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TECHNICAL ASSISTANCE TO THE ETHIOPIAN ELECTRIC AUTHORITY (EEA) ON OFF-GRID REGULATORY FRAMEWORKS

TASK 4C: REGULATORY BEST PRACTICES FOR EEA

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REGULATORY BEST PRACTICES FOR EEA

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Executive Summary

The purpose of this report is to provide the Ethiopian Energy Authority (EEA) with best practices to consider on four topics as it continues to develop its mini-grid regulatory framework and project development capacity. Each best practice was identified from successful international applications and is presented with a definition, examples, challenges for implementation, and summary takeaways for EEA.

First, this report discusses how to design cascading regulations to enable mini-grid project development and avoid the stifling consequences of overregulation. Second, this report addresses designing concession regimes that match national energy goals with mini-grid developer interests. Third, the elements of designing a dispute resolution mechanism to navigate unforeseen mini-grid project challenges are presented. Finally, this report discusses methods for defining cost of capital to develop sustainable means of financing mini-grid initiatives.

The four best practice topics covered in this report are shown in Figure 1 below:

Figure 1: Overview of the Four Best Practices for Mini-grid Regulation

1) Designing Cascading Regulation: Simplified regulation for small mini grid systems

Introduction: Overview of Designing Cascading Regulation

Mini-grids are a diverse asset class in terms of size, technology, operating context, and profitability. To address the variability within the asset class, some regulators have implemented cascading regulations, which apply stricter regulation to larger projects (or more profitable projects, or projects serving areas with lower need) and less restrictive regulation to smaller projects (or less profitable projects, or projects in a more challenging operating context). Cascading regulations allow for a tiered approach to regulation that provides an appropriate level of effort from both the regulator and the developer of a project.

When effectively implemented, light-touch regulation allows regulators to focus on key issues—such as ensuring that prices are not unreasonably high and providing acceptable safety standards for developer and operator compliance. This simple, streamlined approach supports innovation and growth in the mini-grid market, reduces costs for regulators and developers, and allows effective regulation with limited regulatory capacity.

Complying with mini-grid regulations costs developers' time and money. In a sector with slim-to-negative (pre-subsidy) margins adding onerous regulatory requirements can negatively impact a project's commercial viability.[1] Unnecessarily onerous regulation--even when well-intentioned--can easily destroy project economics. For this reason, successful mini-grid markets are often regulated in a light-handed fashion in their early phases. Streamlining and simplifying regulatory process for mini-grids, particularly those below a certain size, allows developers the most flexibility to develop and establish financially sustainable business models.

This section will further delineate both the benefits and challenges of using this simplified regulation and provide concrete examples of its effective implementation in different contexts.

Streamlined Regulation in Practice

What is Streamlined Regulation?

Streamlined or light-touch regulation typically refers to a simplified regulatory framework that minimizes the "regulatory burden for private sector actors."[2] A streamlined regulation includes one or more of the following characteristics:

1. The amount of information the developers must submit to the regulator is limited;
2. There are few regulatory and administrative steps to follow, including few forms to submit;
3. Few site visits and audits are conducted, or required; and/or

[1]The World Bank. (2014). *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa*. Retried from: https://openknowledge.worldbank.org/bitstream/handle/10986/16571/9781464800931.pdf?sequence=1&isAllowed=y

[2]United Nations Development Program. (2018). *De-risking Renewable Energy Investment: Off-Grid Electrification,* pp.19. Retrieved from: https://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/DREI%20Off-Grid%20Electrification%20-%20Full%20Report%20(20181210).pdf

4. Documents for registering a mini-grid are simple and standardized.

To implement a simplified regulatory framework, a clear commitment from the various government agencies is required. For this commitment to emerge, various stakeholders in the sector must understand the benefits of (and ultimately justification for) light-touch regulation.

In practice, regulators must often follow an approach that balances efficiency with comprehensiveness to provide clear guidance and ensure protection of the market and consumers. Specifically, to maintain this balance, the five key areas where a light-handed approach is most beneficial are:

1. Market entry;
2. Retail tariffs;
3. Service standards;
4. Technical standards; and
5. The arrival of the main grid.[3]

Streamlined regulatory requirements may also include non-energy requirements such as an exemption from environmental and social impact assessments (ESIAs) for projects below a certain size, or for projects using certain technologies (e.g., solar vs. hydropower). To ensure effective and balanced light-handed regulation, regulators should still retain some level of oversight (including basic reporting and site visits to ensure basic electrical safety standards are met).

How It Works: Mechanisms for Streamlining Mini-grid Regulation

Streamlined, light-handed, and simplified regulation is particularly effective for small mini-grids with a capacity lower than 0.5 MW.[4] According to a World Bank survey, the majority of mini-grids across the globe have a capacity below 100 kW.[5] Considering the typically small size of these assets, a streamlined approach should apply to the majority of mini-grid projects. Light-handed regulation should be developed in such a way as to provide as much clarity as possible while reducing unnecessary regulatory obligations. In general, development costs should remain less than one to two percent of the total project cost.[6] Streamlined regulation should include ESIA procedures and permitting processes and may allow for mini-grid operations to self-register.

Apart from the four main characteristics listed above, regulators must consider a multitude of other relevant issues when seeking to implement a light-touch regulatory approach. The list below is not exhaustive, but rather provides examples of key actions regulators can take to develop more streamlined regulations.

[3] World Bank Group. (2019). *Mini Grids for Half a Billion People,* pp.74. Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/31926/Mini-Grids-for-Half-a-Billion-People-Market-Outlook-and-Handbook-for-Decision-Makers-Executive-Summary.pdf?sequence=1&isAllowed=y

[4] Africa-EU Renewable Energy Cooperation Programme (RECP). (2014). *Mini-grid Policy Toolkit: Policy and Business Frameworks for Successful Mini-grid Roll-outs,* pp. 54. Retrieved from: http://regulationbodyofknowledge.org/wp-content/uploads/2014/12/RECP_MiniGrid_Policy_Toolkit.pdf

[5] World Bank Group. (2019). *State of the Mini Grid Market Globally*. Retrieved from: https://atainsights.com/wp-content/uploads/2019/06/2.B.James_.Knuckles.World-Bank-notes.pdf

[6] International Renewable Energy Agency. (2016). *Policies and Regulations for Private Sector Renewable Energy Mini-grids*, pp. 51. Retrieved from: https://www.irena.org/DocumentDownloads/Publications/IRENA_Policies_Regulations_minigrids_2016.pdf

- **Clear procedures:** Clearly defined, widely available regulatory procedures minimize uncertainty for developers and limit the time and effort spent by both the regulator and developers in understanding processes.
- **Set an exemption threshold.** As demonstrated in the case studies below, setting a size threshold for exemption from a license, or for eligibility for streamlined regulation, reduces the burden on the regulator's time.
- **Capacity building:** To maintain clarity, streamlined requirements should be paired with capacity building initiatives, particularly for local level actors, to help regulators adopt effective and efficient light-handed regulation. These initiatives may take the form of trainings for government staff, developers, or community members.
- **Bundling approvals:** Bundling regulatory approvals for mini-grid sites under one company, or in one geographic area reduces the time the regulator must spend reviewing approvals.
- **E-governance:** Incorporating mini-grid regulation in e-governance (applying information technology for the delivery of government services) helps streamline regulatory process and reduces costs by allowing forms to be obtained and submitted online.[7]

Benefits of Streamlined Regulation

The regulator, developers, and other market stakeholders all benefit from employing a streamlined regulatory approach during the establishment of a mini-grid market. Four of the key benefits are that a streamlined regulation:

- **Minimizes barriers** to development (including a lack of retail regulations, capacity, political or legal uncertainty for investment decisions, and lack of current technical standards);[8]
- **Saves resources and time** of the regulator needed to approve and oversee mini-grid projects, including transaction costs;
- **Provides flexibility** for developers to determine project locations and business models. Such flexibility minimizes capital costs and allows for successful adaptation to changing conditions in the market and local context; and
- **Promotes innovation** by providing flexibility and opportunities for experimental business models.[9] Creating an environment that supports innovation leads to further growth in the mini-grid market.

Case Study Examples

Many countries have successfully adopted streamlined or cascading regulation for mini-grids. In addition to the following examples, other countries that follow a light-touch regulation for mini-grids include Sri

[7] *Mini Grids for Half a Billion People,* pp. 24.
[8] National Association of Regulatory Utility Commissioners. (2017). *Practical Guide to the Regulatory Treatment of Mini-Grids*, pp. 10. Retrieved from: https://pubs.naruc.org/pub/E1A6363A-A51D-0046-C341-DADE9EBAA6E3
[9] *De-risking Renewable Energy Investment: Off-Grid Electrification,* pp. 19.

Lanka, Zambia,[10] Uganda, and Kenya.[11] See Figure 2 for a comparison of different threshold levels from the case study examples.

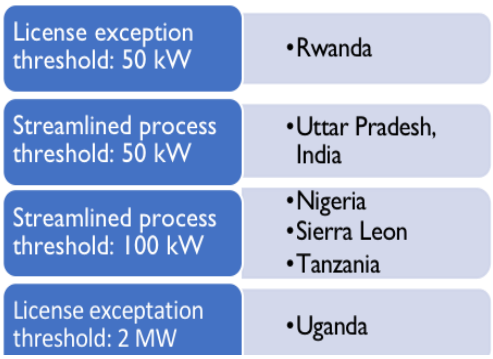

Figure 2. Examples of different threshold levels for a streamlined process

Tanzania's streamlining of its mini-grid regulation has led to growth in their market over the past decade. The Electricity Act of 2008 set the threshold for access to streamlined regulations at 1MW. This threshold was reduced to 100kW in 2015. The regulator Energy and Water Utilities Regulatory Authority (EWURA) conducted a five-year review to assess and revise the standardized power purchase agreement (SPPA) Framework, which resulted in this change and addressed the further development of renewable energy projects.[12] These streamlined regulations excused mini-grids with a capacity of 100kW or less from filing a retail tariff or applying for a generation license with EWURA.[13]

In addition, mini-grid operators may hold a single license for multiple sites, rather than needing to apply separately for each site. Small power producers (SPPs) can obtain a three-year license through a simplified regulatory process which allows them more time to conduct initial activities before applying for a final license.[14] EWURA standardized their PPAs and application forms for both off-grid and on-grid systems. EWURA also set specific feed-in tariffs based on the renewable energy technology and the project size.[15] The competitive bidding process for these projects includes identifying and securing appropriate sites, which requires effective coordination between the national government, district and village levels, to obtain local permission (including a land lease certificate or sales agreement for private land).[16] Prior to receiving the Registration Certificate, the operator must provide proof to the regulator that they have informed consumers of the proposed tariff through public meetings, notices and television and radio, in both Kiswahili and English.[17]

[10] GET.invest. (2019). *Zambia: Solar PV and Hydro Mini-Guide.* Retrieved from: https://www.get-invest.eu/wp-content/uploads/2019/06/GETinvest-Market-Insights_ZMB_Mini-grid_-Guide_2019.pdf
[11] *De-risking Renewable Energy Investment: Off-Grid Electrification,* pp. 82.
[12] Tanzania Traditional Energy Development Organization and World Resources Institute. (2017). *Accelerating Mini-Grid Development in Sub-Saharan Africa: Lessons from Tanzania*, pp. 44. Retrieved from: http://documents1.worldbank.org/curated/en/532751512396163620/pdf/WP-acceleratingminigriddeploymentsubsaharanafrica-PUBLIC.pdf
[13] *Policies and Regulations for Private Sector Renewable Energy Mini-grids*, pp. 8.
[14] *Accelerating Mini-Grid Development in Sub-Saharan Africa: Lessons from Tanzania*, pp. 47.
[15] *Accelerating Mini-Grid Development in Sub-Saharan Africa: Lessons from Tanzania*, pp. 45.
[16] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Oct/IRENA_mini-grid_policies_2018.pdf pg. 46
[17] http://www.ewura.go.tz/wp-content/uploads/2018/06/The-Electricity-Development-of-Small-Power-Projects-Rules-2018.pdf pg. 35-36

Tanzania balances protection for end-users with their light-touch approach through a rule that allows EWURA to review retail tariffs of very small power projects if the regulator receives a petition signed by at least 15% of households served by the project.[18]

Sierra Leone, on the other hand, has an exemption from some of the licensing requirements for systems below 100kW. In the process, it differentiates between a "***basic mini-grid license***," and a "***full license***".[19]

1. The basic license is available for projects under 100kW and includes an authorization to generate electricity as well as a sales license providing the right to sell power within a given unserved area. The basic license also features a more general set of health and safety requirements than a full licensee, and fewer audit-related requirements. For example, a basic licensee follows a set of health and safety guidelines whereas a full licensee must comply with a detailed health and safety code. [20] Mini-grid developers operating under the basic license may set tariffs jointly with the community. The Regulatory Commission intervenes if a consensus cannot be found. However, the basic license holder has limited protections in the event of main grid arrival—they are only required to receive a two-month notification to evacuate, and they receive no compensation.[21]

2. The full license provides the generation authorization, a distribution license, and a sales license. The full license holder faces more stringent auditing requirements, as well as stricter health and safety obligations. In principle, full license holders may charge cost-reflective tariffs (after factoring subsidies received). Tariffs must be submitted to the Commission for approval. Full license holders also have the right to compensation at main grid arrival.[22]

Nigeria provides an example of streamlining project selection and permitting. For mini-grids with less than 100 kW installed capacity in Nigeria, operators are not required to obtain a permit from the National Energy Regulatory Commission (NERC); a simple registration with NERC is sufficient. In addition, mini-grids under 100kW may set their own tariffs.[23] For projects between 100kW and 1MW, a permit is mandatory. Projects with permits benefit from compensation in the event of main grid arrival. Permitted projects must comply with the Multi-Year Tariff Order, which can restrict the level of tariffs allowable.

India's 2016 policy on renewable energy-based mini-grids provides operating frameworks to streamline project development procedures.[24] The state of **Uttar Pradesh** has a solo mini-grid private sector target of 25,000 mini-grids to serve 15 million people by 2023 (10% of the unelectrified population).[25] In states like Uttar Pradesh, the regulations are differentiated based on whether the project receives a 30% government subsidy. Projects that choose to move forward without the subsidy may select any tariff to which the community agrees and will be compensated when the main grid arrives. Projects that accept

[18] International Renewable Energy Agency. (2018). *Policies and Regulations for Renewable Energy Mini-Grids,* pp. 56. Retrieved from: https://www.irena.org/DocumentDownloads/Publications/IRENA_Policies_Regulations_minigrids_2016.pdf
[19] Sierra Leone Electricity and Water Regulatory Commission. (2018). *Draft Mini-Grid Regulations 2018.* Retrieved from https://ewrc.gov.sl/wp-content/uploads/2018/12/Mini-Grid-Regulations-2018-1.pdf
[20] For the health and safety requirements for a full license see https://ewrc.gov.sl/wp-content/uploads/2018/12/Mini-Grid-Regulations-2018-1.pdf pg. 96
[21] *Policies and Regulations for Renewable Energy Mini-Grids,* pp. 42.
[22] *Draft Mini-Grid Regulations 2018.*
[23] Nigerian Electricity Regulatory Commission. (2016). *Regulation for Mini-Grids 2016.* Retrieved from: https://nerc.gov.ng/index.php/library/documents/Regulations/NERC-Regulation-for-Mini-Grid/
[24] *Policies and Regulations for Private Sector Renewable Energy Mini-grids,* pp. 16.
[25] *De-risking Renewable Energy Investment: Off-Grid Electrification,* pp. 17.

the 30% capital subsidy face stricter quality of service regulations, tighter tariff regulations, and stricter safety and security standards.[26] Also, if the main grid arrives, the compensation formula used is based on the depreciated value of the assets, which excludes the initial subsidy received from the government.[27] For projects that opt for the 30% subsidy, the surplus electricity supply can be sold to a project-selected customer.[28]

In addition, Uttar Pradesh differentiates the regulations for mini-grid projects with regard to the technical standards: For projects above 50kW in size, a range of higher technical standards are in place, including standards regarding poles, junction boxes, distribution lines, and design and layout of the mini-grids themselves. For projects below 50kW in size, simplified technical standards are in place.[29]

The **Rwanda** Utilities Regulatory Authority has been following a simplified and streamlined regulatory approach for mini-grid project licensing since 2015. Mini-grids from 50kW to 100kW qualify for simplified permitting and licensing, while single systems under 50kW are exempted from licensing requirements altogether.[30] In Rwanda, most of the mini-grids developed to date have fallen under the 50kW threshold. Operators in Rwanda also have the flexibility to set their own tariffs. For example, after an operator sets their tariff, (if they choose to do so) regulators may review the licensee's tariff calculations to ensure that it is fair for the end-users.

Challenges in Designing Cascading Regulations

While "light-touch" regulation can drive growth in the mini-grid market, it also comes with some challenges which regulators should consider when designing potential mitigation strategies (see Table 1).

Table 1. Challenges in Designing Cascading Regulations

Challenge	Implication
Threshold limitations	When a cap is set for the limited size of a mini-grid project to fall under light-handed regulation requirements, projects tend to be designed to meet that gap, creating potential inefficiencies. For example, if projects under ~~100~~ 50 kW are regulated more lightly than those over ~~100~~ 50 kW, projects close to that cutoff may elect to stay under the threshold to avoid regulation, even if it would be more appropriate to develop a larger project. Setting a higher threshold of at least 100 kW reduces the presence of these inefficiencies, and is therefore recommended for the Ethiopian context.

[26] Ministry of Power, India. (2013). *Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations.* Retrieved from: http://www.cea.nic.in/reports/regulation/distributed_gen.pdf
[27] World Bank Group. (2017). *Mini-Grids in Uttar Pradesh: A Case Study of a Success Story.* Retrieved from: http://documents.worldbank.org/curated/en/181781512395036596/pdf/ESM-fUttarPradeshMiniGridsCaseStudyConfEd-PUBLIC.pdf
[28] IEA/IRENA Renewables Policies Database. (2017). *Uttar Pradesh Mini-Grid Policy 2016.* Retrieved from: https://www.iea.org/policies/6374-uttar-pradesh-mini-grid-policy-2016
[29] Centre for Science and Environment. (2018). *Mini-Grids in Uttar Pradesh Policy Lessons.* Retrieved from: https://www.cseindia.org/content/downloadreports/8826
[30] *Policies and Regulations for Renewable Energy Mini-Grids*, pp. 32.

Systems overwhelmed with project applications	If light-handed regulation is not balanced by some level of oversight or developer responsibility, systems are prone to being overwhelmed. For example, in Nepal, isolated mini-grids are exempted from tariff regulation and can benefit from capital subsidies to support the gap in the local consumers' ability to pay. These projects have minimal requirements for licensing and minimal oversight. As a result, in the past, the regulator was overwhelmed with applications from developers (many of which were not qualified), presumably to take advantage of the lighter-touch treatment, namely that such applications would be exempted from licensing and other requirements.[31] To mitigate the risk of a system being overwhelmed by frivolous applications, regulators should be sure to consider requiring a reasonable amount of effort and investment from potential developers before receiving a license or permit.
Limited customer protection	A regulator exists, in part, to protect end users from predation by mini-grid operators that are their only viable source of electricity. It is important that the regulator considers the minimum level of consumer protection they are comfortable with, and work to define the level of oversight required to ensure those protections. If that oversight is too lax, there is a chance that developers can charge unfair tariffs to end-users. Therefore, standards should balance the flexibility of a light-handed approach with consumer protection through two avenues: 1) bring tariffs in line with national tariffs by creating an encompassing, largely customer-funded cross-subsidy; or 2) allow for complete tariff determination at the site level, in close coordination with residents.
Less regulator control of the development sector	The inherent nature of light-touch regulation and the decreased burden it creates for the regulator afford the regulator less control over the mini-grid development sector. To ensure that this level of control does not lead to unintended consequences such as free-loading or price gauging, the regulator should establish clear and sufficient baseline standards and rules.

Key Takeaways for EEA

1. Streamlining the regulatory process for mini-grids minimizes barriers to entry for developers.
2. A light-touch approach reduces the resources and time required of EEA.
3. A light-touch approach provides additional flexibility for developers, which in turn promotes innovation and growth in the field.
4. A light-touch approach is not appropriate for every country's situation. This approach is best suited for new, isolated mini-grids serving new, rural customers (and is therefore

[31] *Mini Grids for Half a Billion People, pp.71.*

recommended for the Ethiopian context).

5. A key challenge in streamlining the regulatory process is ensuring the system does not become overwhelmed with applications due to a lack of regulation.
6. A light-touch approach must maintain a balance between promoting market reliable participation while maintaining affordability for all actors.
7. Introducing a "light-touch" regulatory approach requires buy-in and coordination across multiple different actors, and Ministries. In order to reduce the administrative burden for smaller sites, several different processes need to be streamlined, and this will require such coordination.
8. A light-touch approach in the Ethiopian context should go beyond tariff setting to most effectively lift administrative and regulatory burdens. For example, this approach should be integrated within the permitting process, licensing, environmental impact assessments, and other non-tariff areas.

2) Designating concession regimes for designated geographic areas

Introduction

Mini-grid development is frequently accompanied by geographic concessions or zones that provide exclusivity to a specific developer.[32] Such concessions are typically carved out by the government, occasionally in partnership with the private sector, and then tendered through a competitive bidding process. In a growing number of cases, government authorities conduct preliminary analyses of the economic and commercial viability of the different sites or concession zones.

Governments can designate areas for concessions that are isolated, not served by the national grid, or consist of mostly low-load customers. By granting the concession to private developers, governments can lessen to total financial cost it needs to expend to develop, build, and operate mini-grid projects. The main challenges for concession regimes include designing a model that creates investable opportunities sufficiently attractive to mobilize private investment, and ensuring long-term project sustainability. This involves designing concession regimes across a range of aspects, including exclusivity, duration, renewal, and revocation, while also laying out what options are available when the main grid arrives.

How Geographic Concession Areas Facilitate Mini-Grid Project Development

A concession is a type of Public-Private Partnership (PPP) wherein a public entity grants a private entity the exclusive right to invest, operate, and maintain distribution assets and sell electricity to end users for a defined timeframe and within a defined service area.[33] Defined concession areas can cover a region with potential to support multiple mini-grid projects, including both large and small villages as well as isolated settlements. The concession regime allows these disparate sites to be bundled and developed together by the concessionaire. This aggregation can help improve overall project efficiency, provide important economies of scale, and help lower individual project costs. In addition to overall cost efficiency, the advantages of using concessions for mini-grid project development include: tapping market forces to offset public financial costs, developing local entrepreneurship and capacity, and attracting more private investment to rural areas.[34] In addition, concession zones can also help increase ticket size, making it easier for larger players to enter the market.

With 78,000 new mini-grid powered connections since 2003, **Mali** is one of the leading sub-Saharan Africa countries in implementing a concession model for mini-grids to enable broader energy access.[35] The current model PCASER (*Projets de Candidatures Spontanées d'Electrification Rurale*) is administered by Mali's rural electrification agency AMADER (*Agence Malienne pour le Développement de l'Energie Domestique et de l'Electrification Rurale*). Mali has set out 10 concession zones (Zones d'Electrification Multisectorielle, ZEM) based on socio-economic criteria to adjust operating conditions to local economic conditions (agriculture, mining, emigration, etc.). Each zone must have a minimum of 5,000 connections. Within the zones, interested parties can propose mini-grid projects to AMADER, and if

[32] For more on concessions, see https://ppp.worldbank.org/public-private-partnership/agreements/concessions-bots-dbos
[33] *Mini-grid Policy Toolkit: Policy and Business Frameworks for Successful Mini-grid Roll-outs,* pp. 92.
[34] World Bank Group. (2017). *Rural Electrification Concessions in Africa : What Does Experience Tell Us,* pp. 27. Retrieved from : http://documents.worldbank.org/curated/en/347141498584160513/pdf/116898-WP-P018952-PUBLIC-Rural-Layout-fin-WEB.pdf
[35] *Rural Electrification Concessions in Africa : What Does Experience Tell Us,* pp.17.

authorized, they can qualify for an investment subsidy of up to 80% of the initial capital costs.[36] Mali's concession model combines "bottom-up" initiative from interested local developers and entrepreneurs as well as "top-down" involvement from AMADER in definition of concession areas and vetting of mini-grid project proposals.

Designating a Concession Area

When setting up concession zones, government authorities typically factor in a wide range of different considerations, including but not limited to:

- Distance from the national grid;
- Population total, as well as population density by village cluster;
- Road access;
- Socio-economic status (income per household) ;
- Presence of local industries (agriculture, fishing, etc.);
- Main resource availability (solar, hydro, biomass, etc.);
- Presence of unique cultural, environmental, historical, or other factors in the region; and
- Potential need (and associated costs) of future re-location of residents.

This compilation of factors can be a data driven process, with regulators prioritizing criteria that align with national development and electrification goals. Newly developed software tools that interpret geospatial data from satellite images can assist local socioeconomic data collection and analysis efforts. **Nigeria** has successfully used such programs to identify clusters of villages suited for mini-grid developments.[37]

Another common approach is to base concession zones off existing subnational administrative boundaries. As many socioeconomic indicators and administrative resources are already aggregated at these levels, concession zones in countries like **Senegal** have been set closely to jurisdictional boundaries. Adopting this approach can be a pragmatic decision when rural energy boards already have the capacity to manage and implement project development processes that mini-grid projects would require.

In 2008, Senegal established a total of 18 concession zones, which was subsequently reduced to 10, largely following regional administrative borders. Each concession provided an exclusive right to generate and distribute electricity over a period of 25 years. Six out of ten concessions were allocated to national or international companies between 2008-2013[38]; the remaining four concessions were granted to the national utility provider, Senelec, in late 2018.[39] As of 2019, Senegal has approximately 100 mini-grids in operation.[40]

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[36] World Bank Group. (2009). *Top Down Concessions in Mail and Senegal*.
[37] Village Data Analytics. (2019). *Scaling Mini-Grids with Machine Learning*. Retrieved from:https://minigrids.org/wp-content/uploads/2019/07/VIDA_TFE_short.pdf
[38] Africa-EU Renewable Energy Cooperation Programme (RECP). (2014). *Mini-Grid Policy Toolkit Case Study: Senegal*. Retrieved from: http://minigridpolicytoolkit.euei-pdf.org/system/files_force/attachments/Mini-Grid%20Policy%20Toolkit%20Case%20Study%20-%20Senegal60ab.pdf?download=1
[39] Dakaractu. (2018). *Concessions d'électrification rurale : L'Etat étend le champ d'action de la Senelec*. Retrieved from https://www.dakaractu.com/Concessions-d-electrification-rurale-L-Etat-etend-le-champ-d-action-de-la-Senelec_a158234.html
[40]USAID. (2019). *Off-Grid Solar Market Assessment Senegal,* pp. 19. Retrieved from: https://www.usaid.gov/sites/default/files/documents/1860/PAOP-Senegal-MarketAssessment-Final_508.pdf

Each concession zone in Senegal is required to have at a minimum 30,000 connections, and the government initially allowed different tariffs to be charged in the different regions, in line with cost recovery principles. As in Mali, mini-grid operators could qualify for an investment subsidy of up to 80%.[41] Tariffs are intended to cover operation and maintenance costs, as well as repairs. In order to implement its strategy, Senegal launched a technology-neutral competitive bidding process. Only villages with fewer than 200 households that were not slated for electrification in the coming three years qualified for mini-grid development. Due to a high reliance on funding from development partners, one lingering concern for Senegal is the financial sustainability of projects over time.[42]

By contrast, the lack of clear concession agreements, or well defined zones of operation for mini-grid operators, has led to a range of challenges in areas such as **Somaliland**, where a number of privately-financed mini-grids provide cost-reflective tariffs to customers, mostly using diesel or gasoline generators. In the absence of a clear regulatory framework, and without obligations related to customer service, or consumer protections, operators in Somaliland only supply those who can afford the full, cost-based tariffs, provide few customer protections, and actively oppose competition of any form from other players, or operators.[43] This has enabled electricity access for some, but lacks the long-term stability that can be provided by long-term concessions.

In order to support commercial viability, countries such as **Kenya** have attempted to refine the traditional concession model by segmenting the off-grid market into different end-use sectors. In Kenya's recently launched Kenya Off-Grid Solar Access Project (KOSAP) initiative, four different end-use sub-sectors have been delineated: 1) mini-grid access for community facilities, enterprises, and households; 2) stand-alone solar systems and clean cooking solutions for remote households; 3) stand-alone solar systems and solar water pumps specifically for community facilities; and 4) implementation support and capacity building.[44]

By segmenting the market in this way, Kenya is attempting to support more commercially viable operations for promoting energy access, as the business models and support mechanisms can be better targeted to the needs and challenges of each category of end-use demand. Areas or population clusters that can be most economically served by mini-grids can be zoned for mini-grid development, while lower-density regions can be zoned for stand-alone solar systems. Similarly, areas with significant productive use potential and (for instance) irrigation needs can be targeted by solar water pump-focused operators. In order to implement this more fine-tuned concession strategy, officials are drawing more heavily on geospatial planning to design more geographically targeted concession zones. A similarly differentiated approach is being adopted in Senegal's latest concessions as well, with different zones being targeted for either mini-grids, grid connection, stand-alone solar systems, or solar water pumps.[45]

Whichever approach is ultimately adopted, EEA should recognize the weight that deciding the perimeter of a concession area carries, as it has far-reaching implications for social, economic, and political

[41] *Top Down Concessions in Mail and Senegal.*
[42] Massachusetts Institute of Technology. (2019). *Assessing the Potential of Electrification Concessions for Universal Energy Access*, pp. 19. Retrieved from: http://energy.mit.edu/wp-content/uploads/2019/09/MITEI-WP-2019-01.pdf
[43] Hunt, Steven. (2019). *Update on UK DFID support to the Green Mini-Grids in Africa.* Retrieved from: https://minigrids.org/update-on-uk-dfid-support-to-the-green-mini-grids-sector-in-africa/
[44] Kenya: Off-grid Solar Access Project for Underserved Counties, *World Bank Group*. Retrieved from: https://projects.worldbank.org/en/projects-operations/project-detail/P160009?lang=en
[45] Commission de Régulation du Secteur de l'Electricité. (2019). *Revision des Conditions Tarifaires de Energie Rurale Africane (ERA)*. Retrieved from: http://www.crse.sn/sites/default/files/2019-11/DOCUMENT%20DE%20CONSULTATION%20PUBLIQUE%20ERA.pdf

interests and development priorities in the region. A clear public-private settlement, or compact, around the overall off-grid strategy, including on the need for the operations in the various zones to be commercially viable, has emerged as a key factor for success.[46]

Exclusivity, Duration, Renewal and Revocation of Concession Regimes

In addition to designating a concession zone, regulators also need to define licensing terms of a concession regarding key aspects such as exclusivity, duration, renewal, and revocation. This allows a concession to be tailored to the financial incentives offered as well as the broader goals for the overall off-grid strategy.

Exclusivity: Regulators can issue licenses exclusively or non-exclusively for the supply of electricity to a given area. Most concession regimes attempt to provide certainty to operators by providing an exclusive right over electricity supply, distribution and/or electricity retailing (i.e., sales) within a given geographic region. In exchange for providing territorial exclusivity, governments often impose a number of obligations, including milestones or targets, that the operator is expected to achieve. In order to provide more flexibility in terms of achieving electrification targets, operators are typically allowed to deploy a mix of mini-grids and stand-alone solar solutions. It is important to note, however, that concession regimes do not necessarily grant the developer a total monopoly on electricity generation, as customers (particularly productive use customers and wealthier households) frequently retain the right to self-supply (e.g., through onsite generators or solar home systems; see the Rwanda example below).

From the developer's perspective, gaining the exclusive right over electricity supply, distribution and sale can reduce several key risks, including risks from competition, while also elevating their interest in the project opportunity. Also, the ability to spread operations, maintenance, and after-sales service costs over a wider geographic area including a larger number of individual sites can provide important economies of scale, making it easier for operators to achieve commercial viability. In turn, unlocking such economies of scale can support government efforts to achieve electrification targets.

Rwanda provides an example of how exclusivity can be integrated with a broader rural electrification strategy. The National Electrification Plan of Rwanda outlines areas intended for mini-grid project development, where operators can apply and receive licenses from the Rwanda Utilities Regulatory Authority (RURA).[47] Rwanda's approach to granting concessions differs slightly from the approaches used in countries like Mali,[48] or Senegal,[49] or Madagascar,[50] in that its licensing regime does not guarantee a geographically exclusive right to electricity generation within a specific region. While the licensee has the exclusive right to distribute and sell electricity, it does not have a monopoly over generation in cases where the system is unable to meet local demand.[51] This means that customers

[46] *Update on UK DFID support to the Green Mini-Grids in Africa.*
[47] *Policies and Regulations for Renewable Energy Mini-Grids*, pp. 32.
[48] Malian Agency for the Development of Household Energy and Rural Electrification (AMADER). (2018). *Mali - Electrification: Concession Contract (Unofficial English translation)*. Retrieved from: https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/ppp_testdumb/documents/Mali1ICONCESSION0CONTRACT0YK.pdf
[49] Senelec. (1999). *Contrat de concession et de licence relatif a l'exploitation de plusieurs parties du secteur de l'electricite.* Retrieved from: *http://www.crse.sn/sites/default/files/2018-02/ContratConcessionSenelec.pdf*
[50] World Bank Group. (2015). *Evaluation of Rural Electrification Concessions in sub-Saharan Africa Detailed Case Study: Madagascar*. Retrieved from: http://documents.worldbank.org/curated/en/781221498152348689/pdf/116643-WP-PUBLIC-P150241-52p-Detailed-Case-Study-Madagascar.pdf
[51] Ibid.

(whether residential or commercial) can self-supply. Exclusive rights for distribution and retail of energy are granted by RURA to operators for a range between 5 to 25 years.[52]

Duration: Regulators can choose to place a time limit on a given license, or concession agreement. In many cases, the aim is for the concession agreement to be short enough so developers are incentivized to develop the project efficiently and to meet interim milestones, but long enough to incorporate time for necessary preparation work and to ensure a long-term commitment to the development of the electricity supply infrastructure.

For example, concessions for off-grid electrification in **South Africa** issued in 1999 provided a 5-year exclusive right to obtain government subsidies to electrify the targeted regions, combined with a 20-year concession agreement that provided territorial exclusivity over the supply of off-grid electricity services to households.[53] However, due to a range of administrative, planning-related, subsidy, and operational issues, only approximately 30% of the targeted households were electrified.[54] This underscores the importance of both setting interim targets and monitoring them over time, to ensure that the overall market, administrative, regulatory and subsidy conditions are sufficiently attractive to allow operators to achieve them. The targets and milestones established within long-term concession agreements are only meaningful if they are accompanied by regular monitoring to ensure that the growth in customer connections remains on track.

Most concession agreements are structured on a 20-year time horizon, including in Mali,[55] and Uganda,[56] with some extending to 25 years, such as in Senegal.[57] In some cases, specific clauses are included stating that the duration of the concession contract shall not exceed the time it takes to recoup the investment made.[58]

Renewal: Regulators can choose whether to make licenses and concession agreements renewable or not. Allowing renewal gives regulators the option to extend their relationship with a mini-grid developer or operator that has demonstrated strong performance, such as by delivering on their targets, and achieved the various milestones set out. Extending the operating licenses or concession agreements to such operators can potentially allow them to extend their impact in the country or region, while recognizing the networks and relationships they have built with the community or communities that have been electrified. By the same token, inserting a renewal clause in the concession agreement can provide an incentive for operators to provide reliable service.

Many mini-grid sites developed in **India** have undergone renewals of their concession agreements and operating permits.[59] In many cases in India, the mini-grid operators have demonstrated their ability to provide more reliable electrical service than the main grid and have managed to establish themselves as

[52] Ibid.
[53] *Assessing the Potential of Electrification Concessions for Universal Energy Access*, pp. 19
[54] Ibid.
[55] See: *Mali - Electrification: Concession Contract (Unofficial English translation)*.
[56] World Bank Group. (2015). *Evaluation of Rural Electrification Concessions in sub-Saharan Africa Detailed Case Study: Uganda*. Retrieved from:
[57] See: *Revision des Conditions Tarifaires de Energie Rurale Africane (ERA)*.
[58] Government of the United Kingdom. (2016). *Concessions Contracts Regulations 2016, Section 18.* Retrieved from: http://www.legislation.gov.uk/uksi/2016/273/regulation/18
[59] United Nations Foundation. (2014). *Minigrids for Rural Electrification: A Critical Review of Best Practices based on Seven Case Studies,* pp. 35. Retrieved from: https://rael.berkeley.edu/wp-content/uploads/2015/04/MicrogridsReportEDS.pdf

key service providers within the community, benefiting from direct community support, engagement, and even volunteering to ensure the continued operation of the mini-grid.[60]

By contrast, if operators fail to meet their targets, the government or regulator can opt to terminate the concession agreement at the end of the agreed-upon term.

Revocation: Regulators can also choose whether licenses or concession agreements can be revoked. If revocation is allowed, regulators gain the flexibility to grant the license to another developer if the terms have been violated, or the project is abandoned. It should be noted, however, that the revocation of a previously-signed concession agreement should be considered a last resort measure and reserved for egregious breaches of contract. If regulators want to allow revocation, they need to outline in a clear and legally-bounded process by which a revocation is legally permissible. Otherwise, the fear of baseless grounds evoked for revocation may raise project risk and lower developer's interests in pursuing projects.

Grid Arrival Options

Defining the options for grid arrival allows developers to better assess the full business opportunity and risks of a project, and avoids the least optimal outcome for developers and customers alike, abandonment. It is necessary for investors and operators of mini-grids to have clarity with regard to what happens if, or when, the main grid arrive; indeed, a *lack* of legal clarity over the options that exist is frequently cited as a major source of uncertainty for developers and investors in mini-grids and a major stumbling block in mobilizing investment.[61]

Four of the most common options regarding what happens when the grid arrives are summarized below:[62]

Convert to a Small-Power Distributor: The operator maintains a distribution network to deliver electricity to retail customers, but purchases electricity wholesale from the national utility. A legal right is conferred for the operator to sell electricity to retail customers within a defined area. The existing distribution system needs to meet interconnection standards with the main grid for this option to be viable. To better prepare mini-grids for this transition, regulators can both require operators to invest money in improving their systems to meet interconnection standards and offer them financial incentives such as zero-interest loans, subsidies, or direct investment support from the national utility, or energy Ministry.

In **Cambodia**, over 250 formerly isolated mini-grid systems are now connected to the national grid under this arrangement and serve over 1 million customers. The Electricity Authority of Cambodia (EAC) both required operators to invest in improving distribution systems throughout the lifetime of the project and offered operational subsidies to close the gap between the uniform retail tariff that otherwise would not have allowed operators to fully recover their actual costs. The EAC also offered engineering assistance to concessionaires to advise on how their systems could be built and operated to enable easier integration to the main grid.

Convert to a Small-Power Producer: The mini-grid system is connected to the main-grid and no longer sells electricity to retail customers. Instead, the system continues to use its existing electricity

[60] Ibid.
[61] *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa, pp. 228.*
[62] Ibid.

generating infrastructure to produce power that is sold directly to the national utility. A successful transition to this model requires a feed-in-tariff, or power purchase agreement, that enables the producer to continue to commercially operate the generating facility.

Convert to a Hybrid Producer-Distributor: Mini-grid systems can also be converted to both sell electricity to retail customers and generate electricity for sale to the national grid. In cases where the main grid has shortages of generation capacity as well as challenges with servicing local populations, this can be a fitting solution. Electricity sold to customers can involve a combination of electricity purchased wholesale from the national utility and generated retail by the mini-grid system operator. This can improve the reliability of service, enable customers to qualify for higher levels of service (e.g., using higher capacity appliances, or registering for a greater number of hours of daily electrical service than were available under the mini-grid service levels) while also potentially helping reduce costs to end consumers.

Compensation and Exit: Under this approach, also commonly known as the "buyout" option, the assets of the mini-grid system are sold to the national utility. This requires the mini-grid to be compatible (inter-operable) with the main grid's distribution assets. In addition, the utility has to have the resources to purchase, takeover, transition, operate, and maintain the system over time. In some cases, the national utility can complete the buy-out and retain local mini-grid staff to support with day-to-day operations. While the buyout value of the mini-grid assets cannot be determined at the beginning of a concession, the methodology that will be used to determine the mini-grid's residual value can be. The appraisal process can be outlined upfront by the regulator, usually some form of estimating the depreciated value of assets that are still serviceable when the concession expires. In the event that subsidies were used to finance the original mini-grid site, the level of compensation should be adjusted accordingly, specifically with regard to the nature of the subsidies in question.

Challenges with Establishing Geographic Concessions

Table 2. Challenges with Establishing Geographic Concessions

Challenge	Implication
Land-related Risks	Establishing right of way and community buy-in to acquire and operate mini-grids throughout the lifetime of a concession can be difficult. Not only can this be an additional upfront cost, maintaining community relations throughout the course of the project also requires investment.
Mobilizing Financing	As concession areas tend to be rural and remote, investment interest can be hard to garner from developers that fear low rates of return.
Uncertainty for Developers	National grid extension planning is often an opaque process, leading to a reluctance to commit substantial resources for mini-grid site development.
Ensuring Homogeneity Between Zones	Developers tend to bid for the most attractive, commercially-viable zones. This may not align with the areas that government deems most in need of electrification.

Balancing Financial Viability and Consumer Costs	In countries where mini-grid sites are allowed to charge higher tariffs, customers near the national grid have started to refuse service, pressing for coverage by the national utility instead. This further undermines the viability of mini-grid concessions.[63]
Long-term Sustainability	It is necessary to keep sufficient operation and maintenance funds to ensure both routine and larger maintenance are conducted. Despite the presence of high investment subsidies in countries like Senegal and Mali, the lack of cost-reflective tariffs makes it difficult for many sites to put aside sufficient funds for maintenance, as well as to ensure that upgrades are possible, including installing new meters, extending the mini-grid to new households, adding generation or storage capacity, etc.[64]

Key Takeaways for EEA

1. Designating zones with low electrification rates as concession areas can be a mechanism for EEA to aggregate and accelerate mini-grid project development.
2. The process of deciding concession zones is likely to draw regional attention and to require direct input from local communities and other stakeholders due to the various social, political, and economic consequences at stake.
3. To best fit the local context and lower project risks, governments can aggregate lower density with higher density regions in order to help operators achieve commercial viability. EEA can also consider whether to follow Kenya's approach by segmenting the market into different end-use sectors, outlining different concession agreements in order to target specific market segments, or allowing market segmentation within different concession zones.
4. Regarding grid arrival options, whichever option is selected, the EEA needs to provide clarity to operators and investors and ensure that the transition and compensation rules are fair, and enforceable.
5. Ensuring commercial viability and long-term project sustainability are the two main challenges facing concession models; no strategy that ignores these requirements will succeed in the long-term. The EEA can look to mitigate these risks by consulting the United Nations Development Program's de-risking tools for mini-grid project development.[65]

[63] *Off-Grid Solar Market Assessment Senegal,* pp. 14.
[64] Ibid.
[65] See resources found on: https://www.undp.org/content/undp/en/home/librarypage/environment-energy/low_emission_climateresilientdevelopment/derisking-renewable-energy-investment/guidance-materials-and-tools.html

3) Designing Dispute Resolution Mechanisms

Introduction

Dispute resolution mechanisms are a central component of regulatory regimes for mini-grids and other privately financed infrastructure projects. They are a common component of contracts for independent power producers and recur frequently in PPP projects across a range of sectors. The need for solid dispute resolution mechanisms stems from the multiple issues can arise over the course of the construction and operation of infrastructure assets. These issues can quickly devolve into litigation if not dealt with in a timely and impartial manner. Indeed, litigation through the courts can be costly and time-consuming for all parties, consuming resources that could be more productively allocated in promoting electrification. Thus, dispute resolution mechanisms exist to provide a framework through which disagreements (whether commercial, contractual, regulatory, or otherwise) can be resolved without reliance on courts.

In mini-grid regulation, disputes can arise over a number of different issues including, but not limited to: meter readings, power quality and reliability, tariff collection, changes to national grid expansion plans that potentially jeopardize the commercial viability of existing or planned mini-grids, asset valuation in the event of the arrival of the main grid, and aspects relating to suspected theft or vandalism.

Due to the variety and complexity of issues that can arise on the ground, it is important to have an impartial dispute resolution process in place, including a responsible body, committee, or individual, to adjudicate and deal with complaints and disputes. In most countries, the various parties to the dispute are urged to arrive at a satisfactory resolution on their own before engaging with the dispute resolution process. It is only in cases where the parties are unable to resolve their disputes on their own that the formal dispute resolution processes are initiated.

How are dispute resolution regimes designed in practice?

Dispute resolution is typically handled by an appointed body, committee, or individual that is selected to fulfil this role in a professional and impartial way, in accordance with a professional code of conduct or ethics. With regard to the selection of the individual or individuals who will make up the dispute resolution body, certain key qualifications are typically required, including prior experience in dispute resolution, an understanding of the market and of the sector as a whole, and impartiality and anti-conflict of interest requirements. In practice, such anti-conflict of interest provisions are introduced to ensure that the body or individual does not have any commercial interest in the outcome of the deliberations.

In addition, most formal dispute resolution processes feature a number of steps: Parties are initially urged to resolve the dispute themselves; failing this, the responsible individual, committee, or body is engaged to evaluate the matter and provide a ruling. In some cases, the complainant can also escalate the matter further by challenging the decision of the dispute resolution process, escalating the matter either to the regulator, or in more extreme cases, to the courts. In sensitive cases, for instance those in which large financial sums are at stake, international arbitration in an impartial jurisdiction can also be

mandated (e.g. London),[66] although it is highly unlikely that mini-grid investment volumes would ever reach sufficiently high levels to make such a provision worthwhile in practice.[67]

Examples from Select Jurisdictions

Nigeria's mini-grid regulations lay out a clear and detailed process for dispute resolution. Based on a review of similar regulations across Africa and Asia, Nigeria's approach for dealing with dispute resolution is among the most sophisticated and can therefore be seen as close to a "gold standard" for the mini-grid sector.

First, the regulatory commission is tasked with appointing a **Dispute Resolution Counsellor (DRC)** with the following powers and duties[68]:

- Administering and ensuring the effective operation of the dispute resolution provisions of the regulation;
- Specifying the format for notices of dispute and the responses thereto;
- Nomination of members of the Dispute Resolution Panel who shall be appointed by the Nigerian Electricity Regulatory Commission (henceforth, "the Commission");
- Assigning members of the Dispute Resolution Panel to mediate, conciliate, arbitrate or otherwise resolve disputes; and
- Facilitating the resolution of disputes.

The Dispute Resolution Counsellor must take all reasonable and necessary steps to resolve the matter within a period of 21 days, and they are remunerated by the Commission for their efforts. The decisions taken by the DRC are intended to be legally binding on all the parties.

In addition, the regulations set out pre-conditions for the **minimum qualifications** of the person identified to act as a DRC. That person must have specific subject-matter expertise and professional qualifications; a detailed understanding and experience of dispute resolution practice and procedures beyond civil litigation before the courts, including mediation and arbitration; an understanding of the Nigerian electricity industry; cannot be an employee of the Government of Nigeria; and cannot be, or have been, a member of the regulator commission.

Nigeria's regulations also include **anti-conflict of interest rules**: In order to ensure that the DRC has no commercial interests that may bias his or her judgment on the case, the DRC's spouse or relative cannot be a director, officer, employee, or agent of a distribution licensee, or mini-grid operator.

All matters that cannot be resolved by the DRC or by the parties will be referred to the **Dispute Resolution Panel (DRP)**, which is to be set up by the Commission.

The rules for the DRP indicate that the panel shall have at least three members. Each is to be appointed by the Commission and, like the DRC, members of the DRP must fulfill certain minimum qualifications. These include knowledge of the industry, understanding of litigation and arbitration, and a commitment to abide by anti-conflict of interest rules. When appearing before the DRP, the parties may appear

[66] See, for instance, the London Court of International Arbitration (LCIA): https://lcia.org/LCIA/introduction.aspx or the International Dispute Resolution Center: https://www.idrc.co.uk

[67] Mark A. Jamison (2005) *Rate of Return Regulation*. Retrieved from: https://www.researchgate.net/publication/228720046_RATE_OF_RETURN_REGULATION

[68] *Regulation for Mini-Grids 2016* Annex 10, Paragraph 10.

directly to make their case, or they can do so via legal representation. The rules state that the DRP shall strive to resolve disputes fairly and expeditiously.

After hearing from the parties, the DRP is mandated to arrive at a decision that will be binding on all parties, including levying penalties where appropriate. The work of the members of the DRP will be remunerated by the National Energy Regulatory Commission (NERC) at rates specified by the Commission itself.

While all parties are urged to seek to resolve grievances amicably, the Nigerian mini-grid regulations include further procedures in the event that a mini-grid operator wishes to lodge a complaint before the Commission against the DRP, or against the NERC itself. In this case, the complainants can apply before the Commission for a review of the decision within 21 days. The subsequent review must be conducted by the Commission within 60 days. If a question of law arises that Commission cannot resolve on its own, it may, of its own initiative or at the request of any party directly affected, escalate the matter to a court of competent jurisdiction in Nigeria.[69]

Finally, in the event that a satisfactory resolution still cannot be found, matters may be escalated to the level of the relevant court within Nigeria as a final resort. International arbitration (e.g., in London or elsewhere) is not foreseen, as in the case of some larger-scale Independent Power Producer projects; the sums involved are simply not deemed large enough to justify escalation beyond the level of in-country courts.

Nigeria's detailed dispute resolution procedures provide important insights for Ethiopia: A step-wise process is provided that enables matters to be escalated as needed; clear anti-conflict of interest rules are in place; importance is placed on competence and prior experience when selecting the DRC and members of the DRP; decisions are to be provided in writing; the DRC and DRP are remunerated for their time and effort; and each step of the process is accompanied by a time-limit, helping ensure that matters can be resolved expeditiously.

Cambodia, by contrast, has adopted a somewhat different approach. The EAC is responsible for resolving disputes with mini-grid operators in Cambodia.[70] Initially, EAC staff made regular site visits to monitor operations. However, due to the high transaction costs of conducting these regular site visits, the EAC adopted a different approach in 2013: It partnered with officials from the Provincial Department of Mines and Energy (PDME) to entrust certain monitoring duties, including dispute resolution, to local PDME officers located within individual provinces with mini-grids. In this capacity, the PDME officers may act on behalf of the EAC.[71]

The regulations in Cambodia also include a clear process for solving disputes. The first step involves up to 30 days of mutual discussions. If the issue cannot be resolved within 30 days, the matter will be referred to domestic courts. For disagreements over meter readings, or when a metering system malfunctions or stops operating, a certified laboratory can be invoked to determine the amount of electricity delivered during the relevant period.[72]

[69] Ibid.
[70] Joseph R. Rose, *Virginia Law Review*, Vol. 43, No. 7 (Nov., 1957), pp. 1079-1102. https://www.jstor.org/stable/1070617?seq=1
[71] Ibid.
[72] https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD-An-Introduction-to-Utility-Cost-of-Capital.pdf

Cambodia's case shows how a differentiated approach can be introduced to enable certain sets of issues (e.g., meter readings) to be dealt with via one set of processes, while other issues (e.g., disputes over asset valuation when the main grid arrives) are dealt with via a more formal process. Cambodia's rules also show how local officials can be empowered to resolve certain issues directly, without having to involve the regulatory commission. Devolving certain decisions to local authorities can help reduce the costs and delays associated with dispute resolution. This notwithstanding, it is important that matters can be escalated to higher levels of decision-making and appealed as required.

In **Ghana**, the entity responsible to act as arbiter with regard to commercial disputes is the Public Utility and Regulatory Commission (PURC). This arguably increases the risk for the developer, as there are no clear provisions for recourse in the event that the dispute is not resolved to the satisfaction of the complainant. Also, relying on the internal resources of the regulatory commission to conduct reviews adds additional burden to often over-stretched staff and can have negative impacts on the quality and consistency of decisions.

Rwanda's approach is in some ways similar to Ghana's: the RURA is responsible for acting as arbitrator in settling disputes and faces many of the same concerns discussed above. The process is designed mainly to deal with consumer complaints, not with grievances raised by mini-grid developers.[73] This underscores a significant issue: It is important that dispute resolution procedures provide means through which complaints both by customers and by developers-operators can be gathered, reviewed, and adjudicated.

Key Takeaways for EEA

1. Dispute resolution processes are critical to reassure investors that disputes will be dealt with in a timely and professional manner.
2. Dispute resolution processes should include **clear timelines** for the various steps in the process, with limits on the number of days within which decisions by counsellors or review bodies need to be made.
3. The decisions made by dispute resolution bodies should always be made available **in writing**.
4. Complainants should be provided with the option of escalating matters by appealing the decisions made by the initial dispute resolution body or counsellor. This can either involve the appointment of a "review panel" as in Nigeria, submitting an appeal directly to the commission, appealing directly to the courts, or in extreme cases, drawing upon international arbitration.
5. Individuals who are part of dispute resolution bodies should be **remunerated** for their role and compensated in a manner commensurate with local pay scales and the time commitment required.
6. Clear **qualifications** should be outlined for individuals selected to be part of dispute resolution bodies, or processes.
7. In order to arrive at rapid settlements (particularly for smaller disputes), the power over certain dispute resolution decisions can be devolved to a local government official, or body, as seen in Cambodia. Allowing local issues to be resolved locally, where possible, can help save costs and ensure that issues are dealt with expeditiously. In Ethiopia, this role could potentially be fulfilled by the Regional Energy Boards (REBs).
8. It is important that Ethiopia put in place procedures to ensure that complaints both from *customers* and from *developer-operators* can be gathered, reviewed, and adjudicated.

4) Defining the Cost of Capital for Mini-grid Companies

Introduction

Most traditional utilities rely on long-term capital to finance their investments in power plants and grid infrastructure. In markets like the United States, this has traditionally meant that utilities have relied on a combination of bonds, preferred stocks, or common equity.[74]

In traditionally regulated markets, regulators allow utilities to adjust their rates in order to cover their estimated revenue requirement. Eligible costs used to calculate the total revenue requirement include both capital and operating expenses, among others, as well as interest on the debt and the return paid to equity investors. This approach has often been referred to simply as "rate of return" regulation.[75] Although not without its downsides, the use of rate of return regulation has been instrumental in giving utilities access to long-term capital at attractive rates.[76]

In order to apply rate of return principles in the regulation of utilities, mini-grid operators or regulators have to make a number of assumptions about the company's cost of capital. However, determining the cost of capital for mini-grid operators is in many ways more challenging than doing so for traditional utilities.

How is the Cost of Capital Determined in Practice?

During the process of calculating utilities' revenue requirement, regulators rely on assumptions about the cost of debt, the cost of equity, and the relative share of each in the company's overall financing. These become the key input parameters in determining the utility's cost of capital. Determining the cost of debt is comparatively straight-forward and is typically based upon the most recent available estimate of debt costs (either from the issuance of bonds, or the provision of commercial or bank debt).

By contrast, determining the cost of equity has proved more difficult, and more contentious.[77] Given the various types of shares that utility companies can issue (common or preferred), whether dividends are paid out or not, and the different sources of equity they can draw from, regulatory determinations regarding the cost of equity often remain speculative.[78] In general, the prevailing view has been that the cost of equity should be commensurate with the returns available from other, alternative investments with comparable risks.[79] However, in markets throughout Africa, it is unclear what investments could be used as a benchmark for determining the appropriate rate of return for mini-grids.
A further challenge that arises is that in order to determine the cost of capital, assumptions must be made about the company's **capital structure** (namely, the relative share of debt: equity in the

[74] For a detailed overview of the issue of determining the cost of capital for electric utilities, see: https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD-An-Introduction-to-Utility-Cost-of-Capital.pdf
[75] Another option is the World Bank-affiliated International Center for the Settlement of Investment Disputes (ICSID), of which Tanzania, among others, is a part (Ethiopia has signed the Convention, but not ratified it): https://icsid.worldbank.org/en/Pages/about/default.aspx
[76] *Regulation for Mini-Grids 2016.*
[77] *Policies and Regulations for Renewable Energy Mini-Grids.*
[78] Energy Sector Management Assistance Program. (2018). *Mini Grids and the Arrival of the Main Grid: Lessons from Cambodia, Sri Lanka, and Indonesia.* Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/29018/134326.pdf?sequence=6&isAllowed=y
[79] Ibid.

company's overall financing). Research conducted in **Nigeria** indicates the mini-grid operators commonly have a debt-equity ratio of 70:30, with some additional share of grant financing.[80] As a benchmark, however, this is misleading, as mini-grid operators will exhibit different capital structures at different stages of market development. For instance, a recent report on access to finance in the off-grid sector posits that mini-grids in the early stages of market development will, on average, derive between 50-75% of their financing from grants. Even in mature mini-grid markets, it is estimated that the share of grants could remain as high as 30%, with the share of debt at 50% and equity at 20%.[81]

Returning to the issue of the cost of capital, in Nigeria debt financing has been obtained by mini-grid operators mainly through concessional loans and impact investors, as well as through crowdfunding platforms. The reported returns on equity have been in the range of **15-20%** on successful projects.[82] (Note that this is in the Nigerian context where the allowable tariffs are much higher than those being mooted in Ethiopia.) However, without details on the respective share of grant funding, it is difficult to draw any firm conclusions with regard to the capital structure or about the real weighted average cost of capital of mini-grid projects in the country.

For the mini-grid sector, other reports suggest indicative equity returns in the range of 12% to 16% on successful projects.[83] However, these values are still considered by many in the sector to be too low in light of the many risks inherent in siting, developing, and operating mini-grid projects. These risks include the lack of track record and the various political, regulatory, currency-related, and operational risks inherent in developing mini-grids. As such, many mini-grid developers in the market continue to argue that these risks require higher risk-adjusted returns, in the range of 15-20%,[84] or possibly even higher. Recent analysis comparing the region of Uttar Pradesh in India and Kenya indicate a cost of equity for mini-grid developers of between 21% and 23%, respectively.[85]

Note that **even where a certain rate of return is "allowed" by the regulator, many operators continue to fail to reach these returns.** This can be due to a range of factors, including higher-than-anticipated project costs, unanticipated delays, logistical and supply chain challenges, over-optimistic load forecasts,[86] currency fluctuations, or other factors.

In other words, due to the greater risks involved, rates of return well beyond this may be required to mobilize capital at scale.[87]

Challenges in Determining the Cost of Capital for Mini-grid Operators

In order to set or approve tariffs, regulatory commissions in traditionally regulated markets have developed methodologies to determine the cost of capital, including what constitutes a reasonable rate

[80] Rwanda Utilities Regulatory Authority, *Complaints Handling Procedures*. Retrieved from: https://www.rura.rw/index.php?id=126
[81] Sustainable Energy for All. (2019). *Energizing Finance 2019: Taking the Pulse*. Retrieved from: https://www.seforall.org/system/files/2019-11/EF-2019-TP-SEforALL-w.pdf
[82] Rocky Mountain Institute. (2018). *Minigrid Investment Report: Scaling the Nigerian Market*. Retrieved from: https://rmi.org/wp-content/uploads/2018/08/RMI_Nigeria_Minigrid_Investment_Report_2018.pdf
[83] *Mini-grid Policy Toolkit: Policy and Business Frameworks for Successful Mini-grid Roll-outs.*
[84] See infographic on: https://rmi.org/wp-content/uploads/2018/08/SEED_Nigeria_Infographic_Rd3_CF-1.pdf
[85] *De-risking Renewable Energy Investment: Off-Grid Electrification,* pp.20.
[86] Next Billion. (2019). *Do Surveys Fall Short? Solving the Challenge of Predicting Mini-Grid Energy Usage in Africa.* Retrieved from: https://nextbillion.net/predicting-mini-grid-energy-usage-in-africa/
[87] Nigerian Rural Electrification Agency. (2017). *Nigeria Minigrid Investment Brief.* Retrieved from: https://rea.gov.ng/Nigeria_MinigridInvestmentBrief_171202-V2.pdf

of return.[88] For context, the regulator-approved rates of return in the **United States** typically vary from 8% to 10%, occasionally rising above 10% depending on the market.[89]

Mini-grid markets, however, differ in many important respects. Determining the cost of capital for mini-grid operators faces a number of practical challenges (see Table 3 below).

Table 3. Challenges in Determining the Cost of Capital for Mini-grid Operators

Challenge	Implication
Mini-grid operators often operate in jurisdictions without fully functioning capital markets.	As a result, different mini-grid operators will have different backers, bringing different capital to the table (including a mix of concessional loans, low-cost capital from a parent company, venture, foundation, impact and even "patient" capital, as well as company or founder's equity, among others). The absence of a functioning local capital market from which mini-grid operators obtain their financing therefore makes it difficult (if not impossible) to arrive at one unitary cost of capital for all operators.
Mini-grid markets are frequently small and comprised of a small number of actors.	A small, nascent market makes it difficult to determine a reasonable cost of capital due to the small sample size.
Mini-grid operators are often more diverse than traditional utilities.	Mini-grid operators often feature a wider range of funding models, various shares of grant financing, and different mixes of local and international financing. In addition, there are important disparities between the various mini-grid operators, including between those backed by larger parent companies (e.g. Engie), those backed by philanthropic or impact capital, and those founded, financed and operated domestically (i.e. local mini-grid operators, such as Ethio). Such disparities mean that the different companies will face often radically different circumstances in accessing capital, as well as different costs of capital. In particular, companies backed by substantial shares of concessional loans or grants may skew the market, and provide an inaccurate picture of "real world" mini-grid financing costs. As such, the "cost of capital" as well as the capital *structure* will differ widely among the different mini-grid operators. It will therefore be difficult for regulators to apply one single "cost of capital" that accurately reflects the cost of financing conditions

[88] In this context, a reasonable rate of return is one that allows the utility (or mini-grid operator) to raise whatever capital it needs to make the necessary investments in the specific project or region in which it is active. See: Joseph R. Rose, *Virginia Law Review*, Vol. 43, No. 7 (Nov., 1957), pp. 1079-1102. https://www.jstor.org/stable/1070617?seq=1

[89] Penn State College of Earth and Mineral Sciences. *Mechanics of Rate of Return Regulation.* Retrieved from: https://www.e-education.psu.edu/eme801/node/531

	faced by the different operators active in the market.
There are substantial differences between the costs of *local* currency debt and equity (Birr), and the cost of *international* currency debt and equity (USD or EUR).	As such, regulators must set out estimates for the cost of both local and international funds that companies are likely to be relying on, without knowing how the shares of local and international funds differ among various operators. Moreover, the costs and availability of both funds are liable to change. In markets where local currency debt financing is available, the terms are often unattractive, featuring high collateral requirements, short loan tenors, and high interest rates.[90]
Many mini-grid operators cannot issue bonds or shares and cannot secure long-term corporate financing from banks because they are too small or not sufficiently mature.	This means that the financing conditions for a given operator will often change on a project-by-project basis. A mini-grid operator's cost of capital will differ over time as market circumstances change, while the blend of external financing sources itself will change as the company matures.[91]
While short-term commercial capital (including commercial debt) may be available within the local market for certain companies, the financing that is most needed by operators is typically *long-term capital*, and this is often scarce.	As a result, mini-grid operators face constant re-financing challenges, and continuous exposure to changing conditions in the capital markets. The absence of long-term financing makes it difficult to finance long-life assets such as grids and generators, and tends to disadvantage mini-grid operators with shorter funding horizons. Partly as a result, operators rely more heavily on equity, pushing up the costs of capital, or on grants, which make scaling up difficult.
Different mini-grid operators face different challenges with regard to exchange rates and currency convertibility.	While companies mainly financed with international capital may benefit from lower cost of capital, they will face greater currency convertibility issues than local actors. While local companies may be able to avoid some of the currency convertibility issues, they will often be required to pay far higher debt and equity costs than their international competitors. This again makes it difficult to arrive at simple comparisons of different mini-grid operators in a given market.
Mini-grids by definition feature highly diverse or different topography, levels of "remoteness", risk profiles, village economic structures, and load characteristics.	As a result, it can be difficult to set a unitary cost of capital for mini-grid operators operating in different regions of the country, as many operators will obtain different financing conditions for different mini-grid sites.

Senegal's tariff calculation methodology lays out a number of key parameters for the calculation of the cost of capital of mini-grid operators. For the concession agreement reached recently with ERA, a regional mini-grid operator, the regulations are based on a post-tax weighted average cost of capital of

[90] Energizing Development. (2019). *Rwanda: Off-grid Sector Status Report 2018,* pp. 19. https://www.urwegobank.com/wp-content/uploads/2019/09/EnDev_Off-Grid-Sector-Status-Report_2018.pdf

[91] *Energizing Finance 2019: Taking the Pulse.*

pre-tax 10.28% over a mini-grid's anticipated project life of 25 years. This is based on the assumption of a cost of debt of 10%, a cost of equity of 10.5%, and a ratio of debt-to-equity of 45:55.[92]

By comparison, the cost of capital (WACC) fixed for the national utility, Senelec, was previously set at 7.34%, after taking into account the cost of debt, the cost of equity, and the capital structure.[93] One third of all revenues are earmarked for deposit into an escrow account to ensure that sufficient funds remain available to cover the amortization of equipment and to finance the necessary maintenance. Note that this escrow account is not included in the calculation of the allowable tariffs, or of the overall revenue requirement; it is strictly instituted to ensure that sufficient funds are being put aside to ensure long-term operations and maintenance of the facilities.[94] Debt service costs and the return on equity must therefore be serviced out of the amounts remaining after funds have been withdrawn and put into the escrow account.

In Nigeria, the regulator retains the right to intervene if it finds that the cost of capital exceeds the prevailing rate for non-recourse commercial debt (in local currency) by more than 6%.[95]

Between 2008 and 2012, the NERC assumed a real pre-tax WACC between 7.9% and 10.8%.[96] For the period between 2012 and 2018, the NERC assumed a real after-tax WACC of 7%.[97] At this assumed WACC, mini-grids are simply not profitable.

Cost reflective tariffs in the Nigerian context are reportedly between USD 0.58 and USD 0.61/kWh.[98] Given the relatively low level of national tariffs in Ethiopia, and the difficulty in obtaining anywhere near these tariff levels in the Ethiopian context, it can be expected that developers will be unable to generate returns in the absence of substantial investment subsidies or viability gap funding. Subsidies in Senegal and Mali were previously set at 80%, while more recent projects in Nigeria benefited from subsidies between 25-75%.[99] In terms of the calculation of the cost of capital, it is common practice for grants to be excluded from the calculation of the WACC.[100] In other words, all funds received as grants or subsidies are excluded in the calculation of the revenue requirement, and from the need to provide a return on capital.[101]

Rwanda's mini-grid regulations provide some guidance on the rate of return allowed by mini-grid operators.[102] In its guidelines, RURA states clearly that operators are allowed to charge cost-reflective tariffs in order to meet their revenue requirement. While this explicitly includes a reference to a reasonable rate of return, further details about what constitutes a reasonable rate of return, and what the actual basis for calculating the cost of capital, remain unclear.

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[92] *Revision des Conditions Tarifaires de Energie Rurale Africane (ERA),* pp. 54.
[93] *Mini-grid Policy Toolkit: Policy and Business Frameworks for Successful Mini-grid Roll-outs.*
[94] Interview with Sacha Bodian, Senior Economist at the Electricity Regulatory Commission (CRSE) in Senegal, May 12 2020.
[95] *Regulation for Mini-Grids 2016*, pp.20.
[96] Nigerian Electricity Regulatory Commission. (2008). *Multi-Year Tariff Order I (2008-2013).* Retrieved from: https://www.iea.org/media/pams/nigeria/NIFERIA_MYTO1_FIT_20082013.pdf
[97] Nigerian Electricity Regulatory Commission. (2012). *2012 MYTO for Distribution*. Retrieved from: http://www.nercng.org/index.php/component/remository/MYTO/MYTO-2/2012-MYTO-for-Distribution/?Itemid=591
[98] World Bank Group. (2017). *Mini Grids in Nigeria: A Case Study of a Promising Market,* pp. 30. http://documents.worldbank.org/curated/en/352561512394263590/pdf/ESM-dNigeriaMiniGridsCaseStudyConfEd-PUBLIC.pdf
[99] Ibid.
[100] Interview with Sacha Bodian, Senior Economist at the Electricity Regulatory Commission (CRSE) in Senegal, May 12 2020.
[101] *Revision des Conditions Tarifaires de Energie Rurale Africane (ERA).*
[102] Rwanda Utilities Regulatory Authority. (2015). *Regulation N°01/R/EL-EWS/RURA/2015 Governing the Simplified Licensing Framework for Rural Electrification in Rwanda,* pp. 24. Retrieved from: http://www.reg.rw/fileadmin/user_upload/RURA-Simplified_Licensing_Regulations_FINAL_APPROVED.pdf

Per the regulation, "The required revenues to recover through tariffs charged by Licensees to their customers shall be determined as follows:

a. The reasonable costs of operating the grid, including depreciation charges and fuel costs if any, ***plus***
b. A reasonable return on the net fixed value of the generation and distribution assets, ***plus***
c. A reasonable margin to cover the costs of supply activities, ***less***
d. Subsidies or grants received specifically for the purpose of lowering tariff levels."[103]

RURA reserves the right to review the tariffs from time to time to ensure that they are reasonable.

Kenya provides a different approach, effectively letting the market determine the tariffs but still subjecting to regulatory review and approval. After extensive discussions among stakeholders and investors in the country, the regulations in Kenya allow developers to charge whatever tariffs they like, as long as their own internal rate of return (IRR) remains below 18%.[104]

Key Takeaways for EEA

1. Determining a unitary cost of capital across a diverse set of mini-grid operators is fraught with challenges. Given the critical importance of achieving electrification targets for the millions of households in Ethiopia without access to electricity, regulators should **avoid using overly-conservative values when estimating the cost of capital.**
2. Regulators should tread carefully when **trying to cap mini-grid returns via regulation.** Even if regulators attempt to estimate the real cost of capital in the market, the risk remains that many mini-grid operators will fail to achieve the levels of return estimated. This is likely to result in a dearth of investment in mini-grids in the country as investors continue to focus their efforts, and their capital, elsewhere. Kenya's approach is instructive in this regard, setting its return cap at 18% and opting for a (relatively) light-touch approach in terms of regulatory oversight and monitoring.
3. For projects that receive subsidies or grants, the grant amounts should be subtracted from the calculation of the revenue requirement, and the cost of capital.
4. Operators backed by large volumes of concessional financing, or grants, may skew the market, and provide an inaccurate picture of "real world" mini-grid financing costs. Regulators should caution against this, and **benchmark their cost of capital** against private, commercially-backed operators.
5. Although **local currency debt** may be available in some markets, most mini-grid operators continue to be financed mainly with equity, in combination with grants or subsidies. The greater reliance on equity pushes up the cost of capital, all else being equal.
6. Regulators should consider **currency and currency convertibility issues** carefully. The spread between the cost of debt and equity sourced in local and international currencies is often large and is liable to change over time as one operator goes from one financing round to another to expand access. Regulators need to ensure that they are clear about whether the cost of capital is the cost of capital in local currency or in international currency.

[103] Ibid.
[104] World Bank Group. (2017). *Mini Grids in Kenya: A Case Study of a Market at a Turning Point,* pp. 34. Retrieved from: http://documents.worldbank.org/curated/en/792001512392701402/pdf/ESM-cKenyaMiniGridsCaseStudyConfEd-PUBLIC.pdf