De-risking small-scale renewable energy in rural areas of the Arab region

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Review and consultation

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Key messages

Key messages

The lack of robust policy frameworks and perceived risks hinder the adoption of small-scale renewable energy in rural areas. De-risking strategies, customized financing solutions and capacity-building are essential to overcome these barriers.

Funding sources should be broadened to include multilateral and international financial institutions, national development banks, foundations, impact funds, private funding and community-based financing. Climate finance should be channelled through Governments and international organizations to improve the capabilities of local players.

Intermediaries such as microfinance institutions play a crucial role by providing flexible loans, technical assistance and capacity-building, as well as mitigating investment risks to support the widespread adoption of renewable energy technologies.

Tailored financial instruments which take into account social norms and gender dimensions, along with diverse business models such as pay-as-you-go and leasing, are necessary to address affordability and accessibility issues in the Arab region.

Establishing strategic partnerships between government institutions, international donors, NGOs and other stakeholders is vital for achieving sustainable rural energy solutions. Effective collaboration and capacity-building initiatives are crucial for scaling up renewable energy in rural areas.

Contents

List of figures

List of boxes

Abbreviations and acronyms

ABC	Anchor-based/business consumer
D-REC	Distributed renewable energy certificate
DESCOs	Distributed energy service companies
DFI	Development finance institution
IFI	International financial institution
GEF	Global Environment Facility
MFI	Microfinance institution
MIGA	Multilateral Investment Guarantee Agency
NGO	Non-governmental organization
PAYG	Pay-as-you-go
PREC	Peace Renewable Energy Credit
PV	Photovoltaic
REC	Renewable energy certificate
REGEND	Regional Initiative for Promoting Small-Scale Renewable Energy Applications in rural areas of the Arab Region
SDGs	Sustainable Development Goals
SMEs	Small and medium-sized enterprises
UNDP	United Nations Development Programme
UNHCR	Office of the United Nations High Commissioner for Refugees
USAID	United States Agency for International Development
VSLAs	Village savings and loans associations

Introduction

In an era defined by the imperatives of sustainable development as well as the need to mitigate climate change, small-scale renewable energy is a promising and necessary tool for rural communities across the Arab region. The potential of small-scale renewable energy to bring about transformative change is undeniable. It offers the prospect of improved livelihoods, expanded economic opportunities and enhanced resilience in the face of climatic uncertainties. This paper addresses the significance of de-risking small-scale renewable energy initiatives, laying the foundation for adopting them and scaling them up rapidly and bringing about various benefits.

The Arab region's vast, largely untapped renewable energy potential presents an opportunity to lift millions out of energy poverty by creating employment and fostering local economic growth. The potential benefits go beyond the mere provision of energy. However, many developing nations, including those within the Arab region, share a narrative of untapped potential, fragmented markets and substantial barriers. Foremost among these obstacles is the high level of risk associated with renewable energy initiatives, discouraging potential developers and investors from venturing into a landscape characterized by uncertainty.

Economies of scale have long been a priority for developers seeking to optimize costs, and for investors seeking returns. But the unique dynamics of rural areas make a different approach necessary. Rural households are often less prosperous; this makes it necessary to identify innovative business models capable of aligning developers' interests with the pressing needs of rural communities, achieving a lasting impact. In the absence of appropriate financial and operational models, the immense potential of integrated small-scale renewable energy solutions remains largely untapped, leaving potential benefits for both developers and communities unrealized.

Against the backdrop of international commitments such as the 2030 Agenda for Sustainable Development and the Paris Agreement, the need to mobilize financial resources to accelerate sustainable development has rapidly gained momentum. To harness the full potential of small-scale renewable energy in rural areas, it will be crucial to achieve a strategic alignment between financiers, developers and end users. This paper attempts to highlight the key instruments and business models that can effectively de-risk small-scale renewable energy initiatives in rural areas in the Arab region. By shedding light on a diverse range of policy and financial tools, it can serve as guide for policymakers and stakeholders for overcoming existing challenges.

The paper covers aspects including the role of intermediaries such as microfinance institutions, and considers diverse sources of finance, from government funding multilateral institutions, providing insights into the complex landscape of climate finance. It also examines financial instruments, risk mitigation strategies, technical assistance programmes and an array of business models. The objective is to present a thorough analysis, coupled with policy instruments and recommendations, with a view to cultivating a conducive environment for the sustainable development of small-scale renewable energy projects in rural Arab communities.

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1. Small-scale renewable energy

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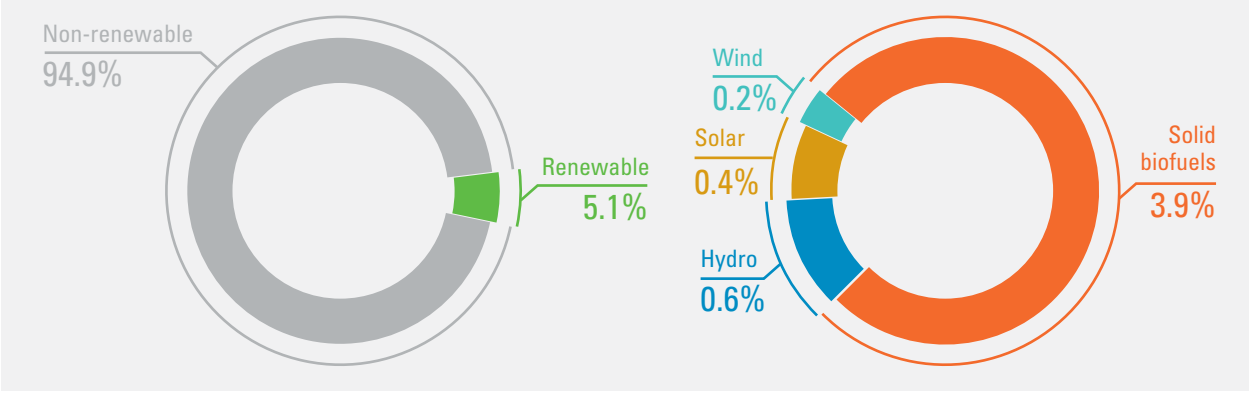
1. Small-scale renewable energy

In the Arab region, the uptake of renewable energy has been mixed. Most countries in the region are net importers of energy. Despite this, the contribution of renewable energy to the region's total final energy consumption in 2020 remained modest, at 5.1 per cent.[1] The divide is most pronounced in rural areas, which face an energy deficit of over 80 per cent, even higher in the region's least developed countries. The adoption of renewable energy in rural regions has been slow. This has been attributed to factors such as inadequate infrastructure leading to higher costs, insufficient financial resources, heavy reliance on conventional energy sources – which accounted for 76 per cent of total renewable energy consumption in the region in 2020 – and an absence of robust policy frameworks prioritizing renewable energy in these settings.[2]

As an example, the potential for solar energy in the Arab region has always been high. But uptake only began to increase when policies were introduced to remove market barriers and encourage private sector investment. These policies led to a positive investment climate for large State-run utility providers, with attractive financing rates, particularly in the Gulf Cooperation Council countries, where record-breaking tenders placed the region amongst the lowest-cost producers of solar photovoltaic (PV) energy.[3]

Efforts to increase the share of renewable energy in the energy mix are ongoing at global level. To achieve this, countries have predominantly focused on large utility-scale renewable energy at the expense of rural electrification. Nevertheless, renewable rural electrification, even on a small scale, can also play a role. It can also contribute to addressing energy access problems and provide a sustainable pathway for economic growth in certain Arab countries. This is especially relevant in countries affected by acute challenges such as conflict. In Yemen, for example, solar infrastructure has demonstrated the potential of small-scale renewable energy to provide essential energy services in crisis areas.[4] Beyond immediate relief, these solutions can also foster economic growth. By circumventing the problems sometimes associated with traditional energy infrastructure constraints, they serve as catalysts for sustainable economic development, empowering local communities and supporting schools and health care facilities.

Figure 1. Total final energy consumption of the Arab countries – breakdown by source, 2020



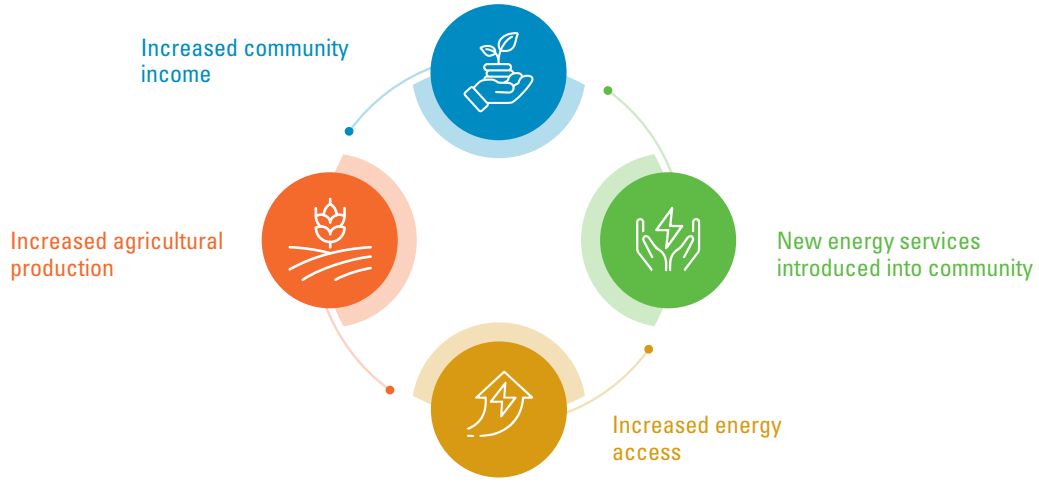
Source: ESCWA, 2023a.

Box 1. REGEND

The Regional Initiative for Promoting Small-Scale Renewable Energy Applications in rural areas of the Arab Region – REGEND – demonstrates the potential benefits of resolving energy disparities in rural Arab areas. By championing small-scale renewable energy, REGEND reduces reliance on "handouts", instead promoting self-sustaining initiatives based on expertise and encouraging investments in renewable energy. REGEND is currently funded by the Swedish International Development Cooperation Agency and the Islamic Development Bank.

The main objective of REGEND is to increase the uptake of renewable energy. However, the challenge lies in de-risking these efforts for wider adoption. Whether it is financed through State or private funds, small-scale renewable energy requires strategies to mitigate risks. The benefits of increased energy access for basic needs and income generation extend to other sectors in the rural economy, such as agriculture, forming a "virtuous circle".

The energy and agriculture virtuous circle



Source: USAID, 2020.

Small-scale renewable energy has brought a multitude of benefits to rural communities. These include improved water and food security, improved health and education and lower levels of pollution. They have had a particularly powerful impact on women and their entire community. In rural areas of Jordan, Lebanon and Tunisia, REGEND has demonstrated that empowering women to own and operate small-scale renewable energy technologies and productive uses of energy can free up time otherwise spent on housekeeping or fuel collection,[a] as well as reducing the operating costs of businesses typically run by women.[b]

a ESCWA, 2020a.
b ESCWA, 2020b.

Gender-inclusive renewable energy solutions in rural areas

In rural areas, women are frequently involved in agriculture and other income-generating activity. Women's participation in the energy sector, however, remains consistently low. This is true both at regional and global level.

In many developing countries, financial institutions lack familiarity with the off-grid energy sector, viewing small renewable energy technologies as unattractive high-risk low-volume endeavours. Consequently, they impose high interest rates and stringent collateral requirements. This poses a barrier to entrepreneurs, and women in particular. Financial institutions also frequently fail to recognize the distinct needs of women-led businesses, leading to a lack of tailored financial instruments and interventions. A comprehensive study involving over 30 CEOs and senior bankers from financial institutions revealed a prevailing perception that male and female clients were essentially alike, discounting the existence of a "business case" for catering to the female market.[5]

Even when women manage to secure financing, additional hurdles persist. For example, money from micro-lending is sometimes diverted towards household expenses or unintended purposes, leaving women obliged to repay loans even though they were unable to use them to invest in their businesses. It is essential to raise understanding of the role gender plays in small-scale renewable energy. Tailored instruments need to be made available to address these challenges so that the opportunities brought by women's participation in the renewable energy sector can be seized.

Box 2. Specific barriers to finance for women

People in remote and rural communities face significant challenges in gaining access to finance.[a] Women face particular difficulties, in particular because of legal and regulatory barriers.[b] In some regions, archaic requirements are formidable obstacles. In some areas, for example, a male family member must provide permission for a woman to open a bank account. Such requirements have a clearly detrimental effect on women's financial inclusion.

Documentation is also a barrier, particularly for women, who often do not have the identification documents they need. In Bangladesh, a birth certificate is needed to open a bank account. But it is common for women, especially women from poorer backgrounds, not to be registered at birth.[c] These women therefore have great difficulty in gaining access to financial services.

There are also barriers associated with the ownership of productive resources. In some countries, property cannot be held in a woman's name. This prevents women from using land and property as collateral for loans. Cultural dynamics further compound these challenges. Women sometimes prefer to have female points of contact in financial services. When this option is unavailable, as it often is, women can be hesitant to engage with financial institutions.

Addressing these multifaceted challenges is crucial to unleashing the untapped potential of women in remote rural areas, ensuring improved livelihoods and enhancing participation in sustainable economic growth.

a DESA, 2018.
b World Bank, 2023.
c Cherie Blair Foundation, 2023.

2. Challenges to de-risking investments in the Arab region

2. Challenges to de-risking investments in the Arab region

The Arab region is a diverse region, a diversity which is mirrored by the challenges and risks the region faces. Some challenges are more pronounced than in other developing countries, and must therefore be taken into special consideration.

Across the globe, renewable energy uptake in rural areas of developing countries has been limited. Some of the reasons for this limited uptake are universal: poverty, for example, has consistently hampered the uptake of renewable energy technologies. Other reasons are more localized. Cultural differences and conflict, for example, vary from place to place. The focus here will be on challenges particular to the Arab region. Risks arising from global disruptions to the market will receive less attention.

Barriers and risks facing various stakeholders along the value chain

Stakeholder group	Barrier or risk	Features	Implications	Regional context
Demand side/ end users	**Poverty and affordability**	• Rural Arab communities face fuel poverty • High upfront costs impact payments • Limited savings • Unpredictable income	• Financial constraints hinder the adoption of small-scale renewable energy • Renewable energy technologies must compete with other essential expenses • Long-term savings potential from renewable energy technologies is overshadowed	Common to least developed countries and rural areas of low- and middle-income countries across the region.
	Suitable finance	• Lack of microfinance tools • Complex procedures	• Limited access to suitable financing options • Cumbersome disbursement procedures hinder the adoption of available financing mechanisms	
	Willingness to pay	• Decisions affected by affordability • Fuel subsidies • Subsidized grid electricity	• Affordability challenges and dependence on subsidized fuels • Consumers exposed to price volatility of liquid fuels • Consumers exposed to often unreliable grid electricity	The largest electricity subsidizers in 2022 were Egypt ($31 billion), Saudi Arabia ($25 billion), Algeria ($14 billion), the United Arab Emirates ($12 billion) and Kuwait ($11 billion). These figures include subsidies on fossil fuels for power generation.[a]

Barriers and risks facing various stakeholders along the value chain

Stakeholder group	Barrier or risk	Features	Implications	Regional context
	Social norms	• Resistance due to limited awareness stemming from lack of education • Perceived complexity of technology • Gender sensitivities	• Limited adoption in areas with cultural resistance, especially in communities with traditional gender norms • Lack of awareness hampers the acceptance of renewable energy technologies	
	Knowledge and awareness	• Lack awareness of available financing options • Limited capacity for navigating financial systems	• Hinders access to suitable finance, especially in rural households and small businesses • Limited capacity to make informed decisions regarding renewable energy investments • Women face additional challenges from inability to put up collateral and obtain loans	
	Isolation	• Geographical remoteness increases financial expenses	• Higher costs due to limited access to training and technology, and constrained market opportunities • Infrastructure challenges from grid connectivity to suitability of dwelling (e.g. for rooftop solar panels) • Higher financial expenses associated with subpar energy solutions	
Supply side/ producers	**Absence of private sector**	• Few companies for installation and maintenance • Few companies providing suitable finance • Limitations on upstream research and development • Limitations on distribution, marketing and sales	• Limited services and financing options for small-scale renewable energy technology • Lower growth and profitability for small businesses • Hampers the availability of resources, expertise and necessary funding	

Barriers and risks facing various stakeholders along the value chain

Stakeholder group	Barrier or risk	Features	Implications	Regional context
	Dedicated financing and capital	• Small and medium-sized enterprises (SMEs) face high-interest loans and collateral issues • Shortage of domestic investor capital and lack of familiarity	• Lower growth and profitability for small businesses, due to reliance on short-term high interest rate loans, especially those in less understood or risky sectors • Limited bargaining power results in challenges accessing suitable finance, including short repayment periods and repayment structures that do not align with revenues	
	Internal capacity-building	• Producers lack knowledge in project development	• Limited ability to understand end-user needs and secure funds for project development and implementation • Skills gap in local capacity hampers effective project development	
	Hardware and operational risks	• Quality and availability concerns	• Risk to reputation and user reluctance due to poor-quality equipment • Challenges in sourcing, procuring, installing, maintaining and repairing renewable energy equipment	
	Currency risks	• Depreciation affects loan repayments in local currency	• Lenders cautious about extending loans in local currency, impacting project financing and affordability for end users • Global currency fluctuations influence imported equipment costs	Countries such as Lebanon, the Syrian Arab Republic and the Sudan have experienced significant currency depreciations, resulting in stark disparities between official and black market exchange rates. The currencies of Egypt and Tunisia have also depreciated by approximately 50 per cent and 20 per cent respectively since the start of the COVID-19 pandemic.
	Last-mile distribution	• Poor infrastructure hinders remote distribution	• Increased costs and logistical complexities in supplying to rural areas, limiting access to small-scale renewable energy solutions • Reluctance to invest in expanding operations due to associated costs	

Barriers and risks facing various stakeholders along the value chain

Stakeholder group	Barrier or risk	Features	Implications	Regional context
	Price mechanisms	• Arab region historically marked by low energy prices • Limited subsidies for renewable energy discourage adoption	• Limited incentives for adopting small-scale renewable energy in rural areas, especially when fossil fuel subsidies persist • Short-term cost comparisons hinder the uptake of renewable energy solutions	
	Uncertain policy and regulatory frameworks	• Unpredictable regulations and taxes governing renewable energy and other interlinked sectors • Inadequate existing legal and regulatory frameworks	• Investor confidence undermined by policy inconsistency and unpredictability • Legal and regulatory frameworks may not adequately address small-scale renewable energy needs.	
Ecosystems and enabling actors	**Lack of capacity**	• Limited expertise in formulating and implementing policies • Stringent labour laws[b] • Absent cohesive cross sector policies (i.e. land ownership)	• Delays, inefficiencies and gaps in regulatory frameworks due to limited capacity • Challenges in attracting and utilising climate finance effectively	For example, in 2015, the Government of Morocco introduced net-metering schemes for solar PV and onshore wind plants, but this only applied to power plants connected to the high-voltage grid.[c]
	Governance structure and decision-making	• Fragmented authority leads to coordination challenges	• Lack of coordination hampers integrated planning and policies across various government entities and ministries • Hindered adoption of evidence-based policies and optimization of implementation	Experiences from the REGEND initiative (Box 1) exposed overlaps in functions across ministries. These overlaps limit the ability to adopt evidence-based policies and optimize implementation. Each ministry operates under a different mandate, leading to a lack of clarity in the regulatory framework. SMEs or developers often find it difficult to determine which ministry is most relevant to their projects.[d]

Barriers and risks facing various stakeholders along the value chain

Stakeholder group	Barrier or risk	Features	Implications	Regional context
	Energy market structure	• Monopolistic utilities prioritize larger-scale delivery	• Rural community needs left unmet as utilities focus on larger-scale projects • Limited opportunities for private sector engagement in the absence of capable private entities	
	Project size and transaction costs	• Small projects and high per-unit costs • Absence of infrastructure • Uncertainty of demand • Data restrictions on ability to pay	• Viability hindered by high transaction costs, particularly in rural areas • Lack of infrastructure contributes to higher transaction costs and impedes the feasibility of small-scale projects	Effective deregulation can often lead to lower transaction costs, as was the case in Cambodia. Nevertheless, the absence of effective regulations can burden investors when private companies apply informal rules. In places where energy oversight is lacking and companies establish prices, consumers often pay steeper power costs.[e]
	Conflict and instability	• Agencies and financial institutions deterred from working in conflict zones • Political instability • Rise of refugees and displaced populations • Damage to and theft of equipment	• Policy decisions hampered by conflict and instability, deterring investors and implementing agencies • Commercial viability is undermined • Additional risks and uncertainties related to changes in tariff rates, subsidies and regulations • Immediate but short-term needs are un-met	This affects countries in conflict (e.g. the State of Palestine, Yemen, Libya, the Sudan), countries recovering from conflict (e.g. Iraq, the Syrian Arab Republic) and countries experiencing instability (e.g. Lebanon).

a IEA, 2023.
b HIVOS, 2021.
c REGlobal, 2022.
d ESCWA, 2022a.
e USAID, 2023.

3. De-risking investments

3. De-risking investments

Various financing and policy instruments could be used to increase the take-up of small-scale renewable energy in rural areas. Traditional financing[6] is not ideal for this purpose, yet it can still be used to improve more tailored funding mechanisms. Commercial banks are deterred by the high levels of risk they perceive in providing loans to rural populations and low-income individuals and households. Although this is being addressed in several countries such as Bangladesh,[7] Nepal and the Philippines,[8] traditional financial institutions are required to channel a minimum proportion of their lending and assistance towards women entrepreneurs and SMEs.

Over the past decade, increasing amounts have been invested in off-grid renewable energy (figure 3). Although a significant proportion of this increase has come from development finance institutions (DFIs), the range of investors has significantly increased.

De-risking cannot be achieved using any single tool or solution. It is a complex process involving various interventions and instruments, such as increased and diversified financing, policy instruments and capacity-building. This section explores how strategic combinations of these instruments can contribute to the successful de-risking of small-scale renewable energy projects, bringing rural electrification forward.

A. Sources of finance

Securing funding from various sources is crucially important for renewable energy access programmes. Remote and underserved regions face various unique challenges. A variety of challenges calls for a variety of solutions. Certain sources of financing are better suited to addressing certain challenges than others. Having various different sources of financing available helps to mitigate perceived risks, and fosters resilience in the face of unexpected hurdles.

1. Government financing

In the Arab region, most power projects are funded using government financing. Utility projects, and especially renewable energy projects, attract a higher proportion of private sector investment. However, Governments can still play a vital role by offering incentives, grants and subsidies for small-scale renewable energy projects. Governments' local knowledge and regulatory influence make them effective in creating a supportive policy framework. Such a framework, which is especially important for de-risking investments, can be most effective in areas where public infrastructure and policy commitment are strong.

2. Multilateral and international financial institutions

International financial institutions (IFIs) continue to play a significant role in financing off-grid renewable energy solutions. IFIs bring considerable resources and expertise to bear on renewable energy projects. They offer concessional loans, technical assistance and risk-sharing mechanisms. This is particularly valuable in areas where private investors may be cautious due to perceived risks.

High loan interest rates pose a substantial obstacle for SMEs in developing countries, discouraging them from applying for financing. Local banks often charge interest rates ranging

from 20 to 25 per cent, while alternative lenders impose even higher rates, typically between 40 and 50 per cent. As a result, 51 per cent of SMEs in the Arab region face a considerable funding deficit. This financing shortage also has repercussions for projects aimed at combating the adverse impacts of climate change, preventing them from obtaining crucial financial support.[9]

DFIs offer a range of blended finance tools specifically designed to address these challenges. One of these tools, concessional lending, involves providing loans to SMEs at interest rates that are considerably lower than those offered by commercial and local lenders. Other tools used by DFIs are geared towards enhancing SMEs' capacity to secure loans from private investors. These include blended finance mechanisms, equity, grants, technical assistance and guarantees. These diversified financial instruments lower the risk of investing in SMEs, making them more attractive to potential private investors.

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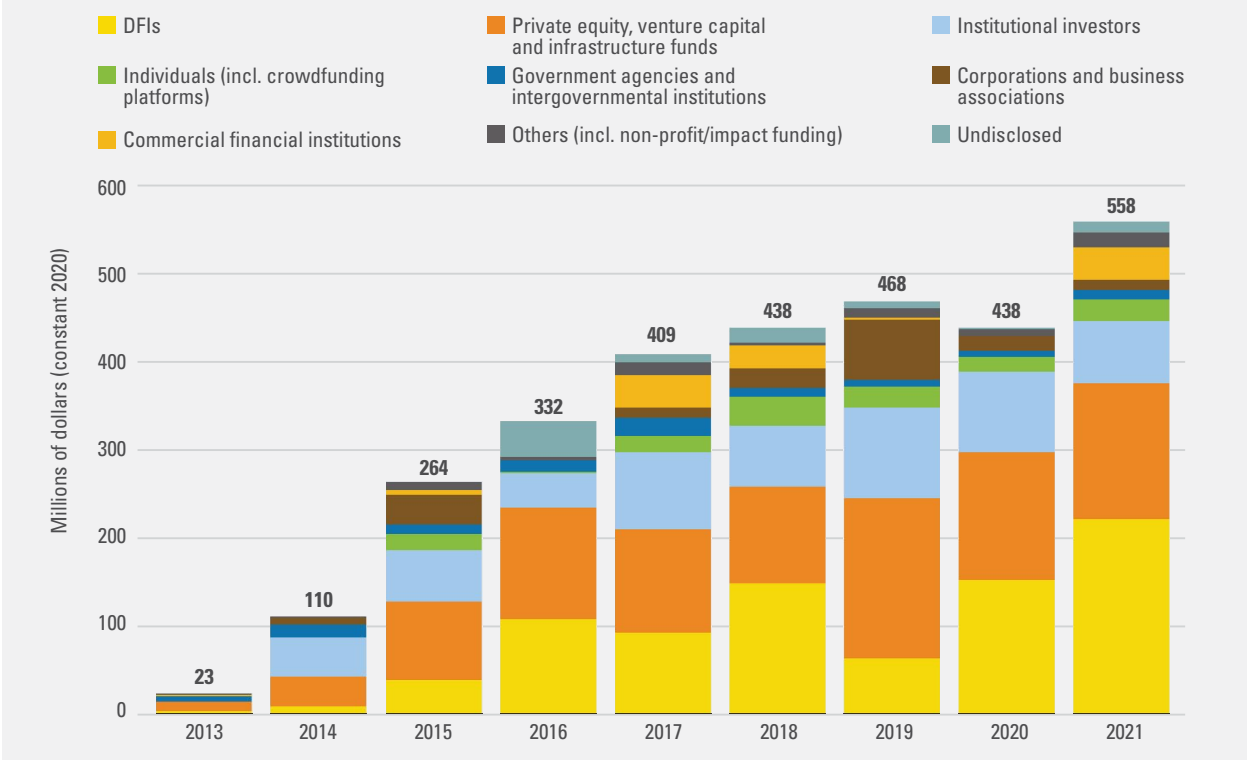
Figure 2. Annual commitments to off-grid renewable energy by type of investor, 2015–2021



Source: IRENA, 2023.

3. Other sources of financing

National development banks have a comprehensive understanding of the local context and can act as intermediaries between Governments and private sector investors. They can offer tailored financing options and project support, making them well-suited for de-risking in various environments. They account for a sizeable proportion of financing in the renewable energy sector.

Foundations contribute in the form of grants. They often seek to encourage innovation and experimentation in renewable energy solutions, channelling funding to small-scale projects in challenging areas where traditional investors might be hesitant.

Impact funds seek to make a social and environmental impact as well as a financial return. By investing in sustainable energy projects, they help to reduce perceived risk and thus attract private capital. They are particularly suitable for areas where the alignment of financial and social goals is critical.

Corporate social responsibility initiatives funded by private companies can contribute to de-risking renewable energy projects in various ways. They can provide funding to community programmes to build positive relationships; they can support capacity-building to reduce operational risks; and they can facilitate pilot programmes to mitigate potential technological or business-model risks. Corporate social responsibility resources can also be channelled into local infrastructure development such as energy-storage facilities, or be used to create risk insurance or guarantee mechanisms.

Community-based financing is essential in remote regions, where local acceptance and support are crucial for project sustainability. Communities can mobilize resources, provide local expertise and foster a sense of ownership, making them integral partners in reducing perceived risks and facilitating long-term success.

These funding sources can be used in combination to de-risk investments. For example, Governments and national development banks can work together to provide guarantees or low-interest loans for private sector initiatives, while foundations and impact funds can support community-driven projects. This approach can significantly reduce risks and enhance the feasibility of small-scale renewable energy projects in remote and challenging areas. In the following sections, we will explore how intermediaries, financial instruments and business models further contribute to this comprehensive risk mitigation strategy.

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Box 3. Unlocking philanthropic potential with the awqaf system in the Arab region

Awqaf is an ancient Islamic tradition involving the endowment of assets for charitable purposes.[a] In the Arab region, awqaf has historically played a significant role in funding social services and development.

In 2020, there were more than 113,000 awqaf institutions in Saudi Arabia; they held an estimated 235 billion Saudi Arabian riyals in assets. In 2020, 7.7 billion Saudi Arabian riyals of awqaf funds was dedicated to Vision 2030, and 7.4 billion Saudi Arabian riyals to fields aligned with the Sustainable Development Goals (SDGs).

Contributions to Vision 2030 by awqaf institutions extend beyond traditional sectors. Initiatives such as Saleh Al-Rajhi, an awqaf institution which provides funding to farms using sustainable practices such as organic farming and solar energy, demonstrate awqaf's potential to promote sustainable agriculture and energy. Awqaf can be used to invest in innovative, high-risk, high-impact projects. This is particularly promising for the field of renewable energy.

Awqaf as a de-risking mechanism in energy investments

Awqaf is aligned with Islamic finance principles which makes it a Sharia-compliant philanthropic tool. It can therefore be used together with other Islamic financing tools, such as equity, grants and guarantees, to further de-risk small-scale renewable energy projects, making them more attractive to investors.

Off-grid solar energy in Yemen

In Yemen, off-grid solar technologies have often been made necessary by crisis situations. Awqaf's ability to provide reliable funding for energy in challenging environments demonstrates its relevance and effectiveness. Awqaf has the potential to bridge humanitarian and development agendas in renewable energy, particularly in regions facing crises.

Unlocking Awqaf's potential

To maximize the impact of awqaf, strategic initiatives are needed. Policies need to be coordinated, enabling legal frameworks need to be put in place, and committees for impact maximization need to be established. Governance improvement, capacity-building and incorporation of contemporary development issues are vital. Technology and innovation can further enhance awqaf's role in shaping a sustainable future. Aligning investments with the SDGs can further promote sustainability.

a United Nations Saudi Arabia, 2021.

B. Intermediaries

1. Microfinance institutions

Microfinance can support the widespread adoption of affordable renewable energy technology by providing flexible loans and tailored funding. Its ability to do so can be increased through the support of IFIs.

In lending to microfinance institutions (MFIs), institutional investors can use criteria designed to overcome specific barriers faced by small-scale renewable energy projects, aligning funding with projected cash flow. Their lending also helps to enhance the capacity of MFIs.

MFIs can decrease risks on the side of both demand and supply. They can offer a broad range of financing to both companies and consumers to help fund small-scale renewable energy projects in rural areas. For example, MFIs can provide microloans to individuals or households to cover the upfront costs of purchasing and installing solar panels, batteries and productive use equipment – equipment that uses energy to create value, for example in the form of increased productivity. They can also offer equally essential non-financial support, such as facilitating connections.

a. Discrete financing instruments

- Individual lending – providing small, manageable loans to micro-entrepreneurs who lack collateral or a formal credit history to support business or for income-generating activities. MFIs that specialize in individual lending typically have a deep understanding of the local context, build strong relationships with borrowers and employ innovative approaches to risk assessment and loan repayment. By lending to a large number of customers, MFIs can **diversify risk,** therefore mitigating the risk of default, as losses from defaults on one loan can be offset by repayments from others. This cycle results in lower interest rates being offered, which enhances affordability.

- Group lending – loans are given to individuals who form groups to gain access to financial services. By acting as co-guarantors for each other's loans, group members reduce the need for collateral and enable lenders to provide credit to individuals with limited credit history. Group lending promotes peer support, fosters accountability and offers access to larger loan amounts. It can also include financial education and training, empowering borrowers with financial management skills and is instrumental in reaching marginalized populations, including women. This holistic approach enhances the effectiveness of microfinance by providing not just credit but also the necessary support and knowledge to help borrowers succeed in their economic endeavours. A good example of this is **community-based lending** methods, which rely on social networks and community pressure to encourage customers to repay their loans. This can also help to mitigate the risk of default, as customers are more likely to repay the loan if they have a good reputation in the community.

- Asset financing – MFIs can offer consumer credit options such as pay-as-you-go (PAYG) financing (discussed below) and partial subsidization for renewable energy technologies and productive use equipment. These approaches help low-income households to afford renewable energy products, allowing them to spread out their payments over time. When this is coupled with other enabling factors, such as offering **flexible repayment terms,** projects become more attractive to developers, particularly in cases where the income generated using the productive use equipment may be low or uncertain.

- Combining credit with government subsidies – subsidies are applied to equipment such as clean cooking fuel technologies. This allows end users to save money on energy consumption or engage in income-generating activities, facilitating loan repayment. MFIs can also **facilitate connections with other stakeholders** such as local governments, utility companies and other financial institutions. They can take advantage of financial incentives offered by these entities to increase funding and bring down the cost of lending. This can also help to increase the visibility of projects and make them more attractive to potential investors and financiers.

b. Non-financial support

- **Providing technical assistance** in addition to providing financial support. This can include assistance in identifying potential sources of financing, and assistance in developing marketing and outreach strategies. This can extend to training and capacity-building support to project developers, and to the development of business plans and other technical documentation. Assistance with system design, installation and maintenance can also be offered; this can help to mitigate technical risks. While MFIs might initially be unable to provide all of this assistance entirely, the support of IFIs and Governments can help them to increase the amount and the effectiveness of the help they can provide.

- Developing specific **credit scoring and evaluation methods** to score the creditworthiness of potential borrowers, which can help to determine the risk of default on a loan.

c. Limitations

While financial institutions such as traditional and cooperative banks can typically deliver microfinance, MFIs specifically provide entrepreneurship financing to populations underserved by traditional institutions.

In Europe, for example, MFIs have often provided loans at interest rates below those of commercial banks, supported by government subsidies and guarantees. But in developing countries, microfinancing is often associated with higher interest rates, as MFIs often bear the full risk of providing loans with no collateral and no government guarantees. Smaller loan sizes and higher costs associated with servicing the loans also contribute to higher interest rates. MFIs in developed and developing countries typically offer flexible repayment options to accommodate the needs of borrowers. However, the challenging financial environment in developing countries, including the limited availability of capital, further influences the interest rates charged by MFIs in those regions.

Repayment methods can be flexible; however, the tenure of loans may not always match that of renewable energy technologies. This means that short-term repayment obligations could still end up outweighing the benefits of the loan, without proper regard being paid to the continued benefits beyond the loan tenure period.

MFIs may encounter regulatory and policy barriers that restrict their ability to finance renewable energy projects. A lack of supportive policies, inadequate regulation and unclear legal frameworks can hinder the growth of renewable energy financing through microfinance. In environments which lack regulation altogether, MFIs could pose a risk to poverty reduction and instead exacerbate it, especially if they lack the technical expertise to evaluate projects or assess end users.

2. Climate finance

Using climate finance to de-risk investments in small-scale renewable energy is crucial for achieving sustainable growth, achieving targets under the SDGs and alleviating the impacts of climate change.

The United Nations Framework Convention on Climate Change states that "Climate finance refers to local, national or transnational financing – drawn from public, private and alternative sources of financing – that seeks to support mitigation and adaptation actions that will address climate change."[10] It can serve as both a source of funding and an intermediary for channelling funds to climate-related projects and initiatives.

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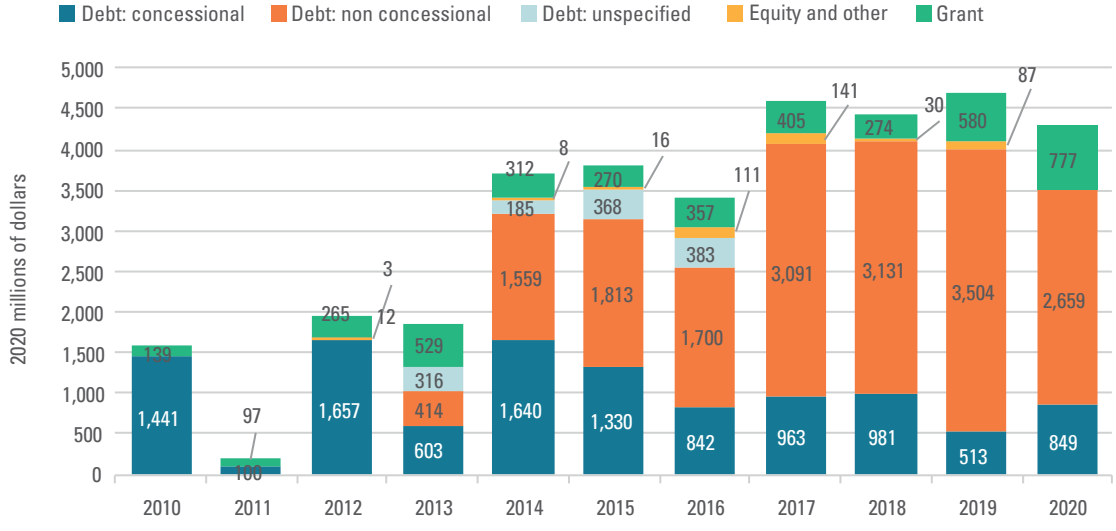
Box 4. Climate finance needs in the Arab region

Based on costed climate finance needs of 11 Arab states, the Arab region requires $570 billion in funding for climate-related spending by 2030. The bulk of this will need to come in the form of public international support or external finance. Less than 5 per cent will come from domestic sources.

Total climate finance in the Arab region by type of financial instrument



Source: Compiled by ESCWA based on the OECD database entitled "Climate-related development finance at the activity level: Recipient perspective 2000–2020.

Over the 2010–2020 period, grants represented a little over 10 per cent of total financing, despite historically high debt service burdens in the region. Non-concessional debt in 2019 represented 75 per cent of total public climate finance flows. Concessional debt accounted for 13 per cent.

Climate finance can be channelled through Governments and international organizations for:

- Grant funding: to support the development of small-scale renewable energy projects in rural areas by reducing financial risk for project developers and making it easier to secure financing from other sources.

- Loan guarantees: to help developers or end users secure financing from banks and other financial institutions by reducing the risk of default for the lender and making it more likely that a project will receive funding.

- Establishing risk-sharing mechanisms such as insurance or reinsurance to mitigate the financial risks associated with project operations.

- Technical assistance: to help to de-risk projects by improving their technical feasibility and increasing the likelihood of their success. This can include providing training and capacity-building support to project developers, as well as supporting the development of business plans and other technical documentation.

Multilateral funds such as the Global Environment Facility (GEF), the Green Climate Fund and development banks are increasingly devoting resources to climate financing. In countries such as Bangladesh and Uganda, the GEF has put in place microfinance schemes to support households and small businesses in purchasing renewable energy technologies.[11] The World Bank has also channelled climate funding to small-scale renewable energy projects in rural areas,[12] including support for SMEs which use renewable energy in their operations. Loans from the International Development Association have been instrumental in de-risking projects such as the Renewable Energy for Rural Access Project and the Renewable Energy for Rural Economic Development, and in mobilizing additional finance.

The Green Climate Fund is a good example of an entity providing funds to intermediaries with higher focus and regional experience in order to make climate finance more accessible at the granular level. One example is the Alternative Energy Promotion Centre in Nepal. The Centre acts as a technical and financial intermediary between donors, Governments and other bodies to channel finance to remote areas, primarily through subsidies. The Centre has established a Central Renewable Energy Fund, which provides end users and SMEs with the financing they need for renewable energy technologies and productive use equipment through commercial banks and MFIs.[13]

Overall, climate finance provided through government channels can play a critical role in supporting the productive use of renewable energy in rural areas, particularly in developing countries where access to finance may be limited. These financing can ensure that special provisions are included to protect vulnerable groups and to address gender barriers. By providing funding and technical assistance to support the development of small-scale renewable energy projects, climate finance can help to increase access to energy, boost economic development and reduce greenhouse gas emissions in rural areas.

Box 5. Using outputs from grant-based programmes to address perceived risks and advocate for innovative financing in the Sudan

With initial support from the GEF and the United Nations Development Programme (UNDP), the Sudan embarked on a pioneering project to modernize its agricultural sector.[a] The first phase of the project involved the installation of 28 solar PV pumps in the Northern State of the Sudan, providing farmers with a glimpse of the technology's potential.

Innovative financing mechanism – de-risking investments

In the project's second phase, to overcome capital constraints faced by farmers, the Sudan established a fund providing resources for PV installations in the Northern State, the Northern State PV Fund. This fund was instrumental in de-risking investments, using GEF funding to attract investments totalling $17.9 million. These investments came from commercial banks and the Ministry of Finance, with a unique subsidy scheme that significantly reduced farmers' financial burden and made solar-powered irrigation accessible.

The success of the Fund paved the way for the development of a National PV Fund, extending the benefits of the funding to farmers across the Sudan. This innovative financing model, supported by both domestic and global sources, demonstrates the transformative power of climate finance in pioneering new financing mechanisms for sustainable agriculture development.

a DESA, 2023.

3. Cooperatives and community-owned projects

Electric cooperatives bring a people-centric approach to the energy sector. Like all cooperatives, they are owned by their members and have democratic leadership structures. Unlike profit-oriented models that channel earnings to international investors, the objective of electric cooperatives is to reinvigorate their community or to distribute economic surpluses among their members. This model offers a more equitable and community-driven alternative to traditional practices.[14]

- Empowering local communities to own and benefit from renewable energy installations is a pivotal strategy in de-risking and expanding access to sustainable energy solutions. Community-owned projects involve residents taking direct ownership or holding significant stakes in renewable energy infrastructure.

- Community members become stakeholders; they have an interest in the success and sustainability of their community's projects. This heightened commitment often translates into greater attention being paid to maintenance and long-term viability, ensuring the longevity of renewable energy infrastructure.

- Cooperatives nurture energy self-sufficiency, reducing dependence on external sources and contributing to energy security. The benefits of community ownership extend to job creation, revenue generation and the enhancement of local infrastructure. Additionally, cooperatives serve as financial buffers against uncertainties and risks. Revenues generated from energy sales or government incentives can be reinvested into the community, diversified across various sectors, or used to offset operational costs. This reduces the financial burden on individual residents and promotes holistic community development.

Case study: the Philippines

In 2011, the Asian Development Bank launched a community-level project aimed at fostering sustainable livelihoods by establishing a revolving fund, funded by the Asian Development Bank and supported with technical assistance. The project encompassed four key activities:

- Pilot renewable energy projects, from installation to operation and maintenance.

- Promote the productive use of renewable energy – engaging with MFIs and non-governmental organizations (NGOs) and ensuring that women play an active role.

- Establish community-based organizations and a revolving fund for livelihood enhancement, including capacity-building.

- Knowledge dissemination to facilitate replication and scaling up.

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The "livelihood" activities included the establishment of a community-based microcredit facility to cater to the financing needs of the electricity-based household micro-businesses and the farm production inputs of the members of the community-based organizations.[15] The microcredit facility is essentially a subset of the revolving fund grant, a component of the Asian Development Bank's technical assistance grant. To establish the fund, manage the facility in the initial phase and build capacity, the programme worked with two NGOs specialized in revolving funds.

To ensure the effectiveness of the facility, a pilot scheme was initially established to gather feedback and assess ability to meet repayment obligations. The process involved collecting loan applications, subjecting them to review by a credit committee, holding applicant seminars, disbursing funds and ongoing monitoring and evaluation being provided by the community-based organizations and an NGO. These entities were responsible for collecting funds and ensuring that transactions were recorded properly.

Facility parameters:

1. Capital deployment is limited to 20 per cent of initial borrowers, with an average loan of 10,000 Philippine pesos (around $175). To account for the slow recovery of payments, the initial tranche of funding (400,000 Philippine pesos) is covered by working capital to cover the initial year's expenses.

2. Revenues and collection efficiency – lending by the community-based organization is restricted to the sum of collections/repayments at the end of the month, less operating expenses.

3. Expenses – loan officers will be hired to ensure responsible bookkeeping.

4. Profitability is forecast to be achieved within three years (assuming a collection efficiency of 97 per cent), and the community-based organization would be able to sustain operations and grow without eroding capital or the grant component of the fund.

5. Over the initial three years, loan capital is expected to facilitate more than 130 loans per year, supported by initial working capital for efficient loan collection.

Figure 3. Process of applying for loans under the microcredit facility

Source: ESCWA, author's notes.

In this instance, the fund is specifically designed to ensure that members of the community-based organization have access to funding to use the energy productively and generate income, which will allow them to pay for energy use and maintain the renewable energy facility and productive use equipment.

Cultural considerations needed to be taken into consideration for the project. In the communities where the project was implemented, men are typically regarded as household heads, and tribal councils are dominated by men. To ensure the equity of the project, applicants were screened thoroughly. Informal groups of women were identified in the communities; they were then organized into women's associations specifically to take part in livelihood activities. During the pilot, there were indicators that women were indeed participating in the project: the community-based organization's members included women, and women were playing roles in the operation of the micro hydropower plant and in the pilot phase of the revolving funds facility.

The sustainability of future renewable energy delivery initiatives relies on factors such as community location, electricity demand generation through income-generating activities, local income-generating power consumers, reliable feasibility studies, available community development and financing organizations, regulatory barriers and policy support.

Ultimately, the community-based organization was expected to take over facility management, reinvest profits, expand its reach and use existing renewable energy capacity for additional income-generating activities and employment. Community-based organizations and cooperatives have been recognized for their effectiveness in reducing risks, optimizing resource use, minimizing renewable energy idle time and fostering mutual support among members.

In a similar project supported under the REGEND initiative, the positive outcomes generated from the initial delivery of renewable energy technologies led the association to source additional funding to purchase more productive equipment, using the available renewable energy capacity, which in turn led to further income-generating activities and employment.[16]

Community-based organizations and cooperatives reduce risk by pooling collateral and resources where needed, reducing renewable energy idle time and, above all, by providing a forum for sharing experiences and difficulties and offering support.

4. Village savings and loans associations

Village savings and loans associations (VSLAs) are a promising business model for de-risking and promoting small-scale renewable energy initiatives in rural areas. Unlike community-owned projects, these community-based financial groups typically comprise individuals with shared goals who pool their financial resources through regular contributions. VSLAs empower rural communities by providing access to microloans at affordable interest rates without requiring collateral, making them an effective tool for mobilizing capital in resource-constrained environments.

VSLAs offer several advantages. They enhance community members' access to finance, and they facilitate investments in clean energy solutions such as solar panels and improved cookstoves. The absence of collateral requirements reduces barriers to entry, particularly for marginalized populations who may lack traditional assets. VSLAs also foster financial literacy and responsibility, nurturing a culture of saving and financial planning among participants.

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Box 6. Mobilizing community savings groups for business finance in Africa

In one project, the Women in Energy Enterprises in Kenya project, an NGO called Practical Action provided VSLAs with assistance to enhance their financial management capacity. VSLAs were given interest-free loans, injecting capital into their lending funds. These funds facilitated broader access to loans for members involved in energy-related businesses.

Under the project, a locally accredited accounting and audit firm was engaged to oversee the credit fund and ensure compliance with government regulations for savings and credit schemes. VSLA members received training in financial management and leadership, alongside continuous monitoring and mentoring.

In turn, entrepreneurs' access to credit and financial services increased from 18 per cent in 2014 to 62 per cent in 2017, with over 80 per cent of entrepreneurs obtaining loans from local VSLAs. VSLAs went through several loan cycles, and members gained confidence: they began requesting larger loans, enabling them to expand their businesses.

By supporting VSLAs, the Women in Energy Enterprises in Kenya project successfully facilitated access to affordable credit for entrepreneurs in Africa, fostering financial independence and promoting business expansion and economic empowerment. While challenges remain, the lessons learned from this approach can be invaluable in setting up similar initiatives, ensuring that members of marginalized communities are able to gain access to the financial resources they need for their businesses.

Limitations

A major limitation of VSLAs is that they typically have low levels of savings. They therefore rely on external injections of capital to be able to extend substantial loans. For larger loans, member guarantees or support from multiple members may be required in cases when collateral is difficult to provide.

Repayment methods and periods must also be aligned with group performance, with mechanisms in place to reduce dependency and ensure sustainability. Community savings groups, including VSLAs, also need training in financial literacy, discipline and leadership to enhance their performance and growth.

5. Distributed energy service companies

Distributed energy service companies (DESCOs) provide decentralized energy solutions such as small-scale renewable energy systems to customers in rural areas. They typically offer a range of services, including the installation and maintenance of renewable energy systems, as well as the sale of electricity to customers.

DESCOs can take on much of the financial and technical risk associated with renewable energy projects. They can provide the capital required for the installation of renewable energy systems, and can offer customers financing options, such as leasing or PAYG plans, that make it more affordable for them to access renewable energy.

Some DESCOs also have the technical expertise to design, install and maintain systems. This can help ensure that the systems the DESCO supports are reliable. This is especially important in rural areas, where the lack of infrastructure and access to technical support can make it more challenging to maintain and repair renewable energy systems. To this end, DESCOs can provide training for local technicians and entrepreneurs.

The African Development Bank has a programme for financing DESCOs. The programme can facilitate local currency financing for DESCOs and provide local lenders with risk mitigation instruments to support them.[17]

6. Crowdfunding

Crowdfunding is an effective way to raise funds, most commonly over the Internet, to finance a specific project or venture. It is especially useful in markets where traditional means of financing are not accessible. Crowdfunding can be used to finance solar home systems in rural areas by allowing individuals or organizations to invest small amounts of money in a project. Crowdfunding can be less expensive than loans from commercial banks.

Crowdfunding can pool individual investors from around the world. Depending on the amount needed, funds can be sourced either from individuals or from smaller banks. As a result, a project can be made appealing to people with varying levels of risk appetite.[18] Borrowers can bypass traditional lending outlets such as banks by bringing their pitches directly to individuals.

Crowdfunding is a promising financing method in many several Arab countries, because it provides an opportunity for members of relatively wealthy diasporas to invest in their home countries. After decades of instability and conflict, over 20 million citizens of countries in the Middle East and North Africa now live abroad, a higher proportion of the population than most regions. These expatriate communities provide remittances and knowledge transfer,[19] especially during periods of crisis and sharp increases in the cost of living. The assistance they provide is often magnified by fluctuations in currency exchange rates. With the right platforms, crowdfunding can help attract additional direct aid from other lenders and commercial banks by channelling remittances to provide financing equity.

A well-established crowdfunding platform can source funding from a diverse pool of investors, including those with high risk appetites and those with relatively modest return expectations. However, acquisition and transaction costs can pose a challenge, as can the need to dedicate funds to marketing. To deal with these obstacles, platforms may decide to use data analytics for user profiling or to explore diversified funding sources and strategic partnerships. By focusing on cost-effective measures, crowdfunding platforms can make their operations more sustainable, ultimately benefiting both the platform itself and end users seeking high-impact investment opportunities.

Crowdfunding can also be useful to banks and Governments seeking to understand levels of risk appetite and realistic pricing levels for renewable energy technologies. It does not need to be the only source of funding: it can potentially be used in blended finance to provide equity in order to gain access to greater volumes of debt financing from commercial banks.

7. Crowdfunding platforms

a. Sun Exchange

Sun Exchange is a peer-to-peer solar leasing platform which allows individuals from around the world to invest in solar energy by leasing equipment to emerging markets, with no need for any physical presence. Sun Exchange installs and maintains the equipment, and investors receive returns from end-user repayments.

Sun Exchange has a global solar cell leasing platform to identify projects, which include schools, organizations and small businesses which wish to use solar electricity, and works with local partners to evaluate the projects to ensure they meet criteria related to economic and technical viability and social and environmental responsibility.

On the platform, people from around the world can make investments to the value of as little as one solar cell. They can track the progress of the project they invested in through the Sun Exchange dashboard, and receive a monthly dividend, less insurance and servicing fees, in a dedicated Sun Exchange wallet, which can be denominated either in local currency or in bitcoin. They can also track the amount of clean energy generated and the amount of carbon offset.[20]

b. Lendahand

Lendahand is a crowdfunding platform that allows investors to support entrepreneurs and SMEs in emerging markets, thereby alleviating poverty. The platform addresses funding gaps in these markets by offering investors the opportunity to participate in projects that align with their preferences and values. The investments made on the platform stimulate local economies, create job opportunities and provide chances for those in need. Once a project is fully funded, investors receive principal repayments along with interest, typically distributed every six months.

As an example, for one of the projects requires a 200,000-euro loan to be raised for a local investment partner, Fortune Credit. It is hoped that the loan will enable approximately 265 rural entrepreneurs, 65 per cent of whom will be women, to gain access to financing. Part of the investment will be directed towards a clean cooking programme which offers credit to rural households to purchase biogas cooking equipment, with the aim of promoting better health and reducing demand for firewood. The investment will allow around 120 households to install biodigesters, helping them to embrace clean cooking solutions.[21]

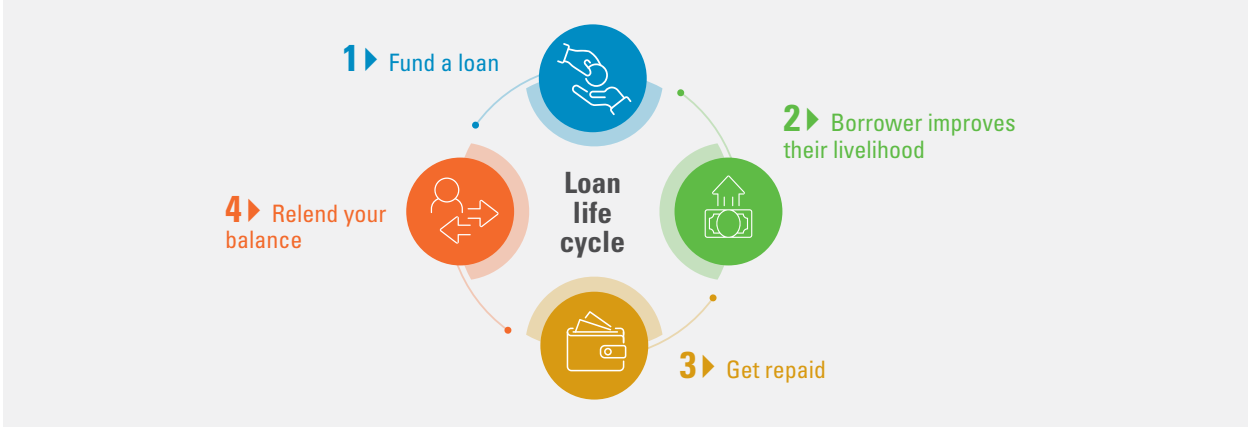
c. Kiva

Kiva is a social impact platform that connects lenders and borrowers around the world to promote financial inclusion and sustainable development. Using crowdfunded microloans, Kiva allows individuals and institutions to lend money to small businesses, farmers and entrepreneurs in developing countries.

Kiva's approach directly addresses various barriers faced by underserved communities. The platform provides financial access to students and women to help them start businesses, and to farmers to help them invest in equipment. The organization makes it clear that the initial payment is a loan and not a donation. Lenders are free to choose which borrows they support, in which countries. The terms of the loans extended through the platform are similar to those from conventional microfinancing providers, but with more flexible terms. This allows Kiva to support community-wide projects while minimizing costs to borrowers.

Individuals who need capital to acquire renewable energy technologies and productive use equipment can apply for a loan through one of Kiva's microfinance lending partners. Once approved, the MFI will post an advertisement on Kiva's website. Advertisements are edited and translated by Kiva volunteers. The minimum investment amount is $5; investors can choose to invest higher sums, up to the full amount of the project.[22] Once the loan is funded it is transferred to the MFI, which passes the money to the end user. The loan allows the end user

Figure 4. Kiva's relending model



Source: Kiva, 2023.

to increase their income; at this point, they begin to make repayments to the lender's Kiva account. Like a revolving facility, but with fewer conditions, lenders can choose to use the returns to make further loans to other projects.

d. Energise Africa

Energise Africa was established in 2017 through a public tender issued by UK Aid and Virgin Unite. It connects individual investors in Europe and beyond with profit-for-purpose businesses in Africa. Energise Africa provides innovative financial products, giving investors the opportunity to make an impact with their lending. Under the initiative, capital has been lent to climate finance projects. For example, Aptech Africa raised 300,000 pounds sterling from individual investors to install two solar-powered mini-grids in Androka and Manatenina, two rural communities in Madagascar.[23]

While solar mini-grids present numerous benefits, challenges include high initial costs and maintenance expenses. Crowdfunding platforms such as Energise Africa aim to provide help with meeting these costs, enabling organizations such as Aptech Africa to build more mini-grids. Aptech Africa also provides training, maintenance and spare parts.

8. Other intermediaries

Various other bodies can fulfil the role of intermediary. Special-purpose vehicles, for example, can be a pivotal source of finance, aggregating capital from diverse investors to kickstart projects and manage their financial aspects. Other government institutions and local municipalities can play a complementary role by providing policy support, incentives and risk-sharing mechanisms that create a conducive environment for investment. Meanwhile, accelerators and incubators contribute by nurturing project developers, providing mentoring and assisting with technical and financial capacities. Collectively, these intermediaries bolster the growth of small-scale renewable energy in rural regions, effectively mitigating risks and encouraging the take-up of sustainable energy solutions.

C. Financial Instruments

1. Grant and subsidies

a. Upfront grants

Grants can be used to offset the burden of high upfront costs, or to mobilize higher levels of financing by covering the higher risk tranches of a financing facility. They can also be issued to cover other costs associated with the business model, such as the costs of productive use equipment and training.

Box 7. The use of grants to promote renewable energy and support household sector in Jordan

The Jordan Renewable Energy and Energy Efficiency Fund operates by making agreements with local banks to implement a concessional financing scheme. The Fund provides 30 per cent of the cost of a total renewable energy system as a grant, making it more accessible. Beneficiaries then repay the remaining 70 per cent over 48 months. There is a cap on assistance: projects are funded up to 3.6 kW, or an equivalent value of 1,980 Jordanian dinars. Despite the Fund's positive impact, challenges persist: there is room for improvement in the Fund's eligibility criteria, its transparency and the robustness of its monitoring and evaluation programmes.

At the same time, community-based organizations, supported by a grant from the GEF, provide revolving loans. REGEND carries out regular rural site assessment visits. These visits have revealed the significance of support to rural women entrepreneurs, many of whom use revolving loans to invest in their home-based businesses.a Loans have also been used to support the acquisition and installation of solar water heaters.

a ESCWA, 2022b.

b. Results-based financing

Results-based financing is a useful tool in sustainable energy development. It hinges on three core principles. First, donor funds can be disbursed to recipients only after agreed results are achieved. Second, recipients are free to determine how these results are achieved. Third, fund disbursement is contingent upon independent verification of results.

Unlike conventional development methods where funding is provided upfront to support inputs and activities, results-based financing bolsters accountability by requiring verifiable evidence of results. This gives recipients an incentive to adhere closely to programme objectives. Linking funding to results shifts recipients' focus from processes to outcomes, compelling them to overcome hurdles and implement lasting structural changes.

Results-based financing can be applied to Governments, public institutions, the private sector and civil society organizations. It therefore has the potential to mitigate market failures. Payments can be made when final or intermediate outcomes are achieved, leaving scope to reward progress incrementally. This approach raises competition among recipients, fostering efficiency and effectiveness in a way which conventional development practices fail to do. It encourages innovation, offers flexibility and shifts the financial risk from donors to recipients. As an example, one of the goals of EnDev's results-based financing facility is to eradicate market barriers and drive private sector engagement in delivering renewable energy services to underserved communities.

Another example is a project in Tanzania, implemented by SNV, which is aimed at enhancing access to small solar energy systems for rural households in the Lake Zone of Tanzania. The project incentivized the development of solar product distribution chains in underserved rural areas with low access to the national electricity grid. By doing so, it triggered rapid

market engagement. Companies moved into the region, establishing new offices and sales hubs, reaching hundreds of retailers and agents. These transformative results demonstrate the importance of results-based financing in de-risking small-scale renewable energy in rural areas, invigorating sustainable energy access and fostering market transformation across the Arab region and beyond.[24]

c. Subsidies

Subsidies can be used to make clean energy sources more affordable for end users and to give SMEs and project developers an incentive to use them. Subsidies can be made available from as early on as the production or manufacturing phases if the equipment is locally made. If it is not, they can be applied to product purchases. Otherwise, subsidies can also be applied to reduce operational costs and repayments where loans have been taken out by subsidizing the cost of transitional fuels such as liquefied petroleum gases.

▸ In Uganda, the Micro-scale Irrigation Programme offers farmers a 25 per cent subsidy for petrol-powered pumps and a 75 per cent subsidy for solar pumps, with financing available to cover the non-subsidized portion.

However, not all countries in the Arab region have the resources to provide subsidies or grants without compromising in other equally important sectors of the economy. This is why donors and philanthropic institutions can be a crucial form of financing and can provide support for feasibility studies and risk assessments. Donors can even extend grants to developers of small projects, subject to a series of sustainable conditions designed to ensure that the business model benefits the end user.

In a study of off-grid solar inclusion in sub-Saharan Africa, countries were categorized on the basis of the challenges they faced. The aim of this categorization was to help Governments and international institutions to identify the instruments best suited to dealing with the challenges that countries face, ultimately helping them to make more effective interventions. The categories included geographical areas with a high need for electricity, countries with matured off-grid solar markets, underserved and low-income markets and fragile countries. Across all categories, working capital facilities to encourage local currency loans were identified as being critical.[25] The importance of well-designed blended finance and financing instruments was also highlighted. Such instruments have the potential to ensure benefits for all by reducing the cost of capital and, in turn, lowering costs for consumers.[26]

Box 8. Subsidy programmes in Jordan

"Fils al Reef", a project initiated in 2019 by the Ministry of Energy and Mineral Resources, targets beneficiaries of the Jordan National Aid Fund to receive fully funded PV and solar water heating systems. This project is designed to support approximately 7,000 families annually across all governorates in Jordan, aiming to reduce the burden of monthly electricity bills and expand the adoption of renewable energy systems.

Over time, the project is intended to reach 100,000 families who receive assistance from the National Aid Fund. By the end of 2019, two phases of the project had successfully been implemented. In all, 5,379 families had each received a 2 kW solar PV system. The collaboration between the Directorate of "Fils Al Reef" and the National Aid Fund has been successful in promoting the uptake of renewable energy systems among economically disadvantaged sections of the population. It has also brought broader economic and social benefits, reducing reliance on subsidized electricity tariffs and addressing tariff-related issues.

2. Concessional debt and equity

Concessional debt and credit enhancement mechanisms, including guarantees, have become vital tools for mitigating risks associated with small-scale renewable energy projects in rural areas. These mechanisms serve to reduce the cost of capital for project developers, making the implementation of clean energy solutions in remote and underserved regions more financially viable. Credit enhancement in the form of guarantees provides an added layer of security to lenders and investors, assuring them that their investments will be safeguarded even in adverse scenarios.

Concessional debt and credit enhancement have two key impacts. First, they reduce the perceived financial risk associated with rural renewable energy projects, making them more attractive to a broader range of investors, including commercial banks and impact investors. Second, they create an environment conducive to the flourishing of smaller, decentralized energy solutions that cater to the specific needs of rural communities.

Concessional finance and guarantees are typically provided through a collaboration of public sector entities, international development organizations and specialized financial institutions. Public sector bodies, often operating through their development finance arms, play a central role in extending concessional finance to renewable energy projects, particularly in regions with limited access to affordable capital. International development organizations, along with regional development banks, contribute to these efforts by offering guarantees and risk-sharing instruments, thus encouraging private sector participation. Additionally, specialized financial institutions, both public and private, may partner with these entities to provide credit enhancement and guarantees, further stimulating investment in small-scale renewable energy initiatives.

3. Financing facilities

a. Credit line

The successful experience with green financing facilities in Morocco, such as the Moroccan Energy Financing Facility (MorSEFF) and the Green Value Chain financing facility, provides a model for de-risking small-scale renewable energy initiatives. MorSEFF, a 110-million-euro credit-line facility established by the European Bank for Reconstruction and Development, along with other partners, is dedicated to channelling financial support through local financial institutions.[27] It funds sustainable energy projects in the private sector in Morocco, with a particular emphasis on SMEs and corporations. MorSEFF focuses on stand-alone small-scale renewable energy projects and energy-efficient investments within the commercial and building sectors. The facility also offers crucial technical assistance, including training, capacity-building, marketing support and the development of appropriate lending products. The Green Value Chain facility follows a similar credit line model, with the aim of enhancing energy, water and resource efficiency in Moroccan SMEs.

Arab countries can draw inspiration from these initiatives, particularly in the context of de-risking investments for SMEs aiming to contribute to decarbonizing the energy sector by installing solar PV equipment and increasing energy efficiency. Replicating a "green" financing facility akin to MorSEFF could streamline financing options, attract both donor and private sector investments and provide technical assistance to local financial institutions to assess the risks associated with small-scale renewable energy investments.

b. Project finance

Project finance has proven to be a versatile tool in enabling small-scale renewable energy initiatives in rural areas. This mechanism has successfully been used to fund grid-connected PV plants of varying sizes, ranging from 2 MW to over 20 MW, and can also be adapted to even smaller projects. By grouping smaller projects into portfolios, the critical size required for cost-effective financing by banks can be achieved. This approach enhances the feasibility of renewable energy ventures in rural regions, ensuring that even the smallest initiatives can contribute to sustainable energy access and rural development.

Though few examples are available in the Arab region for households and individuals, project

finance is gaining traction in the commercial sector. The Arab Energy Fund, a regional DFI, has provided a $50 million credit facility to SirajPower, the leading distributed solar energy provider in the United Arab Emirates.[28] At the time, this transaction signified the largest lease-funding platform for distributed solar energy in the Gulf Cooperation Council countries. It enabled SirajPower to deploy rooftop solar PV solutions, allowing businesses to reduce their utility costs while offsetting their carbon footprint.

There have been several further examples of project financing in the Arab region, suggesting a regional commitment to advancing renewable energy at large. In Egypt, these projects have included rooftop initiatives led by local developers, supported by non-recourse financing through subsidized "green" loans. In Jordan, both rooftop and ground-mounted projects for commercial and industrial clients have been financed by regional and international banks on a non-recourse basis.

These examples demonstrate the increasing prevalence of sustainable energy projects. With the right regulatory environment and commitments from Governments and development banks, initiatives of this kind could be extended to rural small-scale renewable initiatives.

Box 9. Tunisian Solar Programme

In Tunisia, the Tunisian Solar Programme, a joint initiative of the United Nations Environment Programme, the Tunisian National Agency for Energy Conservation and the Société Tunisienne de l'Électricité et de Gaz, established a loan facility to subsidize the purchase of solar water heaters, offering investment subsidies on five-year loans. Collaborating with financial institutions, the Tunisian Solar Programme mitigated risks for banks by involving the electricity utility company as a debt collector. This strategic move not only reduced risks but also expanded the pool of available finance for the widespread adoption of solar water-heating systems.

4. Risk mitigation

a. Credit enhancements and guarantees

Guarantees play a critical role in making investments in small-scale renewable energy more attractive and less risky. Typically, they are commitments provided by entities such as Governments or international organizations to cover potential losses. In the context of renewable energy, these guarantees are vital for mitigating specific risks such as currency risks and political unrest. Many Arab countries also lack the necessary infrastructure and experience to implement renewable energy projects, making guarantees an essential tool for ensuring project completion and performance.

In the Arab region, guarantees play a pivotal role in mitigating diverse risks arising from factors such as ongoing conflicts, political instability and post-conflict reconstruction. In countries such as the Sudan and Yemen, both of which face significant challenges to rural electrification, guarantees are crucial for attracting investments and reducing reliance on traditional fuels. Lebanon and the Syrian Arab Republic, which are confronting political and economic challenges, need guarantees to counter currency risks. Similarly, in Iraq, guarantees are instrumental in attracting investments, especially as the country addresses critical infrastructural gaps.

Entities such as the Multilateral Investment Guarantee Agency (MIGA), a subsidiary of the World Bank Group, play a pivotal role in de-risking investments in off-grid renewable energy. MIGA enables and encourages the growth of clean energy solutions in underserved regions, primarily in Africa.

One of MIGA's initiatives involves the African Infrastructure Investment Fund 3. MIGA has extended a substantial guarantee of $37.1 million to reduce the financial risks associated with the Fund's investments in Bboxx, a solar home systems provider, across Rwanda, Kenya and the Democratic Republic of the Congo. MIGA provides guarantees for a maximum term of 10 years to ensure that the investments it covers can remain secure and profitable.[29]

The Energy Inclusion Facility Off-Grid Energy Access Fund is another project working toward electrification in Africa, backed by the African Development Bank. MIGA has provided a guarantee of $5.9 million to cover the Fund's investments in Bboxx. This guarantee, like the one for the African Infrastructure Investment Fund 3, bolsters the financial security of investments in the electrification sector and makes them more attractive to investors.

The core objective of these guarantees is to mitigate risk by protecting against currency inconvertibility, transfer restrictions, expropriation and even the consequences of war and civil unrest. MIGA's guarantees make investments less uncertain and more appealing to investors and financiers.

The impact of these guarantees extends to the communities they serve. The projects they protect reduce reliance on traditional fuels such as wood. This leads to improved air quality and reduced indoor air pollution, with specific benefits for the health and productivity of women and children.

b. Insurance

Insurance at the micro scale can provide financial protection against a variety of risks that may threaten the viability of projects. These are outlined below:

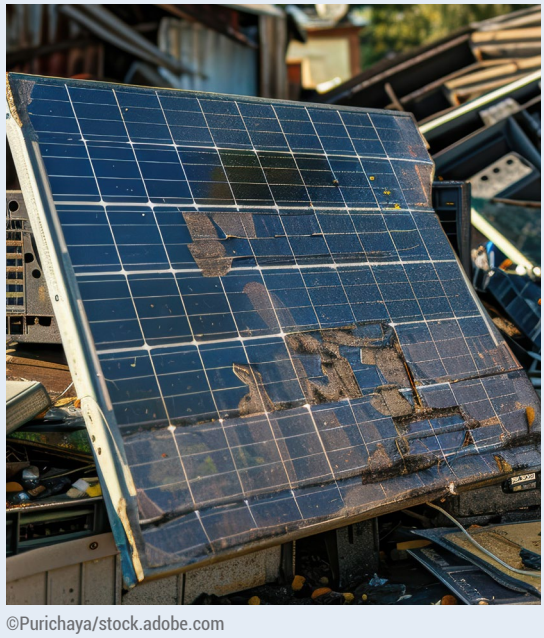
1. **Equipment insurance** to provide financial protection against the risk of equipment failure or damage, which can be particularly important for small-scale renewable energy projects that rely on specialized equipment. For example, if a solar panel or wind turbine fails or is damaged, the cost of repairing or replacing the equipment could be financially catastrophic for a small-scale renewable energy project.

2. **Political risk insurance** to protect against the risk of political events that could disrupt a project's operation. This can be particularly important in developing countries, where the risk of political instability or regulatory changes is often higher. The Arab region has had ongoing instability for decades, most recently in the form of the "Arab Spring" protests, and continued conflicts in some countries thereafter.

3. **Manufacturer warranty insurance** to protect against the risk of equipment failure or defects during the warranty period. This type of insurance can be particularly important as equipment warranties may not fully cover the costs of repairing or replacing equipment that fails during the warranty period.

4. A solar irrigation company active in Uganda, Ethiopia and Malawi announced a ten-year warranty on its systems. This long-term support can help to de-risk farmers' investments, and may lead to greater uptake.[30]

5. **Natural disaster** insurance to protect against the risk of natural disasters such as earthquakes, hurricanes and floods. Disasters of this kind are becoming increasingly frequent because of the effects of climate change. This type of insurance is therefore becoming increasingly important. In the Arab region, there has been an increase in sandstorms, flash floods and extreme heatwaves in recent years. This has affected agriculture and livestock, as well as causing infrastructural damage.



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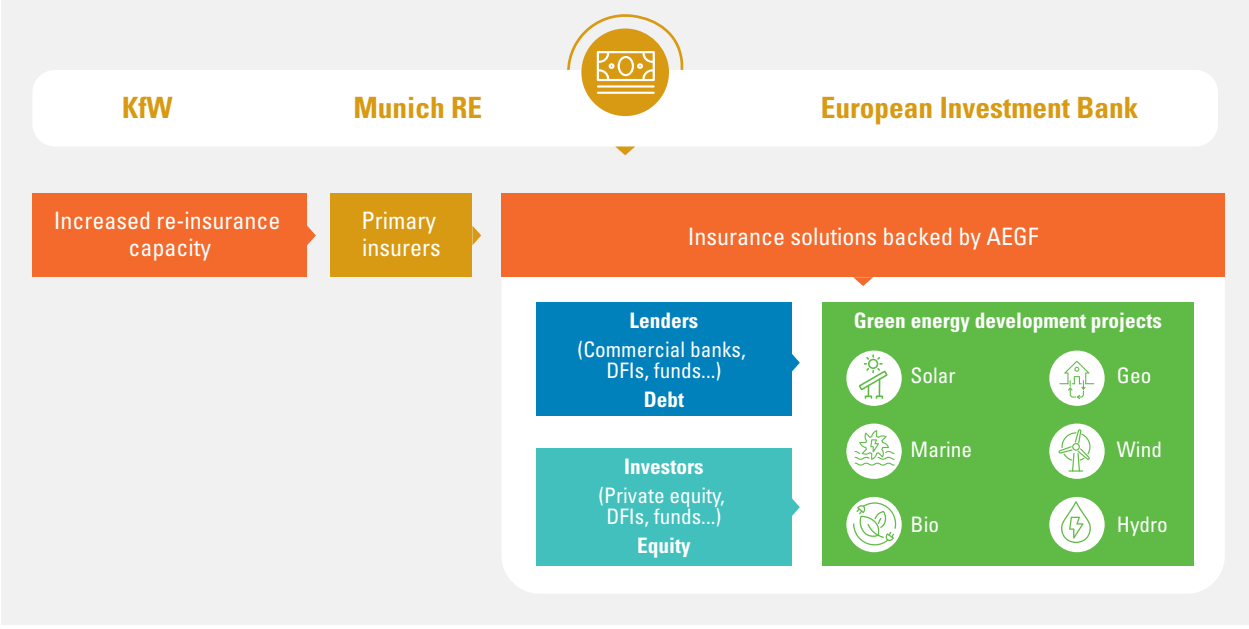
Extreme weather events caused by climate change such as floods, storms and droughts are increasing in frequency and intensity. As a result, demand for insurance against them is increasing. InsuResilience is a global partnership for climate and disaster risk finance and insurance solutions, providing financial support in the immediate aftermath of an extreme weather event.[31]

Parametric (indexed) insurance, for example, particularly weather-indexed insurance, is a unique approach to risk mitigation whereby predefined pay-outs are triggered when specific criteria, often linked to local weather records, are satisfied.[32] Unlike traditional insurance, these pay-outs are not determined by estimating the actual amount of damage incurred by policyholders. This eliminates the cumbersome and time-consuming claims-adjustment process, allowing quicker disbursements to policyholders. In the context of rural small-scale renewable energy projects, parametric insurance can help to reduce the financial vulnerabilities associated with unpredictable weather patterns. It offers protection to farmers against losses caused by extreme weather events such as floods, droughts and temperature extremes. Importantly, it also serves as a financial safety net for renewable energy producers, helping them to mitigate cashflow shortfalls resulting from inadequate returns from renewable energy sources such as solar power. Parametric insurance increases financial resilience, making it an essential tool for de-risking and promoting the adoption of small-scale renewable energy solutions in rural regions, where vulnerability to climate-related challenges is a significant concern.

Including climate risk insurance in a business model will greatly reduce risks for investors. As well as protecting capital, equipment and land from the effects of extreme weather, it will also protect against losses in income. This is especially necessary for poor households and women in rural areas: it will reduce the burden they have to bear as a result of extreme weather events, and ensure that they can return to productive activities without the need to start again with little to no capital and to overcome barriers an additional time.

Figure 5. Mechanism of the African Energy Guarantee Facility



Source: WRI, 2022.

5. Fiscal policy and regulation

Governments can ensure that the costs of renewable energy technologies and productive use equipment are competitive. Means at their disposal in doing so include waving import tariffs and value added tax, and reducing the income or corporate tax burdens of people and businesses using renewable energy technologies and productive use equipment. In some cases, tax credits can also be used to offset carbon emissions.

As an example, Jordan has been granting tax exemptions since 2012 covering a broad spectrum of renewable energy and energy-efficiency products, including solar panels, wind turbines, energy-efficient appliances and LED lighting. The tax exemptions have made these products more affordable for consumers and businesses. In the Syrian Arab Republic, the National Energy Research Centre, established in 2003, has been cooperating with government institutions to promote tax and custom exemptions for renewable energy and energy-saving projects. Similar steps are being introduced in many other developing countries. For example, the Government of Ethiopia is considering lifting tariffs on certain specific productive use appliances.[33]

D. Non-financial instruments

1. Technical assistance programmes: capacity-building and technical support for project developers.

Technical assistance programmes play a crucial role in mitigating investment risks. By offering capacity-building and tailored support to project developers, these programmes address challenges and empower entrepreneurs, ultimately fostering a conducive environment for successful clean energy businesses. For example, the Infrastructure Development Company – a Government-owned financial institution in Bangladesh – has been working with agriculturists to help farmers to learn and apply good agricultural practices to enable higher yields.[34]

One fundamental aspect of this support is building the confidence and competence of entrepreneurs, particularly women, who may lack experience in the clean energy sector. These programmes not only enhance their skills but also alter their self-perception, making clean energy entrepreneurship a viable and profitable endeavour. In this context, technical assistance initiatives provide valuable tools and training to guide entrepreneurs toward self-empowerment, ensuring they can confidently engage in marketing, negotiation and business management.

Innovative training programmes

- Start and Improve Your Business programme focuses on management training for small enterprises, contributing to economic growth and job creation, particularly in developing economies.
- Expand Your Business programme supports growth-oriented enterprises through an integrated approach, offering both training and non-training interventions to facilitate business expansion.

- Empowered Entrepreneur Training Handbook by the Global Alliance for Clean Cookstoves provides women sales agents and entrepreneurs with business skills, empowerment and leadership training to excel in the clean energy sector.[35]

Capacity-building and technical assistance programmes also play a role. Promoting knowledge transfer within these programmes can empower women and young people in clean energy entrepreneurship. People who have received training in this way can bring the theoretical and practical knowledge they acquire back to their communities. This approach enhances inclusivity, bridging gender and generational gaps in the clean energy sector, and encourages community-wide participation. An example of this took place under the REGEND initiative. Women in Akkar were given training by NGOs and received payment for disseminating the information in their communities. This initiative not only acknowledges the contribution the women made; it also establishes a sustainable model for knowledge-sharing.[36]

Effective implementation requires stakeholder engagement through cooperation between NGOs, local communities and trained individuals, forming a network that drives clean energy entrepreneurship and sustainable development at the grassroots level.

2. Developing frameworks and roadmaps

Frameworks and roadmaps can help guide and give structure to complex initiatives, particularly in the context of renewable energy and sustainable development. These documents usually include a strategic path, outlining key steps, objectives and policy adjustments necessary to make the transition to clean and reliable energy sources. They act as unifying roadmaps, aligning diverse stakeholders and allowing them to make informed decisions, mobilize their resources and track their progress effectively. By providing a clear vision and a systematic approach, frameworks and roadmaps are instrumental in de-risking small-scale renewable energy projects.

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Box 10. UNDP De-risking Renewable Energy Investment framework

In 2013, UNDP launched its De-risking Renewable Energy Investment framework.[a] It provides policymakers with valuable insights and tools to foster private sector investment in off-grid electrification projects.

The framework systematically identifies barriers and associated risks that hinder private sector engagement and provides guidance on tailored public interventions to mitigate these risks. By strategically reducing, transferring, or compensating for risk, it is intended to attract significant private sector investment, fostering the growth of reliable, clean and affordable off-grid renewable energy solutions in the Arab region.

The framework categorizes these public interventions according to three main strategies: risk reduction, risk transfer and risk compensation. Each of these strategies is applied to alter the risk-return profile of renewable energy projects in a way that attracts private sector investment at a significant scale.

a UNDP, 2023a.

E. Business models

In the Arab region, renewable energy finance and human security have interacted in ways which demonstrate resilience and provide opportunity. In some countries, such as Yemen, off-grid solar technologies have emerged not in spite of crises but partly due to them, offering reliable energy solutions to communities isolated from traditional centralized grids. These solutions have included the installation of small solar modules. These modules require modest investments, and have the potential to provide energy access even in the most challenging of environments.[37] To bridge the humanitarian and development agendas, innovative financing models and public-private partnerships with multilateral or governmental stakeholders are essential, ensuring the swift deployment of these systems in crisis and post-crisis settings.

This section outlines a series of evolving business models that have been responsible for the growth in de-centralized renewable energy in the larger sub-Saharan Africa and Asian markets.

1. Pay-as-you-go

The PAYG financing model has proved transformative, especially for rural populations in developing countries with limited access to traditional financial services. In regions where households lack access to banks and lending institutions, PAYG has facilitated the purchase of renewable energy equipment such as solar home systems through small, incremental payments made over time. This can make the purchase of renewable energy technologies more affordable for low-income customers in remote rural areas, allowing them to spread payments over periods from six months up to eight years.[38] In other words, there is no need to pay for an entire system upfront.

In 2022, for instance, the European Investment Bank collaborated with ENGIE, a major French utility company to provide a 10-million-euro loan for solar home systems in Benin using PAYG contracts. This initiative extended access to clean energy to 643,000 people, employing digital tools and mobile money to make access-to-energy products affordable. Funding from private investors and impact funds from multilateral funds is a necessary component of this.[39]

The PAYG financing model can be highly effective. In one example, a leading provider of solar-powered home energy products in sub-Saharan Africa and South Asia secured $90 million in funding from European DFIs, impact investors and private equity firms to expand its PAYG solar consumer financing business. As a result, the company has successfully delivered over 1.3 million PAYG solar products to homes in Kenya, Tanzania, Uganda and Nigeria. This expansion occurs at a remarkable pace: every month, an average of 65,000 new rooftop solar installations are installed. More than $69 million has been disbursed already and the company aims to continue delivering solar-powered home energy systems to African homes, improving energy access for households and businesses that have long struggled with electricity access.

This partnership demonstrates that financial inclusion can be pursued as a goal at the same time as advancing the adoption of renewable energy. The approach applied in this case aligns with the goal of making basic solar power accessible to a broad demographic, ultimately contributing to both clean energy adoption and economic empowerment in rural areas.[40]

PAYG has been particularly successful in East Africa, where well-established mobile money systems have proved to be particularly compatible with the PAYG business model. In Kenya, Tanzania and Rwanda, PAYG products accounted for a significant portion of off-grid renewable energy funding commitments, amounting to approximately $2.4 billion from 2010 to 2021.[41]

2. Leasing/lease to own

Leasing allows customers to rent systems, making payments on a regular basis, while the lessor maintains ownership and assumes the risks

associated with the system, such as maintenance and depreciation. This can provide a way for customers to gain access to renewable energy technologies without having to make a large upfront investment. This is particularly beneficial for seasonal activities where demand for energy is not constant, such as produce processing, drying and refrigeration. With the right business model, farmers can lease the equipment only for the period they require it. Alternatively, if the equipment is needed throughout the year, the end user can be given the option to purchase the system at the end of the lease using the income generated by the system. This can be a useful way to provide access to larger solar PV systems or solar water pumps in remote rural areas where customers may not have the means to purchase systems outright.

Box 11. Empowering rural women in Senegal through equipment leasing

In Senegal, Energy 4 Impact, an international NGO, facilitated a loan guarantee arrangement with MFIs to empower women engaged in agriculture and agricultural processing.[a] The arrangement involved, a national MFI, a French financial institute and an equipment supplier.

Under the arrangement, Energy 4 Impact committed to providing support to large numbers of women clients, helping them to draw up business plans. The financial institution provided concessionary finance to the MFI, which in turn made solar equipment such as solar fridges and pumps available to women's groups through the equipment supplier.

As part of this initiative, women's groups received equipment on a lease basis at a 15 per cent interest rate. They made a 10 per cent deposit in a bank account as collateral, committing to repaying the balance in 30 monthly instalments. In the event of repayment difficulties, the equipment was returned to the MFI, which bore most of the risk.

Key features:

- Risk reduction through support: the involvement of Energy 4 Impact, an organization specializing in energy and recruiting, supervising and monitoring entrepreneurs, significantly reduced the perceived risks for the MFI. This made the MFI more comfortable with lending to rural women entrepreneurs.
- Proximity and assurance: despite geographical distances, Energy 4 Impact's proximity to the entrepreneurs reduced the monitoring challenges faced by the MFI. This increased their confidence in the lending process.
- Overcoming financial constraints: in the town where this project was implemented, entrepreneurs sometimes struggled to find the required 10 per cent down payment they were required to make. In view of this, future initiatives should consider establishing a revolving credit system to support women entrepreneurs in making such payments, allowing repayment after the first six months of equipment use.

In this case, the microfinance-based leasing model successfully empowered women in the agriculture sector in Senegal, fostering entrepreneurship, strengthening market links and promoting sustainable economic growth.

a Energia, 2018.

3. Anchor-based/business consumer model

The anchor-based/business consumer (ABC) model can offer benefits for rural electrification. Under this model, energy companies or developers use reputable anchor tenants such as local schools or community centres to attract financing and customers for the installation of solar home systems in nearby areas. The ABC model can also be used to attract financing and customers for the installation of equipment, such as solar-powered irrigation systems, water pumps and milling machines, in remote rural areas. The anchor tenant, such as a local farm or small business, serves as a demonstration site for the equipment, showcasing its reliability and effectiveness to potential customers in the surrounding community. This helps to increase the perceived value of the equipment and make it more attractive to potential customers. Financiers also feel more secure investing in the project as they know the anchor tenant will be a stable customer, and that the need for the equipment is genuine.

The installation of the equipment can increase the anchor tenant's productivity and income; this can help to improve the living standards of the community. It can also attract other potential customers in the area and help to create a positive cycle of economic development. In addition, the anchor tenant can also act as a local service provider and distributor of the equipment. It can offer maintenance services to other customers, creating an additional income stream.

Companies using the ABC model may be able to secure financing for their suppliers at a lower cost than what small-scale farmers for example could obtain independently.[42] The primary purpose of the anchor tenant in the ABC model is to guarantee a steady and reliable income for the developer. The model can also provide practical demonstrations of the technology in question, a secondary but nonetheless important role.

In the absence of community engagement and financial governance, cost distribution can disincentivize the members of the community. Government intervention in the form of cross-subsidization, spatial analysis and planning, and forums for customer engagement can contribute to correcting this.[43]

F. Novel and emerging business models

1. Aggregation

In the context of finance and investments, "aggregating" means combining multiple smaller investment opportunities into a single vehicle or platform. For example, energy companies and investors may pool capital into a portfolio of projects to reduce costs and risks. The use of aggregation in connection with renewable energy is relatively novel. The way in which it is used will have to be adapted to fit small-scale renewable energy technologies in rural areas.

Aggregation can be used to develop new investment products. It can be coupled with various risk-mitigating strategies, including guarantees, tax exemptions, concessional financing and bundled loans. It can also be combined with targeted subsidies and blended public-private financing.[44]

Financial aggregation in the off-grid energy sector uses structured funds to attract diverse investors such as SunFunder's $42.5 million structured energy fund. Funds of this kind offer varying returns for similar risks, backed by decentralized energy systems and companies to spread risk and reduce costs.[45] Impact investors, public and private funds, government programmes and financial intermediaries have been instrumental in testing business models and supporting sector growth. Public aggregators such as the Infrastructure Development Company in Bangladesh and the Alternative Energy Promotion Centre in Nepal have been effective in pooling government and donor funds to boost energy access.

Aggregation, though, is not limited to projects or finance. It can also extend to aggregating demand as well as data to address various barriers depending on the environment. Factors such as population and connectivity to the grid determine the best method of aggregation. In essence, financial de-risking instruments and incentives play a crucial role in lowering the cost of capital for small-scale renewable energy projects by transferring investment risks to public entities such as development banks.

a. Aggregating projects

Project aggregation, encompassing operational bundling and financial bundling, plays a pivotal role in addressing challenges faced by developers. Operational bundling involves aggregating similar projects – such as those with similar business models, geographical areas, technologies, or customer types – to reduce development and operating costs, spread risks and streamline operations. This method enhances the viability of individual projects.

Financial bundling involves aggregating projects into portfolios to attract more private investors by increasing project size and reducing risk. This approach overcomes barriers such as the high cost of power supply in remote areas, uncertainty about customer demand and the challenge of obtaining financing for relatively small transactions. By bundling projects, developers can diversify risk, improve economies of scale and enhance creditworthiness. Furthermore, aggregating facilitates access to financing, making them more attractive to MFIs and private investors.

In the context of microgrids, consistent system design is crucial for successful aggregation. It allows for standardized performance monitoring, streamlined equipment procurement and improved bargaining positions with suppliers.

Box 12. Combining microgrids and the "anchor customer" approach through financial bundling

Under the Kalangala Renewables project in Uganda, a 1.6 MW renewable power system has been created to serve 3,100 households and 24 commercial customers across diverse sectors.[a] Its infrastructure forms a cohesive network which includes a solar-diesel generation unit, a 33 kV transmission system, low-voltage distribution and prepaid metering. This network meets varied energy needs within a concentrated geographical area.

Central to the project's success is the "anchor customer" approach as a de-risking strategy In one such case, Kalangala Infrastructure Services, a mixed-utility project which provides both transport and water supply services, used this approach to alleviate uncertainties in revenue and demand associated with the power business.

The Kalangala Infrastructure Services project involves the operation of long-term government contracts for ferries and road upgrades. It bundles funding mechanisms to make the Kalangala Renewables project more financially robust. The Kalanga Renewables project, which accounts for $16 million of the total investment, benefits from revenue certainties derived from non-energy services. The funding mix involves equity from DFIs, debt backed up with guarantees, and an output-based grant for connection subsidies. Joint debt guarantees by GuarantCo and the United States Agency for International Development (USAID) contribute an additional layer of security. The collaborative ownership structure, involving InfraCo Africa and Ugandan Development Corporation, shows the unity of donor-backed entities and local institutions in driving sustainable development.

a NREL, 2018.

This operational bundling approach contributes to cost reduction, efficient operations and maintenance planning, and enhanced investor confidence through the establishment of a reliable performance track record.

b. Aggregating finance

Special purpose vehicle – Small-scale financing needs can be aggregated into a portfolio from which marketable debt instruments can be issued. Given the additional benefits associated with the underlying investments, these debt instruments can be labelled as green, social or sustainability bonds and can funnel new sources of large-scale financing into the sector, linking small-scale renewable energy finance, financial aggregation and bonds. This guarantees that the funds raised will all be spent on sustainable energy ventures, a guarantee which is more difficult to make for standard bond issuances.

In 2021, A Swiss asset management group announced a $15 million green bond transaction supporting PAYG solar home systems through a secured loan facility. This represented the first use of thematic bonds to finance distributed renewable energy projects in developing countries.[46]

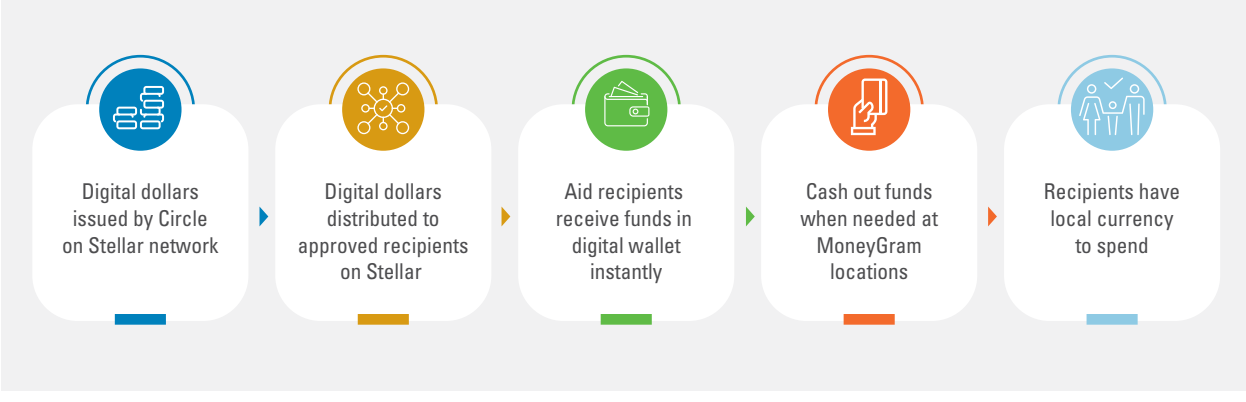
Blockchain technology presents promising solutions for mobilizing finance, project mapping and securing global funding for numerous small players in the renewable energy sector. Its capacity to mitigate currency risk and volatile exchange rates coupled with its ability to reduce transaction costs, makes it a versatile tool. By "pooling" investors, this approach goes some way to addressing the challenges associated with traditional crowdfunding, such as significant marketing and transaction costs.

Alongside online crowdfunding, blockchain can attract additional direct aid flows by channelling diaspora investments into renewable energy initiatives. However, there is scepticism about blockchain's effectiveness in securing additional funding.

While blockchain-based financial models hold promise, their success hinges on careful regulatory development, especially in developing countries. This is key to ensuring the viability of innovative financing structures and providing assurance to small lenders lacking the resources and expertise to navigate modern financial landscapes effectively.

Blockchain is often associated with cryptocurrencies. There is scepticism surrounding the use of cryptocurrencies for financing due to the inherent volatility of many of them. However, not all cryptocurrencies exhibit high volatility; some are pegged to real-world currencies and offer higher stability.[47] Nevertheless, innovative blockchain applications, such as a pilot project in Ukraine supported by the Office of the United Nations High Commissioner for Refugees (UNHCR), demonstrate the potential for digital cash distribution. In this project, UNHCR verifies eligibility and delivers

Figure 6. Flow of funds overview



Source: UNHCR, 2022.

aid through a stable cryptocurrency at parity with the United States dollar. This initiative ensures transparent, rapid and accountable aid disbursement through recipients' secure digital wallets. The blockchain-based solution facilitates seamless conversion to cash when needed, enhancing humanitarian assistance efficiency.[48]

Blockchain technology has the potential to enhance transparency and accountability in development work. However, the adoption of blockchain solutions necessitates careful consideration to address specific contextual challenges and concerns. Ultimately, tools such as blockchain should be harnessed as part of a toolkit to enhance the integration of renewable energy, as well as expanding access to modern energy services which in turn have the potential to enhance overall efficiency and promote equity in development.

New financing vehicles in the form of special financial intermediaries or aggregators can help to mobilize private sector investment by combining public and private financing sources, and facilitating closer collaboration between financiers, off-grid energy enterprises and the State.[49]

In Nepal, for example, the Alternative Energy Promotion Centre acts as a conduit for funding off-grid renewable energy projects by connecting donors, Governments and other partners to channel financing, mainly in the form of subsidies. The Centre has also created the Central Renewable Energy Fund to distribute funding through commercial banks and MFIs.[50]

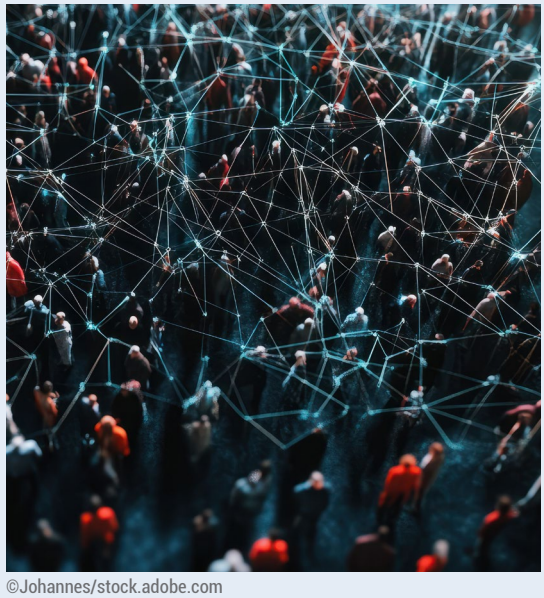
c. Aggregating demand, data and information

Using digital aggregation to standardize the data that decentralized renewable energy companies provide to investors is a means of improving access to finance. Sharing standardized information on risk, returns, impact and the creditworthiness of the target population can also enable targeted capacity-building, as well as being useful in various other functions, including different types of energy service technologies and product standards.[51]

One financial technology platform that partners with energy organizations uses data aggregation and analysis to assess portfolio and energy user risk in order to offer financing directly to small-scale renewable energy companies in rural areas. This financing is provided through the platform's lending arm. It is particularly useful to women who are looking to start or expand businesses that rely on the productive use of energy.

By using data and analysis to increase credit risk transparency, the platform aims to expand access to capital while reducing lending portfolio risk for investors. Digitalization and technology such as mobile payment platforms are being used to make it possible for companies to offer results-based financing, which incentivizes them to reach previously underserved populations, in particular women. This will increase the creditworthiness of the people they reach in this way, making it easier for women to access financing in the future.

Financing for productive use technologies still lags behind financing for energy access. The future development of this will be conditional on developments in general long-term concessional debt and risk capital for innovators and businesses. Financial aggregation can be used in an attempt to resolve this, but will be more effective once the market for products designed to use renewable energy productively increases in size.[52]



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d. Challenges and benefits of aggregation

As discussed earlier, the distributed renewable energy market faces uncertainty with regard to returns, as a result of which lenders charge higher lending rates. Various forms of aggregation can be used in an attempt to bring down the rate of return required by investors (figure 8).

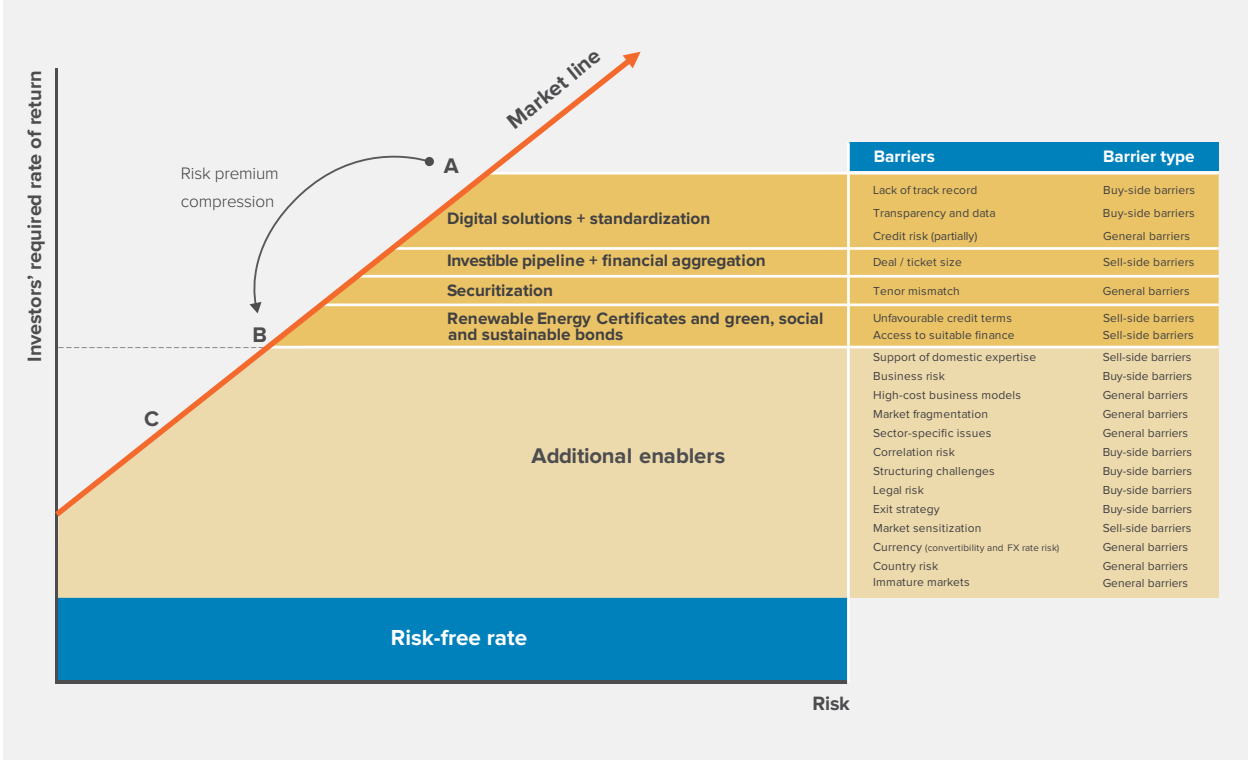
Aggregation allows smaller lenders to offload some of their existing debt and unlock more capital for developers and end users. Once renewable energy projects are securitized, it can then be complemented with distributed renewable energy certificates (D-RECs) to unlock opportunities for the issuance of green, social and sustainability bonds. But since the practice of de-risking investments using aggregation is relatively new, additional measures are still required to enhance the bankability of renewable energy technology projects in rural areas.

2. Carbon credits and corporate social responsibility

Carbon credits and various other social and environmental credits can be used to channel capital towards initiatives aligned with the SDGs, corporate social responsibility objectives and environmental and social governance principles.

These credit systems are typically designed with the intention of enhancing the appeal of projects that may not be financially viable through conventional means. Often, these are projects that hold immense potential for environmental and social benefit but which struggle to attract commercial financing due to their unique challenges or circumstances. Carbon credits and similar instruments can help such projects to become more financially attractive and, consequently, to gain access to resources.

Figure 7. Barriers, enablers and their contribution to the lending rate risk premium



Source: UNDP, 2022.
Note: Figure is only for illustrative purposes and not to scale.

These credits provide a structured framework for measuring, verifying and reporting on the positive outcomes generated by energy initiatives. This is a key advantage: as well as ensuring accountability, they also enhance the credibility and transparency of these projects.

Box 13. Carbon credits in fragile and conflict affected areas

Energy Peace Partners, a United-States-based non-profit, has devised the Peace Renewable Energy Credit (PREC) to address renewable energy investment challenges in fragile areas. The PREC builds on the traditional renewable energy certificate (REC) but focuses on the environmental and social benefits of renewable energy in conflict zones. These virtual credits are tradeable assets.

The PREC is intended to monetize renewable energy production in fragile regions by creating new revenue streams, reducing risks, enhancing financial incentives and shortening payback periods for investors in challenging markets. In time, the model could reduce dependence on diesel power in crisis zones through scalable renewable energy solutions.

The PREC framework and financing models are still being refined, influenced by variables such as project financing gaps and corporate goals. Therefore, putting PRECs into practice will involve navigating the complex political and operational landscape of crisis settings while connecting essential stakeholders, including United Nations missions, humanitarian organizations, Governments, communities, displaced populations, solar developers and industry bodies with voluntary REC buyers and traders.[a]

a Moving Energy Initiative, 2019.

3. Distributed Renewable Energy Certificates

RECs are energy attribute certificates certifying that 1 MWh of energy has been generated from renewable sources.[53] They allow end users to demonstrate their green energy usage, facilitating access to green finance. The introduction of the D-REC expands the REC market to smaller projects, allowing them to demonstrate the use of amounts of green energy as small as 1 kWh, or 1/1000 of an REC.

D-RECs offer two key opportunities. First, they allow MFIs and project developers to gain access to climate finance previously limited to larger projects. Second, end users using renewable energy for productive equipment can signal the sustainability of their final products.[54]

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This decentralized approach requires third-party verification. This process can benefit from blockchain technology, ensuring transparency in REC markets. The possibility of trading units smaller than a full REC broadens the market to individual investors seeking to offset their carbon footprint. As the world embraces environmental, social and governance-centric trade and impact investing, D-RECs may become a lucrative income source, attracting investors and potentially serving as a foreign exchange currency. However, regulatory updates and capacity-building are essential to support proper enrolment and ensure developers use revenue streams to lower costs for end users.

Box 14. Gender in environmental, social and governance

Identifying and investing in companies that promote gender equality and empower women is a crucial aspect of environmental, social and governance investing. British International Investment, a DFI in the United Kingdom, considers that off-grid energy companies, specifically off-grid solar companies, are a key area for creating gender-based opportunities and implementing gender-smart investing strategies.

Several ongoing development projects in various regions, such as sub-Saharan Africa, eastern Asia and the Pacific, are focused on promoting gender equality and empowering women through various means. These initiatives may include investing in companies that have a strong track record of promoting gender equality, supporting women-led businesses and implementing policies and practices that promote the advancement of women in the workplace.

Source: UNDP, 2022.

The value of D-RECs will ultimately determine the attractiveness of the model. The expectation, though, is that with increased uptake and a solid track record, this value could improve over time. D-RECs could also be an effective tool for improving the business case for Mesh grids, a novel technology that creates interconnected solar home systems and brings productive power to off-grid communities.[55]

Mesh grids offer a promising solution to enhance the reliability and resilience of power supply in rural areas. By interconnecting small-scale renewable energy sources in a mesh network, the system remains reliable even if one component fails, mitigating risks for investors. Shared ownership models, facilitated by mesh grids, are a low-cost financing option for small-scale renewable projects in rural communities, fostering local participation and increasing the likelihood of project success. Blockchain technology is used to transparently track and verify renewable energy generation, and to verify the validity of the corresponding D-RECs.

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Box 15. Mesh grids for rural power resilience in Haiti

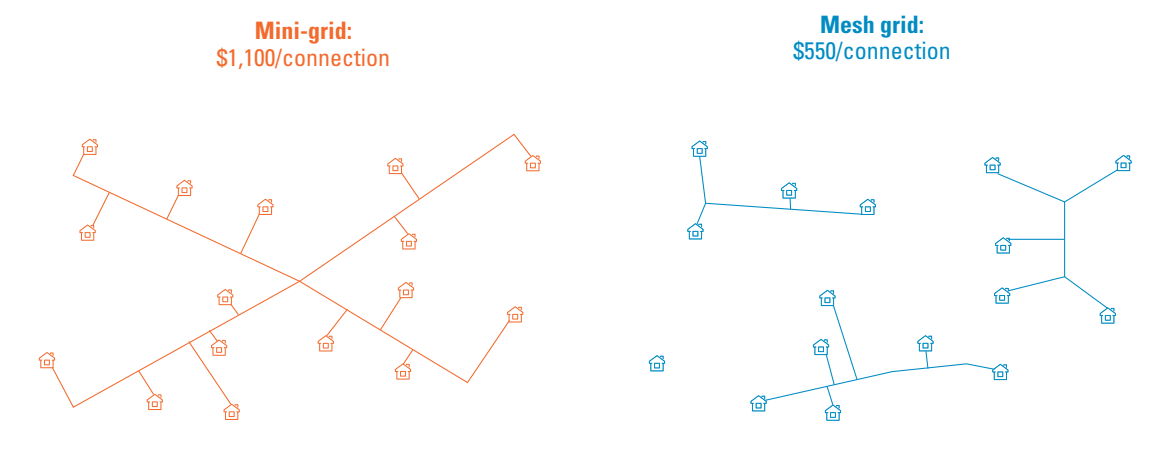
In December 2022, EDFI ElectriFI, an European-Union-funded impact investment facility, allocated $4.5 million to Okra Solar, a company providing mesh technology solutions, including solar PV systems, batteries and inverters in Haiti. This revolving working capital facility addresses the financing gap in the supply chain, enabling cost-effective deployment compared to traditional grid extensions.

In addressing the energy challenges faced by remote areas, Alina Enèji – a Haitian project developer – collaborated with Okra Solar to implement mesh-grid technology in Dulagon, a rural village with limited electrification. The mesh-grid system, initially tested in 30 households, was a success, prompting a broader deployment to a total of 300 households.

Designed around a "hub and spoke" model, the mesh grid included 63 kW of solar PV capacity and 178 kWh of lithium storage capacity, strategically distributing energy between households with varying energy needs. This approach minimized costs by allowing the bulk purchase of larger batteries, optimizing capital expenditure.

Each of the 300 households produced an average of 302 Wh/day, at less than $500 per connection – less than half the typical mini-grid cost in Haiti. Consumers used a mobile money-based prepaid subscription model to make energy payments. Importantly, to ensure sustainable operation and maintenance, the project developer actively trained local agents, and the company established a local technical support team in Haiti.

Comparison between the cost of a traditional mini-grid and a mesh grid



Source: Okra, 2023.

Key considerations: The model's practicality is acknowledged, and third-party verification is essential for establishing credibility. Internet connectivity in off-grid areas and potential trade-offs, including generation capacity and technical limitations for larger appliances, are considered. It is recognized that the model is nascent, requiring further validation and nuance in its implementation.

4. Policy instruments and recommendations

4. Policy instruments and recommendations

Ensuring the success of small-scale renewable energy projects in rural areas of the Arab region requires a broad approach. This involves securing diverse funding sources, refining policies and enhancing skills across the value chain to overcome perceived risks. As the global energy transition takes centre stage, drawing lessons from successful practices from across other regions becomes crucial, but adaptation to the specific needs of the Arab region is equally important. The recommendations presented offer a comprehensive strategy, addressing challenges, promoting rural electrification and improved livelihoods. These entail policy improvements and more effective use of various financial tools such as climate finance, blended finance and de-risking instruments. Implementing these suggestions, however, demands a commitment to further regulatory adjustments, educational enhancements, addressing societal challenges, encouraging integrated approaches, providing essential technical support and ensuring consistent follow-through.

1. Facilitate accessible financing for rural energy solutions

Initiatives should begin by increasing the availability of grants and subsidies to address the high upfront costs associated with renewable energy technologies. These incentives can be complemented by concessional finance options to further reduce the financial barriers that hinder rural communities in gaining access to sustainable energy. Such support not only lowers the carbon footprint but also eliminates the need for costly distribution lines from large power plants. Additionally, it fosters local employment and promotes the development of cooperative organizations at grassroots level, ensuring long-term sustainability. Employing blended finance tools can effectively de-risk capital, making investments in green energy infrastructure more attractive to both public and private investors.

2. Customize financing solutions for diverse rural communities

Recognizing the diverse socioeconomic backgrounds of rural populations, it is essential to tailor financing solutions to specific sub-groups. By characterizing these sub-groups based on factors such as income levels, energy expenses, livelihoods, credit access and sociocultural aspects, financial institutions can develop customized options that cater to individual needs and circumstances. Governments and development organizations should also make a priority of enhancing the climate literacy of client-facing staff in financial institutions, enabling them to better assist customers in navigating the cross-cutting challenges posed by climate change.

3. Scale up patient capital at all stages of social enterprise growth for sustainable rural electrification

Patient capital, offered in the form of equity and debt, has an extended investment horizon, greater risk tolerance, adjusted return expectations and a primary focus on maximizing social impact. It can help to make small-scale renewable energy solutions financially viable and accessible to underserved communities. By providing flexibility to customize delivery models and solutions for different communities, patient capital can expedite the adoption of distributed renewable energy systems, ultimately bridging the energy access gap in rural areas while promoting social and economic development.

4. Strengthen local ecosystems and streamline coordination

It is imperative to build the capacity of various stakeholders, especially local businesses, so that they can effectively provide services to remote communities. Initiatives should make a priority of developing technical and operational capabilities, fostering community awareness and sustainable usage and maintaining energy solutions. Simultaneously, local financial institutions should be empowered to provide affordable credit to remote communities, targeting microfinance lenders, national-level bankers, staff members of international development organizations and fund managers. It is important to foster a common purpose among stakeholders to enhance collaboration within the renewable energy sector. Additionally, Governments should make a priority of establishing partnerships between suppliers and distributors with clear roles and responsibilities, ensuring equitable resource distribution and efficient energy service delivery in rural communities. This holistic approach extends beyond the energy sector, encompassing agriculture, transportation and other sectors, creating an enabling environment for rural electrification. Facilitating these partnerships through match-making platforms, managed by industry associations or local authorities, bridges the gap between practitioners, rural industries and MFIs, streamlining communication and administrative processes for scaling up renewable energy in rural areas effectively.

5. Tailor capacity-building for rural empowerment and energy access

Implement tailored capacity-building programmes, focusing on rural populations, with special emphasis on women and youth empowerment. These programmes should cover various critical aspects, including renewable energy technologies, energy efficiency, income-generating sectors, entrepreneurship and improved access to financial resources. Collaboration with the private sector, coupled with standardized technical assistance from regional and international organizations, is pivotal in ensuring that rural communities and small businesses in the Arab region receive essential support for developing and maintaining renewable energy systems.

6. Empower rural communities through comprehensive national renewable energy strategies

Governments' strategies should serve as roadmaps, outlining clear targets and milestones. By integrating awareness campaigns, skills training, business development support, improved financial accessibility and productive appliance use, these strategies can maximize their socioeconomic impact. Governments should also create dedicated agencies for overseeing small-scale renewable energy projects and implement robust monitoring and evaluation frameworks to enhance policy effectiveness. Regular assessments of local resources and renewable energy potential, informed by international best practices, will provide evidence for decision-making and guide initiatives for remote areas and diverse residential and commercial needs, including those of SMEs. Actively seeking collaborations with local communities, small businesses and international partners should be a priority within these national strategies, helping Governments overcome regulatory, financial and technical barriers.

7. Enhance legal and regulatory frameworks to facilitate the adoption of small-scale renewable energy

Governments play a crucial role in advancing renewable energy initiatives in rural areas through strategic regulatory enhancements. Prioritizing the development and robust enforcement of legal frameworks is paramount. This involves enacting laws

that support renewable energy adoption and robustly enforcing them, incorporating mechanisms such as net-metering, peer-to-peer/community-to-community electricity trade, power wheeling, community solar and leasing arrangements. Such measures not only safeguard developers against demand fluctuations but also optimize the use of excess energy supply. Additionally, a focus on the development of resilient grid-interconnection infrastructure and regulations is vital. This step is instrumental in integrating decentralized energy systems, narrowing rural-urban energy disparities and extending electricity access to remote regions. To complement these efforts, Governments should tailor regulatory incentives across the entire productive use equipment value chain. This encompasses connection-based subsidies and innovative financial tools such as revolving result-based funds, fostering widespread adoption and enhancing the economic viability of renewable energy initiatives in rural areas. By addressing the entire value chain, these measures not only ensure the success of such initiatives but also contribute significantly to local development, fostering economic growth and sustainability in rural communities.

8. Foster regional and global collaboration for sustainable rural energy

Governments should prioritize the establishment of strategic partnerships with international donors, NGOs and other stakeholders to accelerate progress in achieving sustainable rural energy solutions. These partnerships serve as invaluable channels for accessing technical expertise and mitigating financial risks within the sector. By actively engaging with international entities, Governments can unlock opportunities for sustainable finance, knowledge exchange and capacity-building, ultimately enhancing their ability to provide rural communities with reliable and clean energy access.

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Endnotes

1 ESCWA, 2023a.

2 Modern renewable energy refers to solar, wind, hydro and biofuels.

3 Ingram, 2021.

4 UNDP, 2021.

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6 “Traditional financing” refers to commercial bank loans and equity investments.

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31 InsuResilience, 2023.

32 USAID, 2022.

33 IIED, 2021.

34 Ibid.
35 Energia, 2018.
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37 UNDP, 2021.
38 IRENA, 2023.
39 European Investment Bank, 2022.
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42 USAID, 2022.
43 Givens, 2016.
44 UNDP, 2022.
45 IIED, 2019a.
46 UNDP, 2022.
47 Coin Market, 2023.
48 UNHCR, 2022.
49 IIED, 2019b.
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In response to the imperatives of sustainable development and the pressing need to address climate change, this paper explores the transformative potential of small-scale renewable energy in rural communities across the Arab region. Recognizing its capacity for improved livelihoods, economic opportunities and enhanced resilience, the study emphasizes the significance of de-risking small-scale renewable energy initiatives for accelerated adoption, scaling up and realization of various benefits in rural areas.

Grounded in international commitments such as the 2030 Agenda for Sustainable Development and the Paris Agreement, the paper advocates strategic alignment among financiers, developers and end users. It explores key instruments and business models crucial for de-risking small-scale renewable energy projects in Arab rural landscapes, serving as a guiding tool for policymakers and stakeholders. It covers aspects including the role of intermediaries such as microfinance institutions, climate finance, financial instruments, risk mitigation strategies and innovative business models. The paper offers a thorough analysis and policy recommendations to create a conducive environment for the sustainable development of small-scale renewable energy projects in rural Arab communities.

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