report 2022: Outlook”. World Bank.
https://openknowledge.worldbank.org/handle/10986/38163

Husk Power

Mattson, B., Sinha, M. and Brent, W. “Scaling solar hybrid minigrids: An industry roadmap”, 2022. Husk Power.

https://huskpowersystems.com/new-roadmap-says-minigrid-industry-needs-10-companies-with-10-times-current-scale-to-achieve-universal-energy-access-and-sdg7-2/

The International Finance Corporation (IFC) Scaling Mini-Grid Program.

https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/infrastructure/priorities/power/scaling+mini-grid

Among the many documents in the IFC Scaling Mini-Grid Program website, these two are highly recommended: (i) the concession agreement Term Sheet and the (ii) concession agreement User Manual.

The International Finance Corporation (IFC) Scaling Mini-Grid Program, “Concession Agreement User Manual” (2022).

https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/infrastructure/priorities/power/scaling+mini-grid

Results Based Financing, RBF

Energypedia: https://energypedia.info/wiki/Results-Based_Financing

An assessment by GIZ.

https://gruene-buergerenergie.org/wp-content/uploads/Get.Transform-GBE-EAD-Study.pdf

The Mini-Grid Partnership (MGP)

Mini-grids Partnership (MGP) (2024). “State of the Global Mini-grids market report”.

https://minigrids.org/global-market-report-2024/

SEforAll, AFUR and AMDA (2024). “Mini-grid CAPEX and OPEX Benchmark Study:

A Regional Approach in Burkina Faso, Nigeria and Sierra Leone”.

https://www.seforall.org/system/files/2024-08/CAPEXOPEX%20PPT_final.pdf

UNIDO

UNIDO (2020). “The Clean Energy Mini-Grid Policy Development Guide”

https://www.unido.org/sites/default/files/files/2021-03/CEMG_Development_Guide_EN.pdf

World Bank - ESMAP

Energy Sector Management Assistance Program (ESMAP, WB) (2022). “Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers.”

https://www.esmap.org/Mini_Grids_for_Half_a_Billion_People_The_Report

World Bank (2022). “Off-Grid Solar Market Trends Report 2022: State of the Sector.”

https://openknowledge.worldbank.org/handle/10986/38140

Annex 2. A proposal for mini-grid electrification in Zambia.

To support the Government of the Republic of Zambia's (GRZ) ambitious goal of deploying over 1,000 mini-grids in rural areas, SEforALL has developed a two-phased approach specifically tailored to Zambia's unique mini-grid market and broader electrification challenges.

Phase I aims to achieve rapid progress while ensuring long-term sector sustainability. The focus will be placed on maximizing the social and economic impact by prioritizing productive uses of energy for businesses and public institutions.

In Phase II, the mini-grids as infrastructure approach will be adopted, although in the general debate other models will be contemplated. The approach will aim to:

- Leverage synergies between different electrification technologies.
- Ensure that all communities are included ("Leave no one behind").
- Achieve sector sustainability.
- Deliver reliable and affordable modern electricity.
- Maximize social welfare and economic impact.

The main barriers to mini-grid deployment in Zambia must be overcome**.** Today, three programs exist in Zambia with the objective to deploy mini-grids under a cost reflective tariff and partial capex subsidization:

BGFA
Beyond the Grid Fund for Africa

- 2019 Expansion of the Beyond the Grid Fund for Zambia (2016), solar-home-system focused.
- Total funding of $126.3M across Burkina Faso, DR Congo, Liberia, Mozambique, Uganda & Zambia.
- Providing a results-based, per 'connection' subsidy.
- Signed agreements with Zengamina Power Limited and Power Corner Zambia.

IAEREP
Increased Access to Electricity and Renewable Energy Production

- Launched in 2018 with the objective of enhancing access to clean, dependable and cost-effective energy.
- Two funding windows within the country, amounting to €21 million and €31M.
- Offers a CAPEX subsidy of up to 50%.
- Allocating approximately €8 million from terminated contracts towards a funding window in 2024.

OG-RESS
Off Grid Rural Electrification Smart Subsidy

- Launched in 2021 to encourage involvement from the private sector in delivering renewable energy services to remote regions, in collaboration with REA Zambia.
- Secured a total funding of $3.4M
- Offers approximately a 45% CAPEX subsidy for each connection (determined on a minimum subsidy tender approach).
- 3 developers have outlined plans for 30 mini grids, set to be completed by June 2024.
- The program is slated to continue until 2025.

The table below shows the list of developers and near-term pipelines (non-exhaustive).

		Existing	2024	2025	Pipeline Total	Support program
ENGIE	**ENGIE Power Corner** Providing solar mini-grid connections and appliances to households, businesses & public services, using mobile money platforms for collections	1	30	33	63	IAEREP
ARC	**Arc Power** Building solar mini-grids to serve as community electrification hubs powering households and businesses, using PAYGO for collections	0	13	-	13	OGRESS
VIRUNGA POWER	**Virunga Power** Anchored on Hydropower, mini-utility geographic concession model and interconnections	1 large grid (geographic concession approach)	Extend existing grid (1,000 new customers)	-	1	BGFA
SOLAR 23	**Solar 23** Creating local companies to build solar hybrid mini-grids, offering capacity building to communities & making collections through best-fit methods per community	0	7	-	11	IAEREP OGRESS
SM	**Standard Microgrid** Building solar hybrid mini-grids for commercial and social impact (SI) purposes. Collections from SI projects are used for O&M	4	-	-	-	BGFA
KAWAIDA ENERGY	**Kawaida** Offers sales and installation of solar PV solutions that power mostly the productive use of energy	0	13	-	13	OGRESS
SESZ	**Smart Energy** Installation of Solar PV systems to communities particularly for powering agricultural loads	1	6	-	7	USADF
Others (Companies or organizations without 2024/5 construction pipeline)		34	-	-	-	*Various*
Total Market Activity		41	74	33	107	

Although some mini-grids have been already installed, certain challenges persist:

- **Macro-economic conditions:** Over the past four years, Zambia has faced significant macroeconomic challenges, marked by substantial Kwacha depreciation and a severe debt crisis. The Kwacha's value has been volatile due to high public debt, declining foreign reserves, and the economic impacts of the COVID-19 pandemic. Efforts to stabilize the currency included monetary tightening and securing international financial assistance. Meanwhile, Zambia's debt crisis peaked with a default on a Eurobond payment in 2020, leading to extensive debt restructuring negotiations. With support from the IMF and other creditors, the country has made progress in managing its debt, contingent on implementing economic reforms and fiscal austerity measures.
- **Limited Profitable Sites:** Existing subsidy schemes and business models will address most of the bankable mini-grids under cost-reflective tariff and partial CAPEX subsidization business model type. These are expected to be addressed within the next 18 months. Topographic and human settlement patterns are challenging for mini-grid electrification under CAPEX subsidy, especially considering inherent demand risk.
- **Access to and affordability of appliances** is limited in rural regions, hindering electricity consumption.
- **Unleveraged synergies** between electrification technologies.
- **Connecting public institutions** is a geographical and economic challenge.
- There is **high risk of stranded assets** from first generation mini-grid deployment.

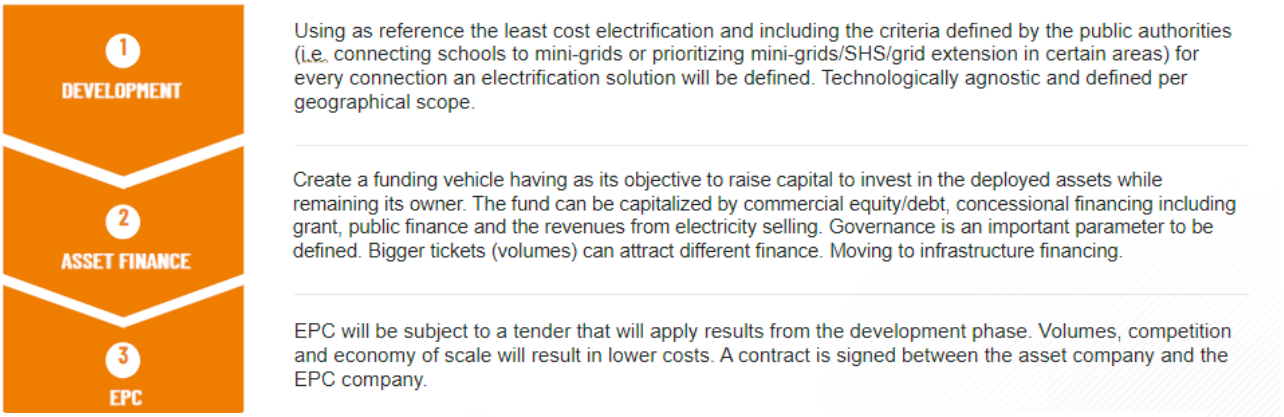
The following aspects of the global mini-grid context must be considered when searching for a suitable approach, in particular the mini-grids as infrastructure approach:

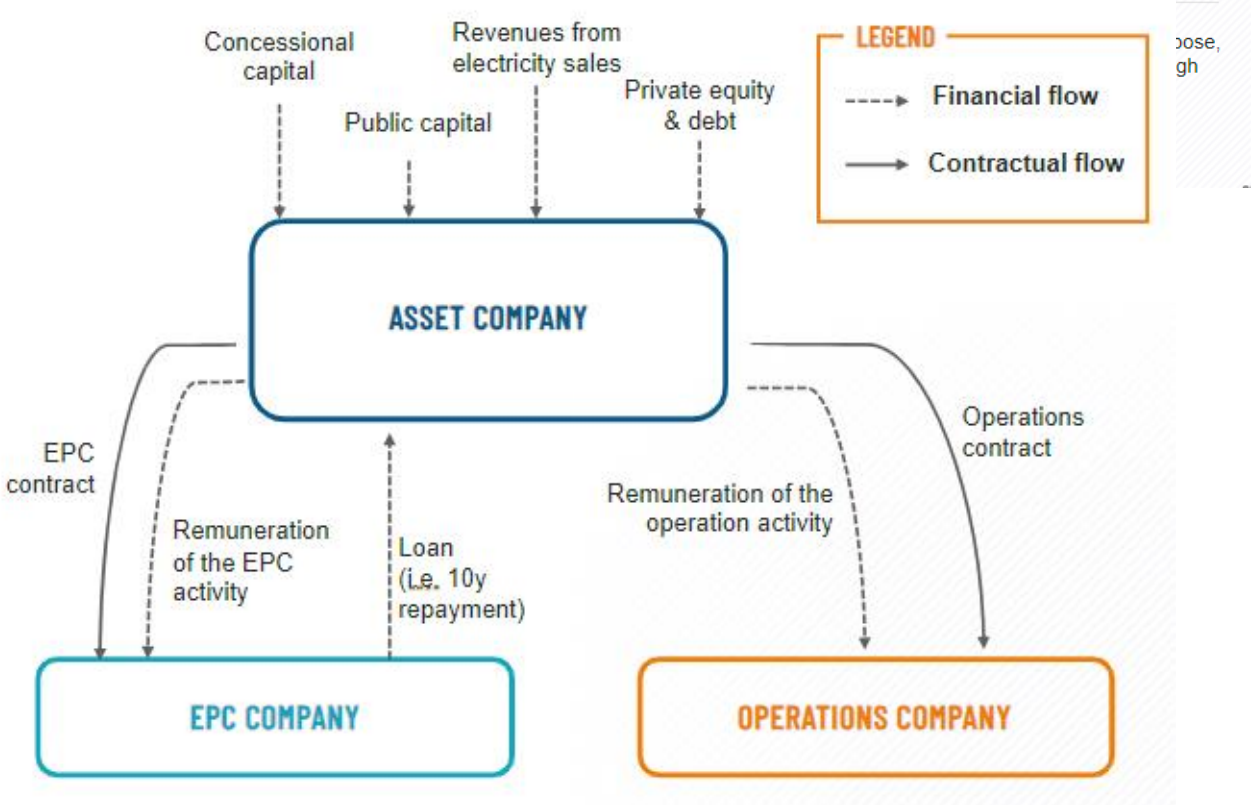
- **Asset-co Op-co-structure** is more and more widespread in the sector. **Unbundling off-grid activities is necessary:** development, operations, EPC and financing are different roles

that are carried by different entities in RES deployment. If we want to ensure sustainability, **operators need to be capable of focusing on operating**.

- Technology-agnostic least-cost solution electrification should be applied to decrease the electricity price. **Village selection by private developers is a redundant activity** that only ensures bankability, but not electrification.
- **Volumes are necessary** for attracting concessional and private capital (ticket size), new actors and to decrease the cost of capital.
- **Instead of de-risking** with a full private approach on financing that does not seem to be capable to attract the private sector, **could PPPs be a solution?**

The draft proposal for phase II in Zambia – which treats mini-grid as infrastructure – consists of the following elements:





The overall concept represented in the figures above leaves some open issues. Several interrelated questions remain unanswered, and they must be addressed in the discussion of this case study to arrive to an actionable proposal:

- What is included in the asset company? Only one technology or several? What is the geographical scope of those assets?
- How is the asset company financed? What percentage of private equity and debt, public capital and concessional capital?
- What is the level of control of the different stakeholders financing the asset company?
- How is the cost of service remunerated? What tariff should be charged to the population connected to these assets?
- How is the split of risks between the operations company and the asset company?