

# Policy Guidebook Advancing Markets for Interconnected Renewable Energy Mini-Grids

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Renewable energy-based interconnected mini-grids (IMGs) are a technical solution that has the potential to directly contribute to achieving United Nations Sustainable Development Goal (SDG) 7: ensuring access to affordable, reliable, sustainable, and modern energy for all. IMGs can also play a key role in facilitating a “green recovery” during and after the global COVID-19 pandemic.

This guidebook summarizes a broad range of policy and financial instruments that governments can implement to foster the development of the IMG market, driven by the private sector. They have been divided into five categories: broad strategy and target-setting, policy and regulation, administrative processes, financial instruments, and other supportive measures.



IMG installation at Wuse Market, Abuja, Nigeria. Photo by Afoke Igwe/SD Strategies

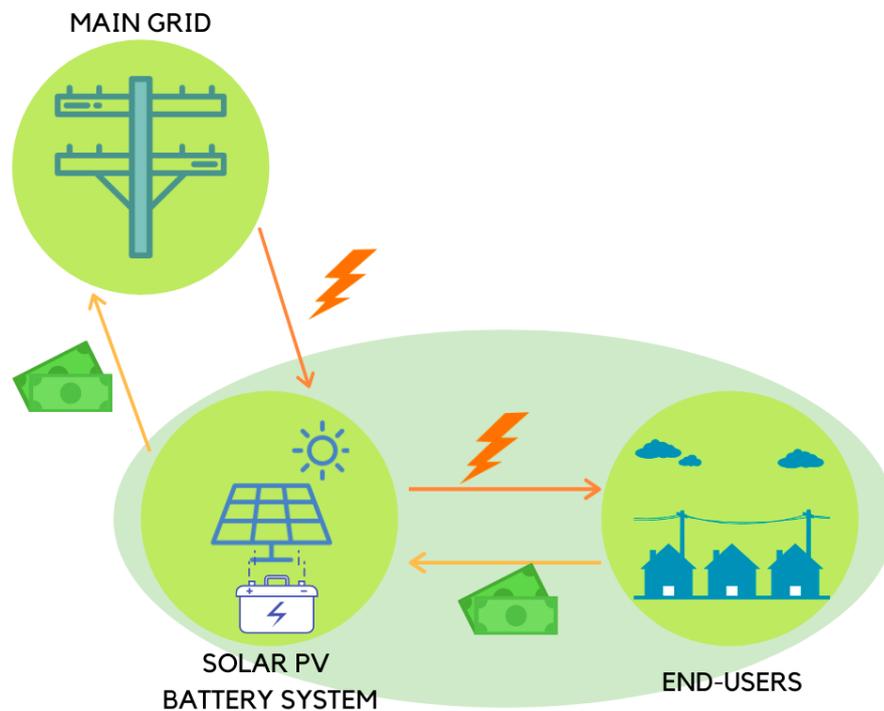
Table 1. Overview of government actions to foster IMG market development.

Category	Description
Broad strategy and target-setting	<ul style="list-style-type: none"> <li>Promote IMGs as a national strategy to foster sustainable economic development</li> <li>Include IMG-related targets in national development, energy, and electrification plans</li> <li>Set ambitious, feasible, and verifiable targets for IMG development and proactively communicate these</li> </ul>
Policy and regulation	<ul style="list-style-type: none"> <li>Align lower-level policies and regulations with the broader strategy and targets for IMG development</li> <li>Establish national technical standards specifically for IMGs</li> <li>Eliminate barriers to entry for IMG developers in the electricity market</li> <li>Reform electricity tariffs to ensure price-competitiveness and long-term economic viability of business models</li> </ul>
Administrative processes	<ul style="list-style-type: none"> <li>Minimize administrative barriers for licensing and connection to the main grid</li> <li>Streamline customs procedures for importing equipment</li> </ul>
Financial instruments	<ul style="list-style-type: none"> <li>Lower operational financial burdens of IMG companies by providing monetary and fiscal support as well as technical assistance, especially during the economic recession due to COVID-19</li> <li>Deploy public financing to reduce, transfer and compensate for investment risks, to foster private investment</li> <li>Leverage available funds from development agencies, international banks, and climate funds such as Green Climate Fund</li> </ul>
Other supportive measures	<ul style="list-style-type: none"> <li>Facilitate collaboration among the government, regulatory agencies, utility companies, businesses, investors, and local communities through active stakeholder and community engagement as well as public-private partnerships</li> <li>Provide technical assistance to help companies obtain nationally or internationally recognized "green" or "SDG-aligned" certifications• Assist companies with monitoring, measuring, and reporting performance</li> <li>Provide educational programs to enhance the technical and managerial capacity of IMG companies</li> <li>Build national capacity for data collection and data sharing</li> </ul>

## Interconnected mini-grids (IMGs) are distributed renewable energy facilities connected to the main grid.

An IMG is a facility that integrates small-scale renewable energy generation, energy storage, metering and control systems, and inverters. As they are connected to the grid, IMGs can operate both autonomously and as part of the grid. Using smart devices for metering, control and monitoring, IMG operators can provide efficient operations, data-driven management, and interactive customer service. The most common technology used for electricity generation in IMGs is solar PV. The costs of key mini-grid components have decreased 62-85% over the

last decade and are expected to decrease a further two-thirds by 2030 (BloombergNEF; MGP; SEforAll, 2020).



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## IMGs are a key solution to meeting sustainable development goals.

### Production of zero-carbon electricity

IMGs can unlock the potential of local renewable energy sources. Increasing the supply of renewable energy can reduce developing countries' reliance on imported fossil fuels, cut fuel costs and reduce the carbon intensity of their economies. Analysis shows that globally, approximately 4.2 gigawatts (GW) of off-grid renewable mini-grid generation capacity can be integrated into the main grid (IRENA, 2018). It is estimated that an additional 10-15 GW of solar PV mini-grids will be installed. This additional capacity would save 1.5 billion tons of CO<sub>2</sub> emissions (ESMAP, 2019).

### Expansion of reliable energy access

IMGs will play an important role in achieving SDG 7 by bringing modern energy systems to communities without reliable access to electricity. Developing country grids tend to be unreliable, and frequent power outages disrupt economic activity and vital services such as healthcare. IMGs can increase the reliability of the electricity service by interacting with the main grid. When the main grid faces a power shortage or when extreme weather events disrupt grid supply, IMGs can act as back-up. Vice versa, when there is a local power shortage, the

main grid can meet energy needs. In areas that have not yet been reached by the main grid, IMG business can start off deploying off-grid mini-grids. These mini-grids can be connected to the main grid once it arrives, as has been successfully demonstrated in Cambodia, Indonesia, Nepal, and Sri Lanka (Tenenbaum et al., 2018).

### **Social and economic empowerment of local communities**

Surplus electricity from IMGs can be sold to the utility company managing the grid. These electricity sales can provide an additional source of income for the local community. Best practices in Indonesia have shown that a cooperative business model can ensure that this income is distributed fairly (Tenenbaum et al., 2018). Economic empowerment of local communities will boost investor confidence, as businesses benefit from electricity customers' ability to pay.

## **Policymakers can foster the market for IMGs by implementing a mix of policy and financial instruments.**

In many countries, the largest barriers to IMG market development are policy uncertainty, underdeveloped policies and regulations and lack of access to financing (IRENA, 2019). Policymakers can take the following measures to eliminate these barriers.

### **Broad strategy and target-setting**

To create a policy environment conducive to market growth, IMGs must be included in national strategies and frameworks for economic development and energy planning. Embedding IMGs in high-level policies sends a clear signal of political support for the solution and provides a benchmark for streamlining relevant regulations. Studies have shown that this can improve market conditions by catalyzing public funds, building private investor confidence, and attracting skilled entrepreneurs (Waissbein et al., 2018). It can also help to create public trust in IMGs as a long-term solution, rather than a temporary fix. Governments should also set ambitious, feasible, and verifiable targets and engage in consistent monitoring to facilitate effective performance management.

### **Policies and regulations**

A comprehensive approach to policymaking is key to attracting investment and ensuring the long-term success of IMG market players. This means that lower-level policies and regulations relevant to IMG business operation must be aligned with the goals and targets specified in the broader strategies and energy plans for IMG market development.

For example, the government should review and reform existing regulations to address common barriers to entry faced by IMG developers. These include the natural monopoly of state-owned electricity providers, a lack of technical standards, and extremely low electricity tariffs.

Indonesia has partially liberalized its electricity market by reforming its national electricity trade law to allow companies to obtain licenses to participate in the electricity market (Tenenbaum et al., 2018, p. 31). Nigeria has established a mechanism involving a contractual agreement among the government, national utility companies, and IMG companies (Ochs et al., 2020).

Specific technical standards for IMGs should also be developed, as technical standardization is necessary to allow for integration into the main grid. Comprehensive reform would include other elements that affect the long-term economic viability of the IMG business model, such as national electricity tariffs. If these are set below-cost, they should be adjusted to improve the price competitiveness of IMG-based electricity.

### Administrative processes

Administrative processes for obtaining licenses must be streamlined and simplified for efficiency. A minimal regulatory burden for the private sector allows companies to grow faster and encourages investment (Tenenbaum et al., 2018; Waissbein et al., 2013). If the domestic capacity for manufacturing IMG equipment is insufficient, customs procedures and tariffs must be minimized so that businesses can easily import this equipment at low costs.



Wuse Market in Abuja, Nigeria, partly powered by a PV IMG. Photo by Afoke Igwe/SD Strategies

### Financial instruments

To kick-start a market for IMGs, companies must be provided with access to affordable finance. Until the market matures, public intervention is necessary. The government can support IMG companies directly by providing low-interest loans, grants, and credits. Governments can also leverage international climate finance provided by development agencies, multilateral institutions, and international public funds such as Green Climate Fund.

Fourteen non-governmental funders have approved a total of USD 2.07 billion for mini-grid projects since 2007 (BloombergNEF; SEforAll, 2020). as the sharp decrease in global development aid and private investment due to the COVID-19 pandemic may make securing financing more difficult in the short- to medium term (OECD, 2020). However, as demand for sustainable recovery financing has been rising globally, multilateral development banks and

the IMF have designated 24%<sup>1</sup> of approved funding for low-carbon projects that contribute to the SDGs. In addition, the GCF has committed 100 million USD to protect off-grid and renewable energy companies in nine African countries from bankruptcy during the economic recession (GCF, 2020). [DEVEX COVID-19 Recovery Funding Opportunities Mapper](#) is a great database for funding opportunities.

Unlocking private investment is key to ensuring long-term IMG market growth and to achieving economies of scale. Policymakers must use their regulatory and fiscal power to reduce, transfer and share the risks perceived by private investors entering this market. UNDP has developed Derisking Renewable Energy Investment (DREI), a highly useful framework that helps to identify relevant investment risks and points towards policy/financial instruments to reduce these. As every country's situation is unique, the tool must be localized prior to the initial assessment. This study on Nigeria's IMG market study on Nigeria's IMG market risk assessment based on the DREI framework can be used as a reference for policymakers (Ochs et al., 2020).

### Other support measures

To further boost IMG markets, policymakers can encourage multi-stakeholder collaboration among regulatory agencies, utility companies, IMG companies, investors, and local communities by resolving potential conflicts and engaging in public-private partnerships (PPP). For example, utility companies often are reluctant to work with IMG companies due to their fears of losing their market share and of high transaction costs. This resistance of utilities is a key barrier to entry for IMG companies. The government can address this problem by creating standardized compensation mechanisms and highlighting mutual benefits of IMG integration with the grid.

The government must actively engage with external funders and facilitate participation of and fair competition among local businesses. For example, the Rural Electrification Agency in Nigeria, in partnership with GIZ and funded by the European Union and German government, launched the Integrated Mini-grid Acceleration Scheme (IMAS) in 2019. Through a nationwide competitive tender, seven developers were selected to partner with regional distribution companies. IMAS is a great example of an initiative that fosters collaboration between the private and public sectors based on technical and financial support from external sources.

Many IMG companies struggle to gain access to public and private finance and financiers struggle to find investment-ready proposals in the IMG space. As a result, only 13% of the approved funding for the development of the IMG market has been disbursed (BloombergNEF; SEforAll, 2020). One of the main issues preventing this money from reaching IMG companies is the companies' lack of technical and administrative capacity for measuring, monitoring, and reporting on their performance and SDG impact. IMG companies should be provided with technical and administrative assistance for data collection and reporting results, to ensure that approved funding is properly disbursed.

In their proposals to international funders and investors, IMG companies must demonstrate compliance with international standards for SDG alignment, such as ESG criteria, the Green

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<sup>1</sup> Calculation based on data provided by CSIS IFI COVID-19 Response Tracker, CSIS Economics Program, Last Updated October 19, 2020.

Climate Fund Taxonomy, or the EU Taxonomy. Policymakers can offer technical assistance for companies to choose and implement appropriate reporting standards for their business.

The long-term development of the IMG market requires sound digital infrastructure. Smart energy grids, mobile data networks, and transparent collection of usage data are especially important. IMG companies need these digital technologies to collect payment, trade electricity with utility companies, and scale up their activities. Therefore, policymakers must invest in smart energy and data collection infrastructure.

## **Conclusion: developing IMG markets requires significant, sustained political will and concerted efforts of the public sector**

IMGs can help countries meet sustainable development goals by delivering clean, reliable, and modern energy to underserved communities. However, the market for this technology is nascent and developing it further requires sustained political will and concerted efforts from the public sector. Policymakers can accelerate the maturation of IMG markets by implementing the policy and financial instruments listed in this guidebook. This list, however, is not exhaustive. Policymakers should consider examining market barriers and risk categories specific to their country using UNDP's De-risking Renewable Energy Investment (DREI) framework. This can help them navigate potential problems and choose appropriate policy options (Ochs et al., 2020). Policymakers should keep in mind that there is no single policy measure that can fix all problems. Rather, they should seek to develop an appropriate mix of measures, tailored to the unique market characteristics of their country.

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