IGC

State Fragility initiative

POLICY TOOLKIT

Legal and regulatory framework: Facilitating an enabling environment for solar mini grids in fragile contexts

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Fragile situations face a range of regulatory challenges around mini grid development. This toolkit outlines practical ways in which governments can approach creating more conducive regulatory environments for deploying solar mini grids, including streamlining licensing processes, enhancing quality standards, and ensuring protection for both investors and consumers, including in situations where national grid extension reaches mini grids.

SEPTEMBER 2024

DIRECTED BY

LSE

UNIVERSITY OF OXFORD

FUNDED BY

The Rockefeller Foundation

Acknowledgements

The author thanks Ignacio Perez Arriaga (MIT Energy Initiative), Irene Calvé Saborit (Sustainable Energy for All), and Julio Eisman (Mesa de Acceso Universal a la Energía) for their careful and insightful review.

This toolkit could not have been written without the input of many colleagues who gave freely their time and shared their invaluable knowledge and insights on an enabling environment for mini grid development in both fragile and non-fragile settings.

For any inquiries about this work or further engagement, contact the IGC State Fragility initiative team at **sfi@theigc.org**.

In this paper

This paper is intended to offer a comprehensive guide for creating an enabling legal and regulatory framework to facilitate the deployment of solar mini grids in fragile and conflict-affected settings (FCS). It provides practical solutions for overcoming the barriers that hinder deployment of mini grids in FCS by outlining how governments can address key regulatory challenges, streamline licensing processes, enhance quality standards, and ensuring protection for both consumers and investors. To scale up investment in off-grid systems in fragile settings, collaborative efforts are required from a range of stakeholders, including donors, development finance institutions, philanthropic entities, private investors (both domestic and international), and energy project developers. Consequently, this paper outlines important lessons for other key stakeholders too.

The technological scope of this toolkit focuses on solar mini grids. However, these are only part of a necessary wider, integrated energy strategy that should include additional off-grid and grid-based technologies. Where relevant, we draw lessons from other technologies, such as diesel mini grids or solar home systems, and endeavour to ensure that this toolkit has lessons that can also be applicable for other technologies beyond the core focus of mini grids.

List of abbreviations

Abbreviation	Meaning
AfDB	African Development Bank
AMADER	Agence Malienne pour le Développement de l'Energie Domestique et de l'Electrification Rurale (Mali)
AMDA	African Minigrid Developers Association
DRE	Distributed renewable energy
DWRM	Directorate of Water Resource Management (Uganda)
EAC	Electricity Authority of Cambodia
EIS	Environmental impact study
EPQ	Energy power quality
FCS	Fragile and conflict-affected situations
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
kW	kilo Watt
MEMD	Ministry of Energy and Mineral Development (Uganda)
MIGA	Multilateral Investment Guarantee Agency
NEMA	National Environmental Management Authority (Uganda)
NERC	Nigerian Energy Regulation Commission
PCASER	Projets de Candidatures Spontanées d'Electrification Rurale
PPA	Power purchase agreement
PPP	Public-private partnership
SPD	Small power distributor
SPP	Small power producer
VAT	Value added tax

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Executive summary

Energy access remains a critical issue in fragile and conflict-affected settings (FCS), where instability, weak institutions, and limited infrastructure impede the development of sustainable energy systems. This toolkit offers a comprehensive guide for creating an enabling legal and regulatory framework to facilitate the deployment of solar mini grids in these challenging environments. By addressing key regulatory challenges, streamlining licensing processes, enhancing quality standards, and ensuring protection for both consumers and investors, the toolkit provides practical solutions for overcoming the barriers that hinder energy access in FCS.

The regulatory landscape in FCS is fraught with complexities that hinder the deployment of mini grids. These challenges include:

- **Unclear and lengthy licensing procedures** – Inconsistent or complex licensing requirements often result in delays and increased project development costs, which deters private sector investment.
- **Weak institutional capacity** – Regulatory bodies in FCS often lack the capacity to oversee and enforce energy regulations effectively. This institutional weakness results in poor coordination among stakeholders and inconsistent application of existing laws, further impeding the development of mini grid projects.
- **Security and political risks** – Operating in FCS involves significant security concerns, with political uncertainties and risks like currency volatility affecting the viability of mini grid projects and investor confidence.
- **Grid arrival uncertainty** – The potential extension of the national grid into areas served by mini grids presents a risk for investors. Without clear regulations to govern this scenario, mini grid operators face the threat of losing their investments if the main grid arrives.
- **Limited consumer and investor protection** – A lack of robust protections for consumers and investors undermines trust in mini grid systems. This gap can result in predatory practices, consumer dissatisfaction, and a reluctance from investors to engage in mini grid projects in FCS.

To address these challenges, this toolkit outlines several key strategies that policymakers, regulators, private sector operators, and donor agencies can implement to establish a more favourable environment for mini grid deployment, including:

- **Streamlining licensing processes** – Simplifying and expediting licensing procedures is essential to reduce administrative delays and lower project development costs. This can be achieved by adopting digital platforms for licensing applications, introducing provisional or bulk licenses, and creating a more flexible and transparent regulatory environment.

- **Implementing quality assurance frameworks** – Adhering to internationally recognised technical and safety standards is crucial for ensuring the reliability and sustainability of mini grid systems. Governments should establish and enforce clear standards for equipment, service quality, and environmental impact, ensuring that mini grid projects meet these benchmarks consistently.
- **Strengthening consumer and investor protection** – To promote trust and confidence in mini grid systems, robust consumer protection principles must be established. This includes ensuring transparency in service agreements, safeguarding consumer data, and providing accessible complaint resolution mechanisms. On the investor side, governments should implement transparent compensation mechanisms, offer political risk insurance, and establish dispute resolution frameworks to protect investments.
- **Facilitating grid integration** – As the national grid expands, clear contingency plans are needed to protect the investments made in mini grids. Policymakers should develop regulations that allow mini grid operators to either transition into becoming small power producers or small power distributors once the main grid arrives. Alternatively, compensation mechanisms should be in place to reimburse developers for their infrastructure.
- **Leveraging fiscal incentives** – Governments can incentivise private sector engagement by offering tax breaks, import duty exemptions, VAT relief, and loan guarantees. These measures reduce the financial burden on mini grid developers, making projects more economically viable in fragile environments.
- **Capacity building for regulators** – Investing in training and capacity building for government officials is essential to ensure that regulations are effectively developed, monitored, and enforced. By enhancing the technical and institutional capacity of regulatory bodies, governments can foster a more stable and predictable regulatory environment that encourages long-term investments.

Achieving energy access in FCS requires coordinated efforts from multiple stakeholders. Policymakers and regulators must work to create a regulatory framework that is flexible, transparent, and responsive to the needs of these challenging contexts. The private sector needs to adopt best practices in mini grid development while remaining agile to navigate the complex challenges in FCS. Donor agencies and development partners play a critical role in supporting capacity-building initiatives and providing financial instruments such as risk insurance to mitigate investment risks.

1. Introduction

A robust legal and regulatory framework is essential for fostering a well-functioning market for distributed renewable energy (DRE) technologies, such as solar mini grids. This framework oversees critical aspects such as licensing, quality assurance, risk mitigation for investors, and the establishment of clear lines of accountability among stakeholders though well-crafted legislation and contractual agreements. In fragile and conflict-affected settings (FCS), the absence of such robust frameworks could significantly hinder the successful deployment of mini grids. Without a clear legal foundation to operate mini grids, developers may struggle to obtain the necessary licenses for power generation and distribution.[1] This challenge is exacerbated by the prevailing weakness in institutional capacities and inadequate enforcement of existing laws and regulations. Addressing these challenges is essential to fostering an enabling environment for mini grids.

The discourse on mini grid regulation is influenced by two philosophies:

i. **Light-handed** government regulation aimed at minimising barriers to private sector development, and

ii. **Comprehensive** government regulation intended to ensure that mini grid projects are deployed systematically, safeguard consumer interests, and deliver electricity services compliant with the standards of the national grid.[2]

In practice, mini grid regulation should strike a balance between these approaches, focusing on creating an enabling environment for the mini grid market by establishing a straightforward and efficient deployment process. This should include the following key principles:[3]

- Minimise the additional workload of regulatory staff
- Minimise the amount of information required by the regulator
- Limit the number of separate regulatory processes and decisions
- Use standardised templates, documentation, and forms
- Acknowledge and leverage related decisions made by other governments or community bodies.

1 USAID, n.d.a.
2 USAID, 2017.
3 ESMAP, 2019.

Flexibility and responsiveness to the local context and evolving dynamics of the mini grid market are equally important for regulations. This policy toolkit aims to offer practical tools for developing a clear enabling regulatory regime for mini grid deployment. Nigeria emerges as one of the frontier countries with a comprehensive set of mini grid regulations in Africa, covering issues such as licensing, retail tariff setting, and contingency planning for grid integration.[4]

This policy toolkit explores the legal and regulatory frameworks that are needed to facilitate an enabling environment for mini grids systems and covers the following topics:

- Mechanisms to streamline and simplify **licensing** processes
- Ensuring **quality assurance** through standards implementation
- Strengthening **consumer protection** policies
- Contingency planning for **grid integration**
- Identifying appropriate **contractual agreements**
- Implementing **fiscal incentives.**

The scope of this toolkit is limited to non-financial regulatory issues related to the deployment of mini grids, such as licensing, quality assurance, risk mitigation for investors, and the establishment of accountability mechanisms through legislation and contractual agreements. Other critical regulatory aspects outside the scope of this paper, including tariffs, subsidies, and financial mechanisms, are addressed in the accompanying policy toolkit *Financing and de-risking tools and approaches for solar mini grid projects in fragile contexts.*

While this toolkit primarily targets policymakers in FCS, addressing energy access challenges in these settings necessitates collaboration among all stakeholders, including mini grid companies, private operators, regulators, the donor community, and national governments. Developing and implementing effective laws and regulations is essential for overcoming systemic challenges and advancing energy access in fragile environments. By working together to establish robust legal and regulatory frameworks, stakeholders can create an enabling environment for the deployment of mini grids, ultimately fostering socio-economic development.

4 Across Asia and Africa, countries like Bangladesh, Cambodia, India, Kenya, Nigeria, Rwanda, Tanzania, and Zambia have developed regulatory frameworks for mini grids that address key issues (ESMAP, 2019).

2. Key regulatory challenges in fragile contexts

Key regulatory challenges in fragile contexts hinder the effective deployment of mini grids, exacerbating complexities in regulation. These challenges are particularly acute in FCS due to undeveloped public-private partnership (PPP) frameworks, limited institutional capacities, and risks such as demand fluctuations, currency instability, and political uncertainties. These challenges prevent stakeholders from planning and developing bankable projects and attracting private sector investment. In general, the lack of an enabling regulatory regime is a primary impediment for the deployment of mini grids. Some key challenges hindering mini grid regulation in FCS include the following:

- **Ambiguous and distorted electrification plans/policies** – FCS often struggle with inconsistencies or gaps in their national electrification strategies, resulting in uncertainties for potential mini grid developers. Institutional inefficiencies and lack of coordination could also be exacerbated due to the increased focus on security issues which can sometimes overshadow other developmental priorities.[5] Integrated planning that includes various electrification modes, along with geospatial algorithms to select the optimal mode for each area, can improve coordination.[6]

- **Lack of flexibility and fit-for-purpose policy frameworks** – Where regulatory frameworks do exist, they may not be sufficiently adapted to the unique needs and challenges of mini grid projects in these settings.

- **Weak institutional capacity** – State capacity and institutions are often weak in fragile settings,[7] which could make it challenging to effectively regulate and oversee mini grid operations. Constrained capacity could result in regulatory gaps, enforcement challenges, and a lack of expertise to support the mini grid market.

- **Complex and lengthy licensing processes** – Overly complicated and rigid licensing procedures can deter potential investors and operators, preventing the timely deployment of mini grid projects as the process is too time- and resource-intensive. Thus, it is important for regulators to develop straightforward and efficient approval processes for mini grids projects to minimise project development time, costs, and risks.

5 Korkovelos et al., 2020
6 IEEE, 2019.
7 Logan & Sacchetto, 2021.

- **Political sensitivities** – Mini grid regulations can sometimes become entangled in complex political dynamics of FCS, leading to delays, uncertainty and, in some cases, project disruptions. Sustainable energy access requires not only clear regulations but also strong, long-term political commitment at the state level to ensure stability and support for energy initiatives over time.

- **Security risks** – Operating in FCS inherently carries security risks for mini grid infrastructure, staff, and customers. Robust security measures, contingency plans, and due diligence assessments are needed to mitigate these risks and safeguard mini grid operations.

- **Arrival of the main-grid** – The possibility of the main grid extending into areas served by mini grids can create regulatory challenges and must be factored into planning and coordination.

- **Poor enforcement and implementation of regulations** – Inadequate enforcement and follow-up of regulations and standards during project implementation undermines regulatory effectiveness.

- **Lack of adherence to technical standards** – The failure to enforce international technical standards for mini grids increases the risks posed by poor-quality equipment. This may result in electrical safety issues, suboptimal quality of service, and high service costs for consumers. It is essential for regulations to not only establish clear technical standards but also mandate their consistent application to improve the quality, consistency, and reliability of mini grid projects.

These challenges may be overcome by developing clear regulatory rules and stimulating an enabling environment for the deployment of mini grid projects in FCS.

3. Licensing

Licenses play a pivotal role in shaping the landscape for mini grid developers, defining their rights and responsibilities in carrying out electricity generation and distribution activities. Licenses typically vary in scope and encompass a range of criteria, including operational conditions, performance requirements, and technical and financial feasibility, among others. The speed at which licenses are issued varies significantly and is often unpredictable.

In many countries, licensing of mini grids remains a key obstacle for developers to scale up mini grid deployment and achieve economies of scale.[8] Unclear, lengthy, and rigid licensing procedures tend to deter investors from entering certain markets as it can introduce significant project development risk, delays, and damage the economic viability of mini grid projects. On average, obtaining a license for a mini grid site takes 26 weeks, with developers having to repeat the approval process for each new 100 kW site.[9] Additionally, lengthy licensing processes contribute to project costs, with estimates suggesting that these costs exceed 10% of a project's capital costs in some countries.[10]

In most cases, the licensing process requires regulators to make decisions on several fundamental issues, including:

- Whether and in which cases to **require a license** – This requirement varies by country, with many countries now adopting a capacity-based approach. Projects below a specific capacity threshold are exempt from the licensing process, while those above require it. For example, Mali exempts projects under 20 kW, Zimbabwe and Tanzania under 100 kW, and Namibia under 500 kW, while Rwanda's requirements vary based on project size.[11] Some countries, such as India, do not require licenses at all and use a simplified registration process for systems under a certain capacity or during the infancy of their mini grid sector. **Table 1** below summarises the advantages and disadvantages associated with license requirements.
- The **process** for issuing licenses.
- The **duration and exclusivity** of licenses.
- Whether license holders will be permitted to **resell their rights**.

8 Energypedia, n.d.
9 AMDA, 2022.
10 ESMAP, 2016.
11 Ibid.

Table 1 Advantages and disadvantages of licensing

	Advantages	Disadvantages
No license requirement	• Reduce project development costs for mini grid developers. • Requires fewer financial and staff resources.	• Less protection for end-users from predatory or spurious mini grid developers. • Lack of comprehensive information on all mini grid projects and developers. • Additional project risk as no security associated with licenses.
License requirement based on capacity of mini grid	• May cut down on length and complexity of approval process. • May reduce number of projects that require review, which can free up resources	• Regulators do not obtain information on all mini grid projects and developers • Some mini grid projects will be developed without being reviewed by the regulatory agency, potentially resulting in varied quality and reliability of mini grids. • Developers give up the security that a license provides, potentially introducing additional risk. • Developers may opt to build projects that do not require a license.
License requirement	• Allows regulators to maintain maximum control over project deployment. • May result in greater consistency across mini grid projects.	• May lead to lengthy, time-intensive reviews for small-scale projects. • Development risks and costs may increase, making developers less likely to enter a country's market. • Requires regulatory capacity to carry out licensing review for small projects.

3.1. Mechanisms to streamline license processes

Developing a simplified and clear regulatory framework to streamline and shorten the licensing process can minimise administrative costs and ultimately accelerate the deployment of mini grids in FCS. This can include the following measures:

- **Provisional licensing** – Introducing provisional licenses can provide developers with temporary exclusivity to build mini grids within specific geographic zones for a period of one to five years. This could be used to carry out assessments, structure project financing, and secure land for the mini grid sites. For example, Sierra Leone issues single licenses allowing developers to generate, distribute, and sell electricity, resulting in the licensing of over 50 mini grids in a single year.[12] Similarly, Tanzania allows developers to obtain a single license for several distinct sites, strengthening operational efficiency. Kenya provides provisional licenses for three years and Nepal for five years.[13]

12 SEforALL, 2020a.
13 EWURA, 2016; Tenenbaum et al., 2014.

- **Bulk licensing of mini grid portfolios** – Current regulations are largely based on regulators approving and monitoring a small number of large mini grid projects.[14] Shifting towards bulk licensing of portfolios, rather than individual sites, can significantly reduce bureaucratic complexities and associated costs.[15] This approach has been successfully implemented in a number of countries, including Uganda, Sierra Leone, and Zambia, ensuring that regulatory compliance and consumer safety are better suited to large-scale mini grid deployment.[16]

- **Digitalisation** – The licensing process can be streamlined by leveraging digitalisation and using smart and remote monitoring technologies to help accelerate approval processes, optimise efficiency, and reduce compliance timelines. For example, Nigeria has been a frontrunner in this regard, employing tailored management tools to facilitate licence applications for mini grid companies.[17]

- **Programmatic and tiered permitting** – Instituting standardised permitting processes tailored to projects with similar technical characteristics (e.g., technology, size, geographical location, etc.) can help streamline regulatory procedures.[18] Additionally, adopting tiered permitting based on project size can support the development of smaller projects. For example, governments may exempt projects smaller than 100 kW from the normal licensing processes and just require them to complete a simplified registration procedure.

- **Flexibility and adaptability** – Adjusting licensing frameworks to accommodate varying project capacities and streamlining certification can support a more flexible regulatory landscape. This can include considering deregulation in certain cases (e.g., India), while ensuring that mechanisms and support schemes are put in place to secure project viability. In some countries, such as Peru, mini grids with more than 500 kW capacity are required to obtain two licenses – one for generation and one for distribution. A basic mechanism to simplify this process is to allow for a single license to manage the entire mini grid, reducing administrative burden and speeding up project implementation.

Streamlined processes not only avoid the duplication of work but also ease the burden on governments. An onerous, complicated, lengthy, or costly approval process could lead to higher development costs and increase risks for project developers and investors, creating a major barrier to market entry. **Box 1** provides an example of key characteristics of an effective approval process for mini grids.

14 Ibid.
15 UNIDO, 2020.
16 Ibid.
17 Ibid.
18 AfDB, n.d.a.

BOX 1 KEY CHARACTERISTICS OF AN EFFECTIVE APPROVAL PROCESS[19]

Ensuring that the approval process for mini grids is both clear and transparent is essential. Transparency in this process can significantly reduce the risk of corruption, enable better-informed decision-making, and expedite approvals by minimising the chances of incomplete or inaccurate applications.

Key characteristics of an effective approval process include:

- Transparency in the process, with clearly defined decision-making criteria accessible to applicants.
- A logical and transparent sequence of general business and electricity sector approvals.
- Final decisions regarding licensing or tariffs are informed by input and decisions from other governmental bodies.
- The process incentivises timely decision-making by national and local government agencies, while also insulating decisions from political influence.
- Commitment from the government or lead agency to conduct external evaluations of the approval system every two to three years.
- Clearly articulated review and approval processes available on the regulatory agency's website.

The regulatory agency should also develop online resources, including:

- Checklists outlining required actions and documents for each stage of the approval process.
- Template documents to guide developers in providing necessary information in a useful format.
- A comprehensive timeline for the review and approval process.

19 Adapted from Tanenbaum et al., 2014.

4. Quality assurance frameworks

Adhering to comprehensive quality assurance frameworks is critical to ensure the operational efficiency and successful deployment of mini grid systems. Quality assurance frameworks cover a range of aspects including equipment quality, warranties, operations, design, longevity, certifications, environmental sustainability, installation procedures, and best practices. They can be categorised into three key areas, which will be covered in more detail below:

- Equipment and system quality
- Quality of service
- Commercial service.

The National Renewable Energy Laboratory and United States Department of Energy have developed a **quality assurance framework** for mini grids.[20] The framework includes an accountability system aimed at defining and formalising the relationships between various stakeholders, including mini grid developers, regulators, investors, and customers. The framework is comprised of two key components:

- **Utility accountability** – This focuses on systematic data collection and dissemination regarding mini grid services. This includes technical reporting on power quality, reliability, system efficiency, as well as business reporting on operational and financial aspects.
- **Consumer accountability** – This ensures that consumers receive the expected level of service through appropriate checks and balances, strengthening confidence in the mini grid system and willingness to pay for its services. It establishes a recourse process for dissatisfied consumers and solidifies the buyer-seller relationship.

Ultimately, robust quality assurance frameworks and standards are needed to oversee product quality, ensure safety, enhance reliability, and optimise the overall efficiency of mini grid installations, while also promoting uniformity and compatibility within broader electricity infrastructure.

20 Baring-Gould et al., 2016.

4.1. Equipment and system quality

The performance and sustainability of any mini grid system lies in the technical quality of its components, overall system design, and the safety of its operations. This involves adherence to strict technical and safety standards to ensure that mini grid equipment (such as solar panels, inverters, and batteries) is certified, reliable, and safe for use. Ensuring compliance with established standards like those set by the International Electrotechnical Commission (IEC)[21] helps prevent system failures, enhances longevity, and safeguards against hazards.

- **Technical standards** – The adoption of technical standards can guarantee the quality, reliability, and proper functioning of mini grid components while facilitating effective monitoring and evaluation of these projects.[22] Certified equipment is key to guaranteeing both optimal system performance and user safety. For example, Nigeria mandates compliance with the Nigerian Energy Regulation Commission (NERC)'s Distribution Code for mini grid permit eligibility, while Tanzania collaborates with international partners to establish similar quality standards. Some countries, such as Australia, have streamlined the process for mini grid developers by pre-approving equipment that meets technical standards.[23] These standards define the minimum requirements for components and ensure optimal performance across various systems.

- **System design and implementation** – Alongside technical quality, the design, procurement, and installation processes of a mini grid system are critical to its success. Proper system design and adhering to best practices not only ensures operational efficiency but also promotes long-term sustainability. Thus, well-planned systems help prevent early system failures[24] and enhance resilience, which is particularly important in FCS.

- **Safety standards** – Rigorous safety standards are essential for both the protection of infrastructure and the well-being of users, ensuring the reliable, safe, and sustainable operation of mini grid systems. By enforcing rigorous safety standards, regulators can foster trust in mini grid technology and promote its widespread adoption. For example, Sierra Leone ties government incentives to the use of mini grid equipment that meets IEC certifications, ensuring high-quality and safe products in the market.[25] This is particularly relevant in FCS where the prevalence of large informal markets for solar products raises concerns about equipment quality, posing challenges to the expansion of the mini grid sector. Robust enforcement of safety standards is essential to mitigate risks and ensure the uptake of high-quality equipment.

21 USAID, n.d.a.
22 AfDB, n.d.b.
23 USAID, 2017.
24 Dutt & MacGill, 2013.
25 SEforAll, 2021.

BOX 2 SAFETY STANDARDS IN NIGERIA

In Nigeria, adherence to health and safety standards for mini grids includes the following requirements:

- Maintaining a prescribed frequency range.
- Providing advance notification of outages to users at least 72 hours in advance.
- Reporting any significant incidents, such as equipment malfunctions or electrical-related injuries, to the Nigerian Electricity Regulatory Commission (NERC) within 24 hours.

These measures promote transparency, accountability, and user safety within the mini grid sector.

4.2. Quality of service

The quality of electricity service provided by mini grids is critical for ensuring user satisfaction, system reliability, and long-term sustainability. It is measured by key performance metrics such as the consistency and reliability of electricity supply, limits on voltage and frequency fluctuations, and the speed with which service is restored after outages. Quality of service also extends to broader discussion on environmental, social, and governance (ESG) standards and environmental impact assessments. Additionally, robust **due diligence assessments** are crucial for managing and mitigating risks effectively, especially in fragile settings.

Service quality standards establish the minimum electric service a mini grid developer must provide to its customers, which is typically determined by three components:

- **Availability** – The existence and duration of the electricity service
- **Capacity** – The amount of power that is made available to end-users
- **Reliability** – The frequency of unplanned interruptions in supply.

While standards are necessary to uphold the quality of service, it is equally important for regulators to refrain from implementing overly stringent standards that could make mini grid development too costly, discourage the growth of the sector, or hinder innovation.[26]

Countries like the Philippines have implemented Energy Power Quality (EPQ) standards to maintain acceptable voltage and frequency levels for mini grids, as is discussed in **Box 3**.

26 USAID, 2017.

BOX 3 ENERGY POWER QUALITY (EPQ) STANDARDS IN THE PHILIPPINES

In off-grid areas, the Philippine government introduced the Small Power Plant Guidelines that categorises mini grids into five groups based on the distribution utility and/or generation entity. The guidelines also establish maximum allowable voltage and frequency variations to still maintain the quality of electricity across all mini grid categories. The Energy Regulatory Commission views these guidelines as crucial for maintaining consistent service quality. However, it also acknowledges the challenges associated in implementing them, including the need for additional outreach and capacity-building efforts for mini grid developers and operators to achieve full compliance.

Environmental standards for mini grids are enforced to lower the environmental impact of power generation and distribution infrastructure. Regulators can establish environmental benchmarks for mini grid facilities and ensure compliance through the submission of **environmental impact assessments** during the mini grid project approval process. However, imposing uniform standards on all mini grid projects can impose significant cost burdens on developers of small-scale projects, especially those with low environmental impact. Thus, it is important to strike a balance between environmental objectives and the scaling of mini grid deployment.

Regulators should also ensure that environmental regulations apply throughout a project's lifecycle, including its operational phase and eventual decommissioning. Protocols should be established for the proper management, transportation, recycling, and disposal of energy technologies and associated waste. For instance, guidelines for the disposal of energy storage components, like lead-acid batteries, are essential to prevent soil pollution and protect community health. For a more detailed discussion on this, refer to the accompanying policy toolkit *E-waste management: Strategies and policies in fragile contexts.*

Developers may be encouraged to adhere to codes of conduct or established social and environmental standards, such as the Performance Standards on Environmental and Social Sustainability of the International Finance Corporation (IFC).

BOX 4 ENVIRONMENTAL COMPLIANCE FOR MINI GRID PROJECTS IN UGANDA[27]

In Uganda, mini grid projects are subject to a rigorous environmental review and approval process overseen by the National Environmental Management Authority (NEMA), in collaboration with the Ministry of Energy and Mineral Development (MEMD) and the Directorate of Water Resource Management (DWRM) for hydropower projects. Uganda's environmental regulations ensure that mini grid projects are thoroughly assessed for their potential impacts and are implemented in an environmentally sustainable manner. Through close collaboration between regulatory authorities, developers, and stakeholders, projects are evaluated, approved, and monitored to ensure they minimise adverse effects on the environment.

The regulatory process follows the following steps:

Environmental review – Mini grid developers must submit a project brief to NEMA for initial screening. Depending on the potential environmental impact, projects may undergo three levels of screening:

- **Level one screening** – Projects with no adverse environmental impact are exempt from further assessment and are approved.
- **Level two screening** – Projects with potential impacts undergo an environmental impact review to identify mitigation measures.
- **Level three screening** – Projects requiring further assessment undergo an environmental impact study (EIS).

Consultation and approval – Developers consult with NEMA, MEMD, and stakeholders during the EIS process, preparing a **scoping report** and **terms of reference** for approval. Once approved, consultants **conduct the EIS**, reviewed jointly by NEMA and MEMD. On the basis of the review of the EIS, NEMA either grants approval for the project (with or without conditions) or may not approve the project.

Implementation and monitoring – Approved projects must adhere to the **mitigation plan** outlined in the EIS and any additional terms or conditions attached to the approval. Projects are licensed for implementation upon approval of the EIS and mitigation plan. All projects that are subject to an EIS must also develop a **monitoring plan** for the operational phase and undergo environmental evaluation by MEMD and the developer during implementation and after decommissioning.

27 Ibid.

SOPA Images,
Getty Images

4.3. Commercial service

The commercial aspect of quality assurance focuses on customer service, addressing consumer engagement, complaint resolution, and incident reporting. Establishing transparent, efficient mechanisms for handling customer issues helps strengthen the relationship between mini grid developers and end-users, building trust and increasing consumers' willingness to pay for services. This is discussed in greater detail in the next section.

- **Customer accountability** – Providing appropriate recourse mechanisms, such as avenues for complaint resolution and advance notifications for planned outages, fosters a positive relationship between consumers and providers. In Nigeria, mini grid operators are required to notify users 72 hours before outages and report major incidents to regulators within 24 hours.

- **Building consumer confidence** – Adherence to robust customer service standards reassures users of the reliability and safety of mini grid systems. Clear communication protocols, combined with high-quality technical service, create a supportive environment for sustainable electricity access.

5. Consumer and investor protection

Creating an enabling environment for the mini grid sector requires ensuring that the growth objectives of the sector remain aligned with the interests of key stakeholders, including both consumers and investors. This alignment is necessary to promote good practices and safeguard the confidence of consumers, investors, governments, and other stakeholders which is needed to ensure the long-term viability of the sector. This can be achieved through robust consumer protection principles and investor safeguards mini grid sector's resilience.

5.1. Consumer protection

Consumer protection can be achieved through the establishment of robust consumer protection principles which outline the minimum standards that every mini grid consumer should expect from their provider. In 2019, the Alliance for Rural Electrification launched the Consumer Protection Principles for Clean Energy Mini Grids, which is comprised of six main principles that aim to safeguard consumer rights, while defining key roles and responsibilities of stakeholders. The six principles are presented in **Figure 1** and are discussed in greater detail below.

Figure 1 Key elements of consumer protection

5.1.1. Ensuring quality consumer care service

This includes the following:

- Providing comprehensive technical and after-sales support services.
- Establishing accessible and timely mechanisms for resolving consumer complaints and issues.
- Educating consumers on the proper and safe use of energy devices.
- Implementing user-friendly interfaces and payment platforms.
- Upholding fair and respectful treatment of all consumers without discrimination.
- Establishing a centralised mechanism for handling consumer complaints.
- Allowing consumers to seek assistance from national regulatory authorities or consumer organisations in case of disputes.
- Implementing a code of conduct for service provision to consumers.
- Communicating effectively with consumers in a language and manner they understand.

5.1.2. Ensuring quality and safety of supply

This includes the following:

- Specifying a minimum level of supply quality in consumer contracts.
- Ensuring that mini grid systems meet international technical, design, and safety standards (discussed in section 4 above).
- Complying with national operating and maintenance requirements for power quality, reliability, and availability.
- Providing evidence of system performance through test results and certificates.
- Holding the service provider accountable if agreed-upon quality standards are not met.
- Sharing performance reports on power delivery and service levels with investors and regulators.

5.1.3. Ensuring fair contracting, pricing, and billing

This includes the following:

- Ensuring contract terms are clear, transparent, and easily understandable.
- Establishing clear procedures for disconnection in case of unpaid bills.
- Implementing appropriate payment structures, methods, and fees for vulnerable consumers.
- Conducting proper credit assessments for potential consumers' financial obligations.

5.1.4. Ensuring data privacy

This includes the following:

- Safeguarding consumer data and maintaining confidentiality.
- Obtaining consumer consent for the collection, use, retention, and sharing of personal information.
- Limiting the collection, use, retention, and sharing of personal information to what is strictly necessary for service provision and business needs.

5.1.5. Promoting professionalism

This includes the following:

- Providing consumer-oriented training for staff.
- Issuing regular operational and financial reports.
- Conducting independent verifications of system performance.
- Auditing annual financial reports.

5.1.6. Implementing social measures

This includes the following:

- Establishing policies and procedures to protect vulnerable and disadvantaged consumers.
- Developing policies for appropriately managing overdue debt.

Similarly, GOGLA recently developed a Consumer Protection Code which consists of a "set of principles and an assessment framework to enable companies to measure, prove and improve their practices, and provide investors and other stakeholders with a framework to promote good practice."[28] It consists of a set of six principles, indicators, and a self-assessment tool and allows companies to measure, monitor, and report their practices and provide investors and other stakeholders with a framework to foster good practice. The six principles can be seen in **Figure 2**.

Figure 2 Key principles of GOGLA's Consumer Protection Code

28 GOGLA, n.d.

5.2. Investor protection

Robust investor protection measures provide legal certainty, mitigate risks, and promote confidence among investors, thereby facilitating the flow of investment into mini grid projects. This section delves into key aspects of investor protection and strategies needed to strengthen investor confidence within the mini grid sector, which is typically weak in FCS. Key aspects are considered below.

5.2.1. Dispute resolution mechanisms

Efficient dispute resolution mechanisms are essential for resolving conflicts between investors and other stakeholders in the mini grid sector. Timely resolution of disputes helps maintain investor confidence and prevents prolonged disruptions to project implementation. Governments can facilitate the establishment of arbitration mechanisms or specialised commercial courts to ensure swift and fair resolution of disputes, thereby strengthening investor protection.

5.2.2. Political risk insurance

Political risk insurance offers an additional layer of protection for investors in the mini grid sector, particularly in FCS. This type of insurance provides coverage against risks such as expropriation, political violence, and currency inconvertibility, mitigating the impact of political instability on investment returns. Collaboration between governments and international organisations can facilitate the provision of political risk insurance schemes, enhancing investor confidence and attracting investment to challenging environments. For example, the World Bank's Multilateral Investment Guarantee Agency (MIGA) provides a range of political risk insurance products to attract private capital into emerging markets.[29]

5.2.3. Transparent compensation mechanisms

Transparent compensation mechanisms are essential for protecting investors in the event of expropriation or other adverse government actions, ensuring that private property rights are upheld (for example, in the case of the arrival of the main grid discussed in the next section). Clear guidelines and processes for fair and timely compensation ensure that investors are adequately compensated for their investments, mitigating the risk of financial loss. Establishing transparent compensation mechanisms demonstrates a government's commitment to protecting investor rights and promoting a conducive investment climate in the mini grid sector.

29 IFC, 2022.

6. Arrival of the main grid

The arrival of the main grid in previously unconnected areas can create uncertainties for mini grid investors and developers. Extension of the main grid is very unlikely in FCS due to limited government revenues, the logistical complexities and unfavourable economics of grid extension to remote and sparsely populated regions, and the risk of critical infrastructure being targeted in conflict settings. Nevertheless, it remains a scenario of considerable importance that needs to be addressed.

Many governments lack regulations that protect isolated mini grids in such scenarios.[30] The potential redundancy of mini grid systems upon the arrival of the main grid can act as a deterrent for potential investors. Thus, it is important for policymakers and regulators to effectively manage these risks and develop a straightforward approach to ownership and mode of operation when the main grid reaches mini grids to safeguard the interests and revenue streams of investors. This can include incorporating clear rules concerning grid arrival into national regulatory frameworks and/or licenses and establishing compensatory measures to protect mini grid assets and investors who can review and decide which alternative compensation route to choose. These include:

- **Compensation** – Compensation might encompass unrecovered operational costs, including those reliant on electricity sales or subsidies. Initial capital expenditures, such as generation costs, could also be factored in after accounting for accumulated depreciation. Governments might choose to reimburse developers for taking over distribution assets, excluding generation.

- **Conversion to small power distributor or producer:**

  - *Small power distributor (SPD)* – In these arrangements, the mini grid converts from operating as an autonomous mini grid to a SPD that buys electricity at wholesale price from the national or regional utility and resells it at retail prices to its local customers. Mini grid operators would effectively function as distribution network operators and maintain normal retail service relationships with customers. For example, regulators in Cambodia have authorised more than 170 rural electrification entities operating mini grids to become SPDs once the grid arrives as is discussed in **Box 5** below.[31]

  - *Small power producer (SPP)* – The mini grid sells electricity to the operator of the national grid (or some other designated entity), but no longer sells electricity to retail customers. Mini grid operators would effectively function as independent power producers and would sign a power purchase agreement (PPA) that would dictate the sale of power from the generation asset to the national grid.

30 SE4All, 2020b.
31 USAID, n.d.a.

- **Operating alongside the grid** – Mini grid operators may opt to function alongside the main grid, creating competition. Although tariffs for mini grid customers could be notably higher than government-subsidised grid rates, customers might still prefer the mini grid due to its superior service quality. This is particularly true in settings where the national grid is unreliable and prone to outages and attacks.

- **Abandon or move** – The distribution grid and generator are abandoned, sold for scrap, or moved. The connecting utility builds and operates a new distribution system to serve customers in the area.

BOX 5 SMALL POWER DISTRIBUTORS IN CAMBODIA[32]

In Cambodia, the Electricity Authority of Cambodia (EAC) has implemented comprehensive regulations enabling mini grid operators to integrate with the national grid and transition into distribution network operators. Prior to this policy, mini grid developers had been hesitant to upgrade infrastructure, fearing loss of assets if the grid extended to their service areas. Under the new regulations, former mini grid operators connected to the grid can purchase power from the national utility at wholesale rates. The EAC has set wholesale and retail triffs at levels ensuring profitability for these small distribution network operators.

It is important for regulators to consult with mini grid developers, operators, and other stakeholders as they review and select the appropriate option for ownership and mode of operation following the arrival of the national grid. Nigeria, Rwanda and Tanzania are examples of countries with clear rules of engagement. For example, Nigeria offers three options in the event the main grid reaches isolated mini grids, which are discussed in **Box 6** below.

BOX 6 GRID ARRIVAL RULES IN NIGERIA

Nigeria has developed clear and explicit grid arrival rules, aimed at protecting the value of mini grids and attracting investors into the industry. In the event the main grid reaches isolated mini grids, three options are available:[33]

i. The regional distribution company (disco) purchases any excess electricity generated from the mini grid beyond what is needed to serve its existing customers.

ii. The disco buys all the mini grid's generated electricity and treats it as part of the main grid system.

iii. The disco compensates the developer for any revenue loss incurred.

32 Greacen et al., 2013.
33 SE4All, 2020a.

The establishment of such rules can generate mutual benefits for mini grid owners, investors, and the utility. Owners and investors benefit from the protection of asset value even after the main grid arrives, while the utility can integrate mini grids directly into the main grid, avoiding additional capital expenditure.

Table 2 Advantages and disadvantages of contingency plans for grid arrival

	Advantages	Disadvantages
Small power distributor (SPD)	• Mini grid operator maintains a portion of their regular business. • Mini grid operator would be treated in the same regulatory manner as current distribution network operators. • Mini grid operator upholds its standard customer service relationship.	• Can be a time consuming and potentially costly process for both the regulator and mini grid operator if processes, methods, and standards are not already in place to facilitate the transition. • Generation assets may be decommissioned prematurely. • Can be challenging to ensure mini grid operators receive a fair price for generation assets that provide a reasonable return on investment.
Small power producer (SPP)	• In countries where independent power producers already play a defined role, this approach reflects the current ownership structure of the national grid. • Avoids a situation where regulators must oversee a patchwork of small distribution networks in the long term, thus conserving regulatory resources.	• May not be viable if small, independent power producers do not already have a defined role in the national grid. • Transition will affect the customer service relationship, which may be complicated if the mini grid payment and metering structure differs from that of the national grid. • Can be a time consuming and potentially costly process for both the regulator and mini grid operator if processes, methods and standards are not already in place to facilitate the transition (e.g. determining which party is responsible for technical upgrades or interconnection costs).
Abandon or move	• Limited benefits. • Mini grid operators may be able to sell the equipment and recoup some costs. • Mini grid operators may be able to move the mini grid and establish business in an area where grid extension has not and will not take place in the near future.	• Duplicative investment in infrastructure. • Limits the ability of the mini grid operators to earn a return on their investment. • If abandoned or sold, will need to decide who is responsible for the costs of cleaning up the site and properly disposing of equipment to avoid any health or safety concerns for the surrounding community.

Interconnection of mini grids to the national grid would also require compatibility with technical standards (section 4). As such, regulators should require mini grids to be compatible with national-grid technical standards (e.g., conductor characteristics, distribution network, generation equipment, grounding, inverters, transformers, etc.) from the outset. However, adhering to national grid standards when designing and building mini grids can be an expensive and complicated process which could potentially deter mini grid developers.[34] Thus, to promote the deployment of mini grids, it is advisable for regulators to establish more adaptable and flexible standards for grid connection. Ultimately, as regulators consider regulations for grid interconnection, they will need to determine how rigid the technical standards will be, establish communication protocols, and outline the process for interconnection. They also need to factor in the realistic likelihood of the main grid being extended into new areas – if this likelihood is very low, then more flexibility should be allowed for mini grids.

Ensuring power quality when integrating a mini grid with the national grid is a primary concern, requiring collaboration among mini grid developers, operators, regulators, and the national utility. To address this, the following technical issues must be taken into consideration:[35]

- The ability to deactivate mini grid equipment regulating fuel supply (for diesel or hybrid systems)
- Swift disconnection and reconnection during distribution network failures
- Transitioning to islanded mode where the mini grid can switch to isolate itself and operate independently from the national grid in case of a fault
- Evaluating electrical and fault ratings
- Assessing the impact of mini grid storage systems on power quality
- Overall compliance to national grid standards.

The Institute of Electrical and Electronics Engineers (IEEE) 1547 is an international standard that has established technical specifications and testing protocols for interconnections, alongside stipulating performance, operational safety, and maintenance criteria.

34 USAID, 2017.
35 Grimley & Farrell, 2016; Greacen et al., 2013.

7. Contractual agreements

Robust contractual agreements serve as the foundation for establishing transparent and constructive relationships while also defining clear lines of accountability among various stakeholders Such agreements play a crucial role in delineating the roles, responsibilities, and interests of different stakeholders which is necessary to ensure the smooth operation and long-term sustainability of mini grid systems. In other words, these agreements are not just legal documents but strategic tools that can help guide the planning, implementation, and management of mini grid projects, ultimately contributing towards their long-term sustainability.

Moreover, an independent and effective judiciary is essential to legally enforce these contractual arrangements. This is a specific challenge for FCS where the lack of judicial enforcement can undermine the effectiveness of such agreements. Therefore, FCS governments should invest in strengthening their judicial systems as part of attracting investment in mini grid projects.

This toolkit will discuss the following forms contractual agreements between various entities:

- **Concession agreement** – Contract between a public entity (e.g., the regulator) and a private entity (e.g., the developer) that grants the private entity exclusive rights for mini grid deployment and operations within defined areas for a specific period of time. These agreements often entail private investment targets and/or connection targets and are often awarded through competitive bidding to optimise cost-efficiency.

- **Service agreements** – These agreements facilitate the interaction between the mini grid owner and consumers and often specify parameters such as tariffs, stipulated hours of provision, and other regulatory aspects. These agreements could also serve as a form of "regulation by contract" on the local level, providing a framework for dispute resolution.[36]

- **Power purchase agreements (PPAs)** – These are long-term off-taker agreements used in situations where a mini grid connects with the main grid and the mini grid operator retains ownership of the system and generation assets. PPAs dictate the terms of power sale between the mini grid developer and the utility. Additionally, PPAs define the rights and responsibilities of both the mini grid operator and utility buyer and delineate financial arrangements. Under a PPA, each party is responsible for operating and maintaining its own system.

36 USAID, n.d.b.

7.1. Concession agreement

Under a concession agreement, the private entity is typically granted the right to construct, operate, and maintain assets for the generation, distribution, and sale of electricity to end-users for a given number of years in a specific service area. The duration of the concession agreement is typically between 15 to 25 years and often entails favourable terms such as financial incentives, preferential tariff arrangements, or exclusive operational rights within the specified area.[37] They are almost always awarded through a competitive bidding process and often require the private entity to maintain a certain quality of service and establish a set number of connections. Regulators may also conduct competitive bidding for concession schemes, enabling developers to bid for larger or multiple service areas, thereby consolidating mini grid projects. This flexibility aids in cost reduction and enhances profitability by streamlining various aspects, including planning, financing, administration, equipment procurement, and operational upkeep.[38] A successful example of a mini grid concession agreement in Mali is discussed in **Box 7** below.

BOX 7 MALI'S RURAL ELECTRIFICATION PCASER CONCESSIONS[39]

Mali's bottom-up mini grid concessions approach, spearheaded by the Projets de Candidatures Spontanées d'Electrification Rurale (PCASER) initiative, has transformed rural electrification efforts. In collaboration with the rural electrification agency, AMADER, local entrepreneurs have driven the implementation of over **250 mini grid projects, connecting approximately 78,000 rural households**. These projects, primarily powered by diesel generators, have proven financially sustainable, with operators remaining viable without ongoing subsidies.

Despite initial challenges stemming from Mali's complex socio-economic landscape and energy sector history, including the nationalisation of the state-owned utility, Energie du Mali (EDM), AMADER's regulatory oversight and subsidy programmes have been instrumental. By subsidising initial investment costs and regulating tariff structures, AMADER has facilitated the successful development and operation of mini grid concessions, ensuring compliance with quality standards and promoting rural electrification.

Mali's experience with PCASER concessions offers the following key lessons for other governments seeking to address rural electrification challenges through concession agreements:

- **State-owned utilities impact** – Inefficient state-owned utilities can impede rural electrification by absorbing subsidies and selling power below cost, creating challenges for private concessionaires and requiring government intervention.

37 USAID, 2017.
38 RECP & EUEI PDF, 2014.
39 Hosier et al., 2017.

- **Balancing speed and governance** – Achieving a balance between project approval speed and governance is crucial. While central agencies like AMADER are essential for rural electrification, their decision-making discretion may raise transparency concerns. Finding a middle ground is necessary to ensure efficient project implementation without compromising governance standards.
- **Role of regulatory authority** – Formal regulatory authority within the rural electrification agency enhances mini grid concession effectiveness. Mali's experience highlights the benefits of combining grant allocation and regulatory functions within a single agency like AMADER. Conversely, dividing regulatory responsibilities between different entities, as seen in some countries like Senegal, may hinder effective concession management.

Another successful example of mini grid development is that of Cambodia, where mini grids (mostly diesel) were developed by rural entrepreneurs after the 1967-75 civil war that destroyed most of the country's electricity system. Private operators became distributors in their zones and received subsidies that allowed them to meet their revenue requirements while customers paid regulated, below-cost tariffs.[40]

7.2. Service agreement

Service agreements seek to regulate of the quality of service offered to consumers. In FCS, where regulatory oversight may be limited and institutional capacity is often weak, service agreements are particularly important for setting clear expectations, ensuring accountability, and fostering trust in service provision. Such agreements are typically comprised of the following three elements:[41]

1. **Product regulation** – This ensures that electricity generated meets specific frequency and voltage requirements. By maintaining consistent quality standards, this helps to safeguard the reliability and safety of electrical appliances and equipment.
2. **Service regulation** – This governs reliability of supply as measured by hours of available power or frequency and duration of blackouts. Regulators may establish performance standards for mini grid operators to ensure reliable and uninterrupted electricity supply to consumers.
3. **Commercial service regulation** – This relates to how long it takes to get a connection and addresses how consumer grievances are handled. Efficient customer service processes and effective complaint resolution mechanisms are essential for maintaining consumer satisfaction and trust in mini grid systems.

40 McCulloch et al., 2023.
41 USAID, n.d.b.

7.3. Power purchase agreements (PPAs)

In situations where the mini grid connects with the main grid while the mini grid operator retains ownership of the system and associated assets, a PPA becomes essential. A PPA serves as a contractual framework that delineates the terms and conditions governing the sale of electricity between the mini grid developer and utility provider. Under a PPA, each party is responsible for operating and maintaining its own system.

A well-structured PPA should not only specify the pricing mechanisms for electricity sales but also outline the rights and obligations of both the mini grid operator and the purchaser. This includes provisions for maintenance responsibilities, performance standards, dispute resolution mechanisms, and termination clauses. By clearly defining these aspects, a PPA helps to minimise ambiguity and mitigate any potential conflicts between the mini grid operator and utility provider. Additionally, PPAs that ensure an even and fair distribution of risks between the parties are critical to attracting developers and facilitating their access to finance.[42]

Standardised PPAs are highly encouraged as they simplify the negotiation process by providing a predefined template that can be easily adapted to suit the specific circumstances of individual projects. This not only reduces transaction costs but also expedites the development process by streamlining PPA tariff negotiations. Standardised PPAs also promote consistency and predictability in the regulatory environment, fostering investor confidence and facilitating the scalability of mini grid deployments. Many countries (e.g., Tanzania and Zimbabwe) and organisations such as the World Bank and USAID have developed standardised PPA templates, guidelines, and best practices for isolated mini grid connections that can be adapted to various contexts.

42 Ibid.

8. Fiscal incentives

Governments can also leverage fiscal incentives to stimulate an enabling environment for solar mini grids. By strategically employing "smart incentives" such as import duty exemptions, VAT relief, and tax reductions, governments can create an environment conducive to increased private sector engagement. Such incentives can help reduce the capital and operational costs of mini grids, thus easing the financial burden on mini grid developers. This is particularly relevant for FCS that are characterised by underdeveloped markets and face challenges in accessing affordable finance due to perceived investment risks and limited access to capital markets. Ultimately, the integration of fiscal incentives within the legal and regulatory framework can serve as a powerful tool to accelerate the deployment of solar mini grids.

According to the African Development Bank (AfDB), fiscal incentives can include the following measures:[43]

- **Import duty and tax exemptions for components** – Granting exemptions from import duties, taxes, and fees for the components necessary for mini grid deployment can help alleviate the financial burden associated with importing equipment. This is particularly true in emerging economies where most mini grid developers (excluding China and India) rely on importing generation and distribution equipment. Such import duty and tax breaks essentially serve as direct cash transfers for developers, resulting in more cost-effective project implementation and greater affordability for developers.[44] For example, several countries such as Nigeria, Rwanda, and Indonesia have introduced import duty exemptions for solar equipment to promote renewable energy adoption.[45]

- **VAT exemption for domestic purchases** – Offering value-added tax (VAT) exemptions on components purchased within the country can incentivise the use of locally sourced materials and stimulate domestic manufacturing. This is particularly relevant for low-income and fragile countries that often have nascent or underdeveloped domestic manufacturing industries. Thus, VAT exemptions in such settings not only incentivises local production but can also contribute to job creation and foster local entrepreneurship. For example, in Kenya, the government provides VAT exemptions for domestically manufactured solar and wind equipment to support the growth of the local renewable energy industry.[46]

- **Reduced taxation on mini grid corporate profits** – Implementing reduced taxation rates on corporate profits generated by mini grid projects can help mitigate investment risks typically associated with FCS and enhance the financial viability of such ventures, ultimately encouraging greater investment in the sector.

43 AfDB, n.d.c.; USAID, 2017.
44 USAID, 2017.
45 IRENA, 2018.
46 GOGLA 2021.

- **Allow repatriation of mini grid profits** – FCS often face challenges of macroeconomic instability, which may prompt governments to block foreign investors' repatriation of profits. However, allowing developers to repatriate profits earned from mini grid operations is critical to provide assurance to investors and facilitate greater foreign investment in the sector. This would involve ensuring both the convertibility of profits into hard currency and its transferability to investors' countries of origin.

- **Renewable energy premium tariff (RPT) or 'off-grid feed-in tariff'** – This provides mini grid developers with an above-market price for the electricity that they deliver to the grid, thereby helping to compensate for ongoing costs for mini grid operators. This mechanism can support lower customer tariffs, maintain financial sustainability of project operations, and provide an incentive for sustaining quality service.[47]

- **Accelerated depreciation of generation and distribution assets** – Allowing for accelerated depreciation allowances for generation and distribution assets provides tax benefits to developers and can help offset initial investment costs.

- **Loan guarantees or low-interest loans** – These can lower the cost of capital for mini grid projects, thereby reducing overall costs, enhancing financial feasibility, and assisting developers to overcome the high up-front costs associated with mini grid projects. This is particularly important in fragile settings where companies often face challenges in accessing affordable finance due to perceived investment risks and limited access to capital markets.

For a more detailed discussion on innovative financing mechanisms to support the deployment of mini grids, refer to the accompanying toolkit *Financing and de-risking tools and approaches for solar mini grid projects in fragile contexts.*

47 USAID, 2017.

9. Conclusion

In conclusion, establishing a robust legal and regulatory framework is critical for fostering an enabling environment for mini grid systems in fragile settings. Key actions for achieving this include streamlining licensing processes to minimise bureaucratic delays, adhering to quality assurance frameworks, and strengthening consumer and investor protection to secure the rights of mini grid users and attract investment. Facilitating grid integration with clear contingency plans and promoting appropriate contractual agreements, such as concession agreements and PPAs, are also vital steps to establish transparent and accountable relationships among stakeholders.

Additionally, implementing fiscal incentives, such as tax breaks, import duty exemptions, and loan guarantees, can reduce project costs and enhance affordability. To ensure these measures are effective, investing in the capacity building of government officials is crucial. Training programs should enhance officials' understanding of technical standards, regulatory processes, and enforcement mechanisms, thus strengthening institutional capacity for effective regulation development, monitoring, and enforcement.

It is also important to highlight the importance of regulatory certainty and predictability. Arbitrary changes in regulations or unequal enforcement can significantly deter investment and undermine stakeholder confidence. A stable and predictable regulatory environment, where policies are consistently applied and transparently enforced, encourages long-term investments and supports the sustainable growth of the mini grid sector. By addressing these key areas, stakeholders can create an enabling environment for mini grid systems, driving progress towards energy access and sustainability in FCS.

A summary of recommendations for key stakeholders is as follows:

- **Policymakers and regulators**
    - **Streamline licensing processes** – Simplify and expedite licensing procedures by introducing digital platforms and bulk licensing options to reduce administrative delays.
    - **Implement quality assurance standards** – Ensure adherence to international technical standards and develop clear environmental and safety guidelines to maintain the operational integrity and reliability of mini grids.
    - **Develop contingency plans for grid arrival** – Establish transparent rules to manage the transition if the main grid reaches isolated mini grid areas, ensuring protection for mini grid operators and their investments.
    - **Strengthen capacity** – Invest in training programs for regulatory staff to enhance their ability to implement and enforce mini grid regulations effectively.

- **Private sector operators and investors**
  - **Adopt best practices** – Ensure compliance with licensing and quality standards to maintain the sustainability of mini grid projects.
  - **Engage in PPPs** – Collaborate with governments and donor agencies to explore co-financing options and leverage fiscal incentives for mini grid projects.
  - **Plan for potential grid integration** – Prepare for scenarios where mini grids may need to operate alongside or transition into the national grid by negotiating PPAs and considering small power distributor models.
- **Donors and development partners**
  - **Support risk mitigation measures** – Provide political risk insurance and guarantee schemes to incentivise private sector investment in FCS.
  - **Facilitate capacity development programmes** – Offer technical assistance to governments to enhance institutional capacity for regulation, enforcement, and monitoring of mini grid projects.
  - **Promote policy dialogue** – Encourage continuous dialogue between governments, private operators, and civil society to address evolving challenges and ensure the sustainability of mini grid projects in fragile settings.

By focusing on these key areas, stakeholders can collaboratively create an enabling environment for mini grid systems that support long-term energy access and economic resilience in fragile settings.

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State Fragility initiative

IGC

The **State Fragility initiative** (SFi) is an International Growth Centre (IGC) initiative that aims to work with national, regional, and international actors to catalyse new thinking, develop more effective approaches to addressing state fragility, and support collaborative efforts to take emerging consensus into practice. SFi brings together robust evidence and practical insight to produce and promote actionable, policy-focused guidance in the following areas: state legitimacy, state effectiveness, private sector development, and conflict and security. SFi also serves as the Secretariat for the Council on State Fragility.

theigc.org/statefragilityinitiative