Regional Initiative for Promoting Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region

Business models toolkit

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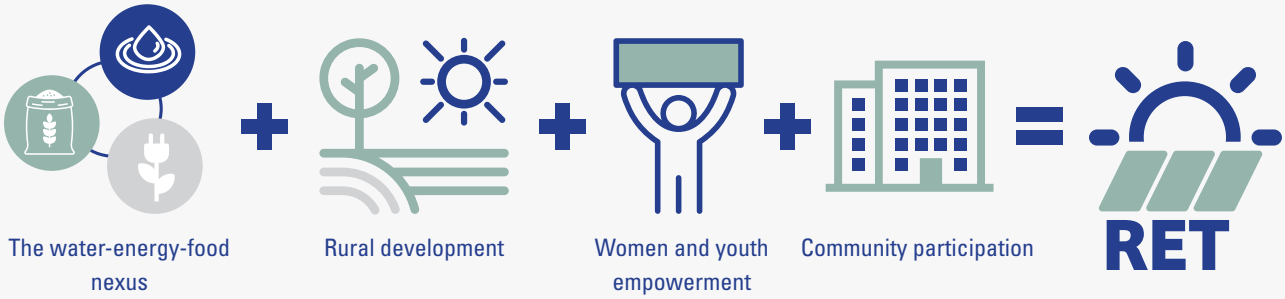
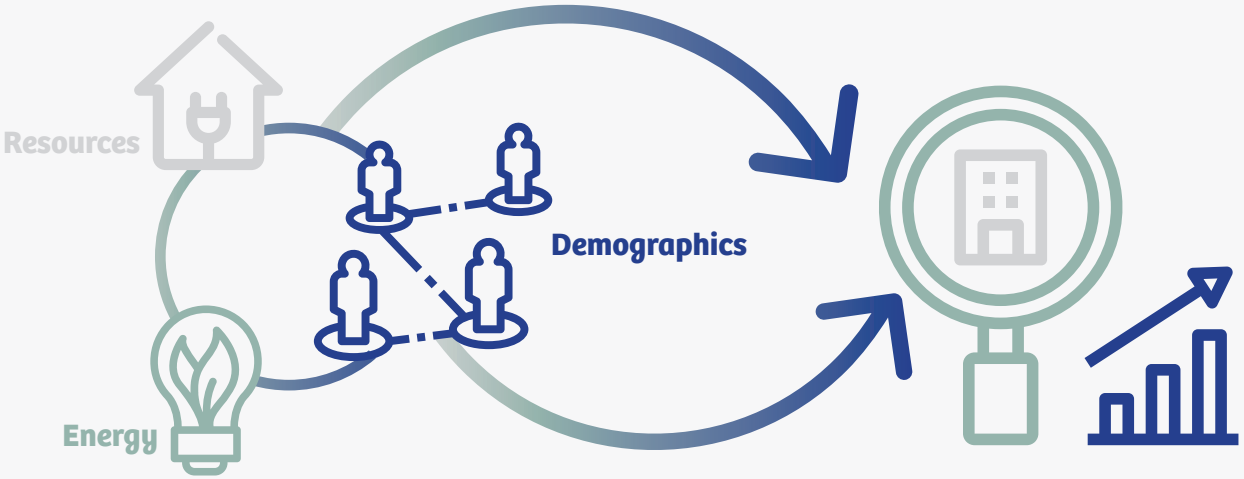
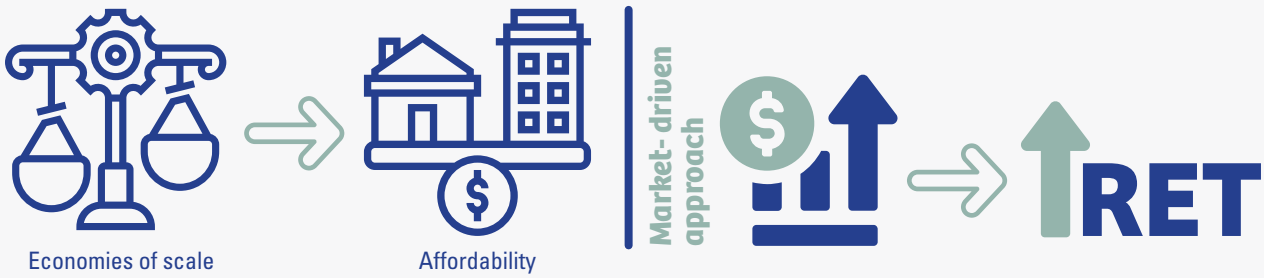
Key messages



Deploying small-scale RETs in rural communities within the Arab region should be done through an integrated approach, including elements such as affordability, the water-energy-food nexus, rural development, women and youth empowerment, community participation and buy-in, climate change and environmental protection, financing mechanisms and capacity-building.



Developing a business model starts with establishing baselines for demographics, energy requirements, available renewable energy sources, etc. It then determines and selects feasible RETs for identified opportunities, and creates a delivery model framework, taking into consideration potential barriers and how to mitigate them.



Economies of scale of RETs can improve affordability and accessibility for rural communities. The scale-up of RET deployment can be achieved through a regulated approach or a market-driven approach. Each option suits different conditions, such as a small number of end users in the former and a larger number in the latter.

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ABC	anchor-business-community
ADB	Asian Development Bank
BGFZ	Beyond the Grid Fund in Zambia
BOO	build-own-operate
BOOT	build-own-operate-transfer
CRT/N	Centre for Rural Technology, Nepal
EMSA	Energy Market System Assessment
ERRY	Enhanced Rural Resilience in Yemen
ESCO	energy service company
ESCWA	Economic and Social Commission for Western Asia
EUEI-PDF	European Union Energy Initiative Partnership Development Facility
EUR	Euro
GDP	gross domestic product
ICS	improved cooking stoves
IDCOL	Infrastructure Development Company Limited (Bangladesh)
IFC	International Finance Group
IPP	independent power producer
IRENA	International Renewable Energy Agency
IWME	improved water mills for electrification
kW	kilowatt
MFI	micro finance institution
MW	mega watt
PAYG	pay-as-you-go
PV	photovoltaic
REA	Rural Electrification Agency
REEEP	Renewable Energy and Energy Efficiency Partnership (Zambia)
REGEND	Regional Initiative for Promoting Small-scale Renewable Energy Applications in Rural Areas of the Arab Region
RET	renewable energy technology
RTO	rent-to-own
SDG	Sustainable Development Goal
SHS	Solar (PV) Home Systems
Sida	Swedish International Development Cooperation Agency
SME	small and medium enterprise
TaTEDO	Tanzania Traditional Energy Development Organization
TBD	to be determined
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPS	uninterruptable power supply
WEF	water-energy-food
WRI	World Resources Institute

1. Background

The Economic and Social Commission for Western Asia (ESCWA) is implementing the Regional Initiative for Promoting Small-scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND), in partnership with the Swedish International Development Cooperation Agency (Sida).[1] The project aims to improve livelihoods and economic benefits in rural communities, particularly among marginalized groups, and promote social inclusion and gender equality.

The present toolkit aims to provide guidelines for the deployment of selected small-scale renewable energy technologies (RETs) in rural communities within the Arab region. The toolkit provides general information, an integrated approach and considerations for developing a viable business model based on a desk review of similar initiatives.

The toolkit covers the following topics:

- The detailed steps required for developing a business model suitable for rural communities in the Arab region, based on an integrated approach that considers all important and relevant aspects within the context of the toolkit.
- Financing options to promote the affordability and accessibility of small-scale RET products and services, and models that enable the needs of the rural end user to be met effectively, such as the service model and ownership model.
- Specific focus is given to achieving economies of scale to provide feasible RET products and services in rural communities. The report highlights the scale up of RETs through a regulated or market-driven approach depending on different conditions.
- The success in implementing the RET model is reviewed through an effective policy and regulation framework to enable the adoption and scale-up of small-scale RETs.
- A summary of the key points and some recommendations for optimum deployment of small-scale RETs in rural areas in the Arab region are included at the end of the report.

A. Small-scale renewable energy technologies

In rural areas, access to energy or modern efficient technologies can be limited and unreliable, or prohibitively expensive. In some cases, rural areas' grid access is many years away or not planned for the foreseeable future. In such situations, electricity access is provided through fossil fuel-run generators; however, fuel prices are volatile and usually expensive and fuel requires high transportation costs and is harmful to the environment. Furthermore, the reduced or lack of access to electricity often results in lower economic development and poverty in many remote communities.

Small-scale renewable energy technologies can offer affordable, sustainable and environmentally friendly alternatives. The formal definitions adopted in the REGEND small-scale RET solutions operational toolkit for the Arab region are:

- **Renewable energy:** is the energy generated from renewable, theoretically inexhaustible and non-fossil-based energy sources which are replenished in a human lifetime. Renewable energy sources include solar, wind, marine (ocean), hydropower, geothermal and bioenergy.
- **Small-scale RETs:** Technologies which convert renewable energy sources into electrical or thermal energy with an output power capacity of up to around 100 kW.

The terms "off-grid" and "decentralized" are utilized widely in the literature in the context of RETs.

Small-scale RET systems are often both off-grid and decentralized.

The present report also mentions mini-grids and micro grids, where the former have a generating capacity ranging of 50 kW to 1 MW, and the latter generate up to 50 kW.

With small-scale RETs, electricity can be generated near or at the rural sites where it will be used by mini-grids or standalone systems. RETs can also be affordable alternatives to increase productivity and economic activity in regions where grid access is expensive or unreliable. Several Arab countries, such as Morocco and Tunisia,[2] experience routine load shedding owing to poor grid service. RETs offer a sustainable and economic alternative to diesel generators and uninterruptable power supplies (UPS).

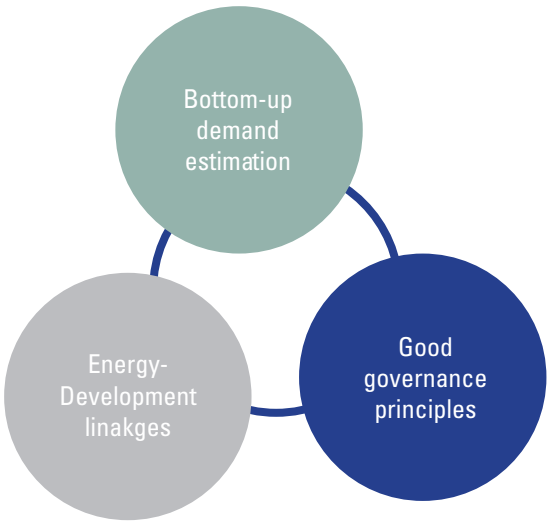
Many rural communities rely primarily on agriculture. Productive RETs can aid rural community development and capacity-building. These RETs are an affordable, secure and sustainable means to create jobs through entrepreneurship and agricultural yield improvement. This can subsequently reduce poverty, improve health outcomes, enhance access to food and water, improve the quality of life of communities where they are deployed, and provide a mechanism for gender empowerment.[3]

Smaller scale RETs of a particular type can be used as a gateway technology to raise awareness and demand for other types of RETs, or larger scale RETs of the same type. For example, Solar Aid rolled out a range of innovative solar products to distribute a cost effective solution in rural areas. Initially, the aim was to utilise solar lights for schools. However, a trading subsidiary, SunnyMoney, aided in catalysing a viable market for the uptake of small-scale solar technologies beyond schools to larger communities.[4]

B. Integrated business model development

The approach adopted for the REGEND project focuses on integrating community development with the provision of modern renewable energy tools and access through all phases of the business model. The integrated approach can be divided into three key principles (figure 1). These principles are seen as common factors in the analysis of some of the most successful implementation strategies worldwide.

Figure 1. Key elements to improving access to energy services



Source: Odarno, Lily and others, 2016.

Firstly, for small-scale RET strategies to be successful, energy access and development efforts for rural communities must go hand-in-hand. The business model needs to link RET access with local development initiatives. Consequently, with the integrated approach, the business model must incorporate the following aspects throughout its market chain:

» **Affordability.** It is imperative that the RETs are affordable, of good quality and reliable for community members to buy in and consistently utilize the technologies. Case studies have shown that simply providing access to electricity or RETs does not automatically bring development benefits. If the technology is too expensive, then it is not affordable for rural households; and if the energy or service provided is not of sufficient quality, it will constrain the productive activities that can be done by households and enterprises. Even if the RETs are of good quality and affordable, if a stable demand is not guaranteed from the rural end users, then RET providers cannot sustain a viable business and the endeavour will most likely fail.[5] Therefore, including suitable end user financing mechanisms within the business model can significantly enhance

affordability, and thus gain a larger market segment. End user financing that meets rural beneficiaries' ability and willingness to pay can determine how the market segment will grow and develop, and needs to be an integral part of the delivery model as it is key to its financial sustainability. Solutions such as micro-financing and pay-as-you-go (PAYG) in the models allow for RETs to be accessible to a wider market. In most cases, some degree of public funding to support operating costs and tariffs will also be needed to make costs affordable to rural beneficiaries.[6]

» **Capital financing.** One of the major barriers to RET business models for market entry is upfront capital financing. The success of the decentralized approach hinges on the ability of the RET market segment to attract private investments.[7] The REGEND projects are designed to provide services and products in service areas where poverty is widespread, and the ability to pay is generally low. Therefore, securing interested private investors can be vital in ensuring long-term economic sustainability and growth of the market segment. Capital financing is needed throughout the market chain of the business model, so requirements should be identified and accounted for in the planning to ensure financial viability.

» RETs will improve the quality of life and provide benefits to communities that cannot be easily quantified monetarily. These benefits include saving time on manual labour, improving health, reducing poverty, and protecting the environment by avoiding fossil fuels and preventing deforestation. Such benefits are difficult to reflect within the costs or tariffs of the products. Therefore, the business model might need to account for these benefits through some form of public subsidy, or recognition that the tariffs would only cover the cost of the supply.[8] For example, subsidizing the initial equipment cost.

» **Water-energy-food (WEF) nexus.** The impact of, and synergies between, the water, energy and food sectors also need to be considered throughout the chosen RET delivery model. Sustainable development of the community can be supported by utilizing RETs for WEF nexus related services. Options where a suite of RETs are combined to provide comprehensive solutions can also be explored.

» In rural settings, agriculture is typically the main source of livelihood and food. Farmers rely often on traditional animals, human labour and fuels (wood, animal dung) due to limited access to fossil fuels (such as diesel for generators) and electricity, given the low electrification levels in rural areas.

» Limited access to energy has meant that rural communities are constrained to low-quality agricultural goods with little diversity.[9] Introducing decentralized RETs can help mitigate these issues throughout the agri-food chain, including in production (irrigation), post harvesting activities (processing and preserving through cooling, drying, milling, dairy and meat processing), and food preparation and cooking (improved cooking stoves (ICS)).[10]

» However, special attention needs to be paid to WEF nexus points to ensure natural resources are used sustainably. With decentralized RETs, once the upfront capital costs are paid, there are generally limited or minimal costs of usage, which can lead to the over exploitation of natural resources. For example, excessive pumping from aquifers or increased harvesting can lead to soil-degradation that endangers food supply, and to increased land usage leading to deforestation and climate change. Relevant WEF nexus impact assessments based on reliable and sound data should be considered as part of the community baseline assessment.

» **Rural development.** The business model should support viable entrepreneurial and rural development activities within communities. The business plan must therefore be based von a clear understanding of the enabling role of RETs, how they can impact the livelihoods of vulnerable households, and how these end users value and use RETs. Synergies between RET use and rural development can be identified by the project developers and incorporated in the business plan, so that expertise and funds can be leveraged by partnering with other development actors, finance organizations, and community groups that can support development goals.

- **Women empowerment.** At the household level, it is generally women who make decisions regarding energy in rural settings. The lack of energy in rural communities also has a disproportionate effect on women and girls. Involving women in gender mainstreaming efforts within the business model is important for its success, and can narrow gender gaps and create economic independence.

- RETs can benefit women in their activities throughout the agri-food chain. Greater efficiency in activities, such as harvesting, hauling water, wood fuel collection, and other manual work, create time savings that can be used for productive activities, education, or socializing. Additional benefits also include improved safety with modern lighting at night, and healthier cooking conditions with improved and clean cookstoves.

- RETs can also provide rural women with pathways to financial stability by creating new income streams. These gains are also passed on to family members, which positively reverberates throughout the community. Cooling, freezing and refrigeration can support dairy businesses, and power can allow women to use tools such as sewing machines for handicrafts.

- Initiatives can be created where women are directly involved in the new market chain from management and operation, to retail and marketing of RETs. Case studies have found that women represent a critical market for lighting, clean cooking products and services, and have catalysed RET markets as entrepreneurs.[11] This is reflected in the work of Groupe Energies Renouvelables Environnement et Solidarités, a non-governmental organization that promotes women entrepreneurship through innovative energy solutions in local communities. The economic impact of RETs was observed where 17 women entrepreneurs in Myanmar secured a total turnover of almost EUR 6,000 on energy-related products (cookstoves and (SHS). In Mali, the total turnover of five small and medium enterprises (SMEs) led by women, connected to two mini-grids, was EUR 7,500 between January and June 2020.[12]

- **Community engagement and capacity-building.** Successful RET applications and best practices have shown that it is imperative to align the needs and interests of the community with the objectives of the business model. In many rural settings, community members likely have limited or no prior experience with RETs. In addition, certain factors might influence RET adoption due to minimal awareness of RETs (for example, some people do not accept the installation of wind turbines because they fear the impact of noise pollution).

- **Community participation and buy-in** is vital for successful and long-term utilization of RETs. Activities to engage, raise awareness and educate end users and the community need to be included from the get-go. Capacity-building and training within the community can support the sustainable operation and maintenance of RETs locally, and facilitate rural economic development. The assessments of the REGEND pilot sites indicated that rural populations generally had limited understanding of marketing principles and expanding reach.[13] Capacity-building towards marketing efforts, especially through digital technology and social media, should therefore be explored.

- **Environmental protection.** Utilizing RETs supports green, environmentally friendly solutions as alternatives to fossil fuel systems. However, careful consideration needs to be given to environmental impacts and sustainability throughout the market chain of the business model. Maximizing energy efficiency should be encouraged and prioritized when possible. For example, encouraging the use of super-efficient appliances will provide savings in end users' energy bills, increase reliability when the appliances are supported by limited energy supply or RETs, and support the environment. Recycling initiatives, buy-back schemes, and safe disposal are environmentally sound measures that can reinforce the financial viability and sustainability of the business models.

The second aspect of the integrated approach is ensuring a suitable baseline analysis as the starting point of the project. ESCWA has carried out baseline analyses at the national level for Jordan, Lebanon and Tunisia, where the pilot sites for the REGEND project were selected. The baseline reports provide country overviews and valuable understanding of prevailing rural conditions, potential productive activities in those areas, and analyses of the pilot sites.[14,15,16] Once the programme expands to other

Arab countries, similar national baselines will need to be established for each setting.

A further granular baseline analysis is then required at the community level. The baseline establishes and quantifies bottom-up demand, based on dialogue with community members who will be the beneficiaries of the technologies. As such, the selection of an optimum solution needs to be built on sound and reliable data, with a contextual understanding and buy-in of the rural communities. This allows for data that are sufficiently granular and disaggregated to capture how the RET requirements will vary across the different end user segments.[17] This can include the following activities:

- Creating a database of the communities requiring access, their locations, and relevant demographic data (total population, household income, people per household, average energy requirements and price/cost, estimation of the end users' ability to pay). Geographical information systems (GIS) mapping can be used to determine spatial distributions.
- Canvasing the requirements for a baseline assessment of the community through surveys and dialogue to determine the specific problems, needs and opportunities, and end users' willingness and ability to pay.
- Building databases of end-use equipment and service to manage operations and maintenance in different market segments.[18]

The third component of the integrated approach is to incorporate good governance principles into the business model, and leverage existing government programmes and initiatives. For example, if a community cooperative is set up to operate RETs, its success will greatly depend on clear roles and job definitions, transparency and good management. Furthermore, along with providing rational subsidies, Governments can play a facilitative role by supporting initiatives, such as encouraging emerging end user finance models (such as PAYG), and streamlining policies and regulations for decentralized models that reduce costs and give confidence to private sector investments. This can include setting up structures for transparency and accountability in service delivery as a strategic objective. Strong and consistent commitment to small-scale RETs at all government levels will enable the rapid uptake and expansion of the projects. RET initiatives can be included as a high priority item in national and local political agendas. Vocal support from influential community leaders will help gain trust within the community, and increase the adoption of small RETs.

C. Renewable energy technology selection

The ESCWA REGEND small-scale RET solutions in the Arab region: operational toolkit[19] should be consulted to identify feasible and optimum RET solutions for a particular project site. For the pilot projects, feasible renewable energy sources and RET application opportunities have been identified (table 1). The RET toolkit can be used to select suitable technologies. Once selected, a viable and sustainable business model is needed to deploy the selected RETs within rural communities.

D. Decentralized approach

Providing energy access to remote rural areas, often with difficult terrain, is expensive, with significant capital costs that are required upfront. In many cases, government investments and public budgets through a centralized approach are insufficient to provide affordable access in a sustainable manner.[20] The private sector can therefore be incentivized to mobilize financial resources to expand local energy services and bridge the gap through a decentralized approach.

In a decentralized approach, the RET deployment is typically carried out by non-governmental entities, such as private entrepreneurs, aid agencies, or user-communities. The focus is on stimulating and enabling the private sector to finance and execute solutions in a competitive and sustainable market through a bottom-up approach.

E. Scale-up of RET deployment

The next steps in the project are to consider expanding the deployment to benefit a greater number of communities and leverage economies of scale. The technology will remain small-scale RETs; however, the planning and deployment can be brought to a larger regional or national scale.

F. Project pilot sites

The ESCWA baseline reports analysed and selected feasible pilot sites for the REGEND project. The sites were selected on the basis of field assessments and screenings with respect to their development potential based on strengths, weaknesses, opportunities and threats (SWOT) analyses. Two feasible locations were selected in Jordan and Lebanon, and one location was selected in Tunisia. Findings from the baseline reports are summarised in table 1.

Table 1. Summary of recommendations from ESCWA baseline studies for proposed REGEND pilot sites

	Selected pilot sites				
	Jordan		Lebanon		Tunisia
	Al Ash'ary	Batir and Rakin	Akkar El Atika	Chaqdouf	Chorbane
Feasible renewable energy sources					
Solar	a	a	a	a	a
Wind	a	a	a	-	-
Hydropower	-	-	TBD	-	-
Biofuels	TBD	TBD	TBD	-	-
Opportunities identified for small-scale RET applications					
Affordable electricity production	a	a	a	a	-
Heating potable water	-	-	a	a	-
Agriculture (production and processing)	a	a	a	-	a
Pumping for irrigation or potable water	a	-	a	-	-
Livestock (feed, drinking water, processing)	a	a	a	-	a
Dairy products (processing and storage)	a	a	a	-	a
Agri-food production (e.g. beekeeping, fishing)	a	-	a	-	a
Handicrafts	a	a	a	a	a
Eco-tourism	-	-	a	-	-
Supporting activities to be integrated with RET deployment					
Financing (end user affordability)	a	a	a	a	a
Financing (capital)	a	a	a	a	a
WEF nexus management	a	a	a	a	a
Rural development (entrepreneurial activities)	a	a	a	a	a
Women empowerment initiatives	a	a	a	a	a
Community engagement & capacity building	a	a	a	a	a
Environmental protection	a	a	a	a	a

Sources: ESCWA, 2020a; ESCWA, 2020b; ESCWA, 2020c. **Note:** TBD: to be determined.

2. Business model development

Selecting the most suitable approach to developing a business model highly depends on the context and needs of the project, where it will be implemented, and the scale required. The main steps in developing a business model are as follows:

a. Establishing national and regional baseline analyses and suitable site locations in line with the methodologies employed by REGEND in Jordan, Lebanon and Tunisia;

b. Establishing a baseline analysis to quantify the demographic data, energy requirements and price/cost, and availability rates of renewable energy sources at the project site; engaging the community and establishing bottom-up demand identifying opportunities for RET utilizations, incorporating the principles of the integrated approach from section 1.B; and incorporating the use of modern and feasible technologies, such as databases and cloud platforms, wherever possible;

c. Determining and selecting feasible RETs for identified opportunities, guided by the REGEND RET Operational Toolkit;

d. After familiarization with the Energy Market System Assessment (EMSA) delivery model framework (section 2.A), creating a delivery model by defining the market chain (from development to end user consumption) on how RET will be delivered to rural end users, either as a product or service. The following components need to be defined for the model:

» Enabling environment (section 2.B).
» Ownership (section 2.C).
» Capital financing (section 2.D).
» Delivery model option (section 2.E).
» End user financing (section 2.F and 3).
» Stakeholders (section 2.G).

Careful attention should be placed on ensuring that each of these components incorporate the principles of the integrated approach towards rural development. Once the components are defined, they can be used to create an energy market map for the business model as described in the EMSA delivery model framework (section 2.A).

e. Using the energy market map to identify barriers and respective mitigations and interventions following the framework methodology.

A successful business model must be financially sustainable within the constraints of the project, while adopting an integrated approach to support and benefit rural communities where it is deployed. Modern digital technologies and social media strategies should be incorporated to increase efficiency, improve costs, and raise awareness. A table of successful applications of decentralized, small-scale RET is included in section 2.H for reference.

A. EMSA delivery model framework

A delivery model will need to take into consideration the specific context of the country and community it will be deployed in for it to be effective. A framework can help build that contextual understanding and identify the necessary interventions needed to support the delivery model. The Energy Market System Assessment (EMSA) Framework, developed by the European Union Energy Initiative Partnership Development Facility (EUEI PDF) and Practical Action Consulting, was created with this in mind. Its aim is to provide development professionals, at both the policy and practitioner levels, as well as the general

public, with a tool to help systematically understand and assess how decentralized markets work, and how they can be effectively supported and promoted. The authors do not consider it a support programme implementation tool, but it can provide a basis for orientation on projects to initiate discussions.

The framework, the process of which is highlighted in the present section, is defined in two steps.[21] The first step is to create the delivery model by defining the market chain, enabling environment, inputs, services and finance. Subsequently, an energy market map can be created where these components are referred to as levels, as shown in figure 2. This helps to systematically identify all the system's components, the individual actors involved, their roles, and how they interact with each other.

The second step is to use the map to identify potential obstacles and opportunities in the three levels to understand whether the system would work effectively, and the rationale behind it. Once this is done, potential interventions can be considered to build a sustainable market system and delivery model. The framework also supports categorization and prioritization of the interventions.

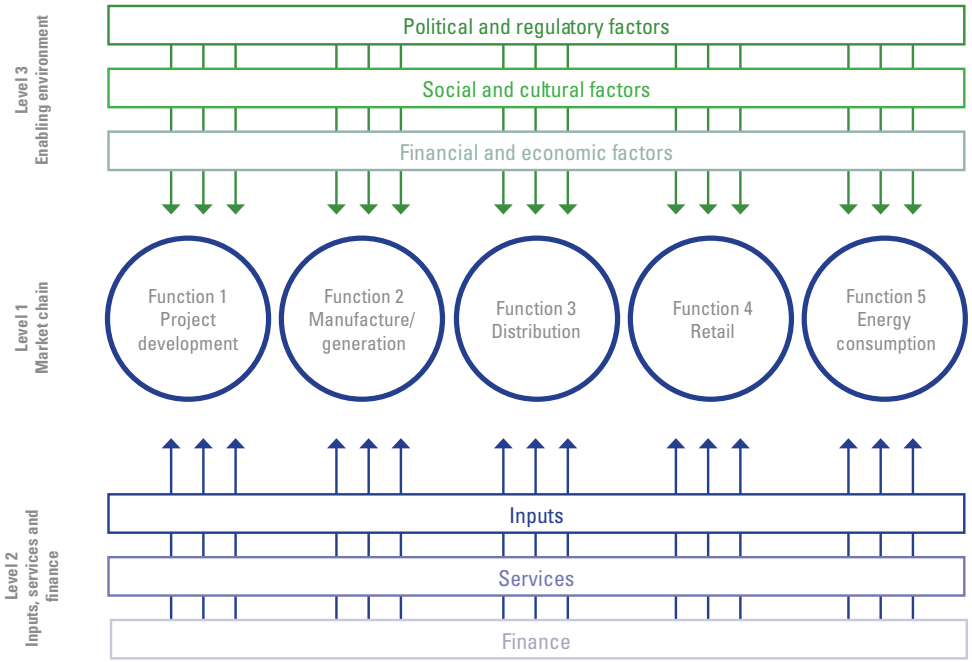
The framework guide has created generic maps for specific RET market systems that can be used as starting points. System maps for mini-grids, solar PV lanterns, SHS, and biomass-fuelled cookstoves are included, along with relevant case studies showing the framework applications.

The market chain (level 1, figure 2) constitutes the delivery model. To define the model, the key stages to address are the planning, execution, and operational life of the project.

The planning stage includes the project definition and development, and corresponds to FUNCTION 1 of the framework. At this stage, the RET solution scope is defined and designed, which will dictate the business model and thus the ownership, key stakeholders, and financial planning. The execution of the model includes the deployment of the technology, from manufacturing, building, or importing and then disseminating the product or service to the end user identified as FUNCTIONS 2 to 4 in the framework. And finally, FUNCTION 5 corresponds to activities necessary to operate, maintain, and manage the RET to provide services to beneficiaries.

The delivery models are heavily context-based. They require an understanding of the enabling environment, location, community and user profiles, and what their needs are to understand the specific barriers and constraints that need to be addressed.

Figure 2. A simplified summary of the EMSA framework with the three functional levels



Source: EUEI PDF, 2015.

B. Enabling environment

An understanding of the policy and regulatory framework, public support systems and programmes, and cultural practices within a country and community is necessary in developing the delivery model. These diverse set of factors are termed the "enabling environment" in the EMSA framework, and act as the rules of the game.[22] In general, the environment is created by the institutions, such as research agencies and national and local authorities, and directly influence the delivery model. In some cases, the small-scale RET framework may be ambiguous or overlooked in policies. Therefore, determining the limitations and barriers to the model with an analysis through the EMSA framework can help identify and deploy the required interventions and mitigations for each specific market chain element. Existing policies and programmes for gender mainstreaming, rural development, and green solutions can be explored for synergies with the selected business model.

C. Ownership of the delivery model

The main options for the ownership of the delivery model can be public, private, community-based, or a hybrid approach that involves multi-party ownership or public-private partnerships.

A public ownership model can be deployed through a rural electrification agency (REA), municipal government, or a utility. Efforts need to be in place to ensure sustainability of the business models. Case studies have shown that these models can face financial and technical problems that undermine their sustainability by applying national tariffs that are very low, especially when compared with the tariffs awarded to private operators after negotiating and licensing, by not involving the local community effectively, and by a lack of a comprehensive approach to support access to energy or RETs.[23] However recent innovations have seen public utilities adapting to the use of distributed service operators generating power with small-scale renewables for cost-effective and flexible local solutions.

Private ownership can be either profit or non-profit based. There can also be partnerships between profit and non-profit companies. Social enterprises are innovative business models that help meet development challenges which are not met by traditional providers. These companies combine the organizational forms of for-profit businesses and community sector organizations.[24] In the context of energy access, these companies can provide clean, affordable, accessible, and scalable energy solutions that match the economic, social, and geographic characteristics of low-income consumers.[25] A World Resources Institute (WRI) study notes that the success of impactful social enterprises can be attributed to the following four core business functions:[26]

- Understanding consumer needs, preferences, and their ability to pay.
- Demonstrating the value of a new technology or energy service delivery model to the rural community members.
- Building and maintaining consumer trust in their solution, i.e., product and supply chain.
- Designing financing and payment schemes that fit the budgets of their end users.

An understanding of the policy and regulatory framework, public support systems and programmes, and cultural practices within a country and community is necessary in developing the delivery model. These diverse set of factors are termed the 'enabling environment' in the EMSA framework, and act as the rules of the game.

Box 1. Tanzanian decentralized approach: example of a social ente rprise

Innovative social enterprise: Tanzania Traditional Energy Development Organization

A WRI study conducted interviews and a three-day workshop with innovative social enterprises to identify successful strategies. The report included findings from the Tanzania Traditional Energy Development Organization (TaTEDO). As a modern social enterprise, TaTEDO aims to increase access to sustainable energy technologies and services to the urban poor and rural populations in Tanzania.[a]

The WRI study attributed the success of TaTEDO to understanding the specific needs of its customers as part of its strategy. The TaTEDO strategy includes conducting voluntary monitoring of its customers, and then maintaining an information and knowledge management system to develop its insights. When TaTEDO engages with a community, it first develops a baseline assessment by developing a set of indicators and conducting surveys, both at the village and district levels. Then, through a voluntary rural appraisal, the company engages community members in an iterative dialogue to identify core sets of problems, needs and opportunities. This process helps determine which RETs and services are most suitable, so as to begin including the community in the project planning.

This approach helps TaTEDO identify and incorporate specific cultural nuances within their plan to help increase uptake of the technologies. For example, many of their solutions have been to replace traditional cookstoves with cleaner and more efficient stoves through culturally specific demonstrations. It also trains local technicians to maintain their RETs. TaTEDO has also supported local groups to produce, distribute and install several thousand solar energy systems, and over a million efficient cookstoves in rural and urban areas.[b]

Sources: a Clean Cooking Alliance, n.d.
b Ballesteros and others, 2013.

A **user-cooperative owned** business model is typically used for RETs such as mini-grids, battery charging stations, and community solar systems. It is established as a non-profit community organization that is owned, managed and funded by its members to provide an energy service to the wider community for a fee.[27] The funding can be with or without external support from public or non-public entities. The cooperative manages all the operational and administrative tasks involved. This would typically include installation, maintenance, safe operation, financial management, and payments between users, contractors, operators and the cooperative. As per a study by the Asian Development Bank, a user cooperative should operate on the following principles:[28]

- Voluntary and open membership to the cooperative, where any person who is able to use the service and that is willing to take the responsibility of the membership can join.
- A democratic member-controlled organization, where members can actively participate in making decisions and setting policies.
- Members' economic participation to contribute equitably and to democratically control the capital of the cooperative.
- An autonomous and independent entity and self-help organization, controlled by the members.
- Education, training, and information provided to members, managers, elected representatives and employees, so that the cooperative can develop effectively.
- Cooperation between the members to effectively operate and strengthen the cooperative.
- Concern for the community by supporting sustainable development of their community along with addressing member needs.

Hybrid approaches can also be adopted through multi-party ownerships or public-private partnerships. A multi-party partnership might be suited for energy projects that have high technical complexity or have multiple separate units, such as a bio-gas production unit where the gas is then used for power generation.[29] Multi-party ownership can also be used together with user cooperatives and one or several private vendor companies to form public-private partnerships.

D. Capital financing options for the delivery model

Small-scale RET projects will often be implemented in vulnerable rural communities that have incomes at or often below the poverty line. The financial sustainability of the business models is vital to the success of the projects, but would need to meet end users' ability to pay. A detailed assessment of local market conditions will help to understand this from the start of the project. Financing will be required across the market chain to enable the various parties to produce the products and services at a high quality and to deliver their solutions.[30] This creates an opportunity for capacity-building activities to be organized to increase productivity and improve the quality of locally produced products. This reflects positively on sales, income and cash flow, which reduce financial risks and increase the willingness and ability to pay.

The majority of the expenses for the projects is the upfront capital expenditure involved in bringing the RET service or product to rural beneficiaries. These costs typically include project development, manufacture and transport, building, distributions and installation.

Financing is also needed for working capital and for long-term growth. Some of the working capital will go towards operating expenses, such as operational, maintenance, management, expenses and purchasing spare parts. This would also include any costs related to the safe and environmentally-appropriate dismantling and disposal of waste (e.g., batteries). Economies of scale by servicing a larger pool of end users can help lower the risk and improve affordability, and this is why the aggregation of farmers and active community members is recommended.

There are various options to finance a project, and usually combinations of sources can also be used. The capital costs can be supported through grants and subsidies from a public REA or other national rural development programmes. They can be financed through non-governmental organizations, development agencies and banks, or other international or private donors. Alternatively, the project can be conventionally financed through equity, credits and loans. Case studies analysis of sub-Saharan countries similar to Mauritania have shown that the majority of the projects have relied on grants for a substantial portion of the capital finance.[31]

Businesses can set up customer fees to maintain operations or generate profit. However, as the communities have marginal incomes, operating costs may need to be managed through a blend of resources, such as public funds, subsidies and customer fees which will depend on the specific national and local context of the project.

Box 2. Innovative funding support for decentralized project: Zambia

Innovative approaches have also been taken recently towards financing. The Beyond the Grid Fund for Zambia, funded by Sida, is worth $22 million and was developed and implemented through the Renewable Energy and Energy Efficiency Partnership (REEEP). As at January 2021, the Fund has financed RET projects that have provided clean energy to 915,000 beneficiaries that would have struggled to afford it otherwise. It does this by making the market less risky for private companies to enter the Zambian off-grid market, designed to kick start a viable and sustainable market for clean-energy services in the country through an enabling policy environment, and by lowering the entry-barrier for businesses and innovative business models.

Unlike a challenge fund or other traditional concessional financing, the Fund works like a public procurement process where instead of a specific product or service, it uses result-based social-impact procurement. In effect, it buys social impact that supports the connection of people to clean, high-quality energy. The companies receive a grant based on result-linked financing, such as the number of connections they commit to deploying. The bidding companies must show that they can provide a sustained long-term quality of connection, and provide good-quality products with strong warranties and long-term contracts. They must also share data and market intelligence that makes the market less risky for investors. The Fund is designed to complement other energy access and development projects in Zambia, aiming to provide 1 million Zambians with access to electricity in 2021.

The companies that have been contracted through the Fund have provided solar lighting, SHS, solar mini and micro grids, and clean cookstoves to rural communities across Zambia. Many of these customers would have been left behind with a purely market-driven model. The presence of these new companies is also boosting rural employment, creating approximately 1,376 new jobs in operations, sales and marketing. In addition, as a result of the fund initiatives, more than 242,000 tons of carbon dioxide emissions are expected to be avoided in 2021.

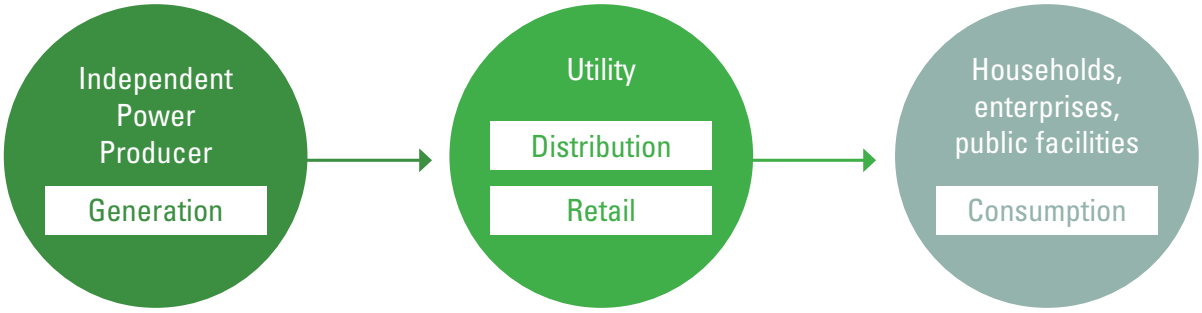
The Fund and REEEP have received several accolades for their efforts, which include the 2019 United Nations Global Climate Action Award and the 2019 Ashden Award for innovative finance. The Fund served as a pilot for the initiative, and it has now been established as the Beyond the Grid Fund for Africa, which aims to expand the approach to sub-Saharan countries and launch new funding for Zambia. REEEP works with low- and middle-income countries with GDP per capita defined by the World Bank as up to $4. It has implemented projects in 60 countries, with priority currently given to South Africa, Zambia, Tanzania, Kenya and India.

Sources: Ashden, n.d.a; REEEP, n.d.; BGFZ, n.d.; World Bank, 2017a.

E. Delivery model options based on RET service

The delivery model will define the structure of the value chain, and this will depend on a number of factors. The purpose of the project and the RETs selected to meet those objectives will dictate the delivery options and services offered by the business model. The scale of the project will also determine what shapes the model. A solution catering to a few users or a single community will be different to one devised for a regional scale or larger. For the long-term view, the replicability and scalability of the project must also be considered. Lastly, understanding the beneficiaries is key. Meeting end users' requirements, ability-to-pay, gender mainstreaming, and community buy-in are critical to the long-term success of the business model. Creating productive economic activities, especially around the WEF nexus, will further support the financial sustainability of the project in line with the objectives of integrated approach. How the model will be operated and maintained (third-party, community) needs to be considered, along with setting up the appropriate administration body accordingly. The beneficiary can be a household, small village cooperative, a large industrial user, or the national grid.[32]

Figure 3. Delivery model for an IPP and utility public-private partnership to deliver power to rural end users



Source: EUEI PDF, 2015.

1. Electricity generation and distribution

RET options: Any renewable energy power generation, mini-grids, SHS. Super-efficient appliances, productive, and WEF nexus RETs can be developed as a parallel product stream.

Electricity generation companies are typically differentiated based on their size (usually 10MW or less), and the RET that they use (e.g., solar, wind, hydro, biomass). They can take the following forms:

- Independent power producer (IPP) that sells power to the national utility on the grid, a utility-owned isolated mini-grid, or private businesses.
- An energy service company (ESCO) that generates and distributes electricity to end users through a build, own, operate/transfer (BOO/T) model.
- A combination of both options.

a. Independent power producers

Small-scale IPPs are companies that generate their own electricity and then sell it to a utility, central government buyer, private business, or directly to the end users. An IPP can form a public-private partnership with the utility or a central government buyer, who will be responsible for the distribution and retail of the electricity, as shown in figure 3.

The power can be generated by mini-grids or small power generation facilities, such as a biomass or bio-gas fuelled power generator. Rural companies generating power through co-generation units can also be incentivized to sell their excess power through small power purchase agreements to government-owned distribution systems, including regional mini-grids, as is the case in Tanzania (refer to TANAWAT as an example in table 2 for further details).

b. Energy service company

An ESCO is a commercial business that provides a wide range of energy services that include energy infrastructure, power generation, energy supply, and distribution.[33]

A private company will build and generate its own renewable energy, and operate, maintain, manage the equipment and distribute power through RETs, such as mini-grids or SHS. A private sector led-approach for mini-grid deployment is widely considered to be the optimum solution for achieving scale and long-term operation.[34] However, this model requires a sound and reliable regulatory environment to build confidence and sustainability into the market and encourage private investments. The private sector is geared towards efficiency and growth of business. Appropriate regulations can encourage companies to complement business sustainability with social goals, and essentially operate as social enterprises. The private sector faces the following policy and regulatory challenges:[35]

- Clarity in regulations with respect to the governance and ownership of mini-grids.
- Ease of obtaining permits and licenses to operate.
- Gaining access to public financial support.
- Any regulations for retail tariff to help with cost recovery.

» Risk from grid encroachment as a result of uncertainty in the plans for grid-extension into their area, and any uncertainty related to the possibility of selling power to the grid and the terms and conditions related to that.

The delivery model for ESCOs would be based on variations of the BOOT model, and can be developed through the EMSA framework that has developed a specific market map for mini-grids.[36]

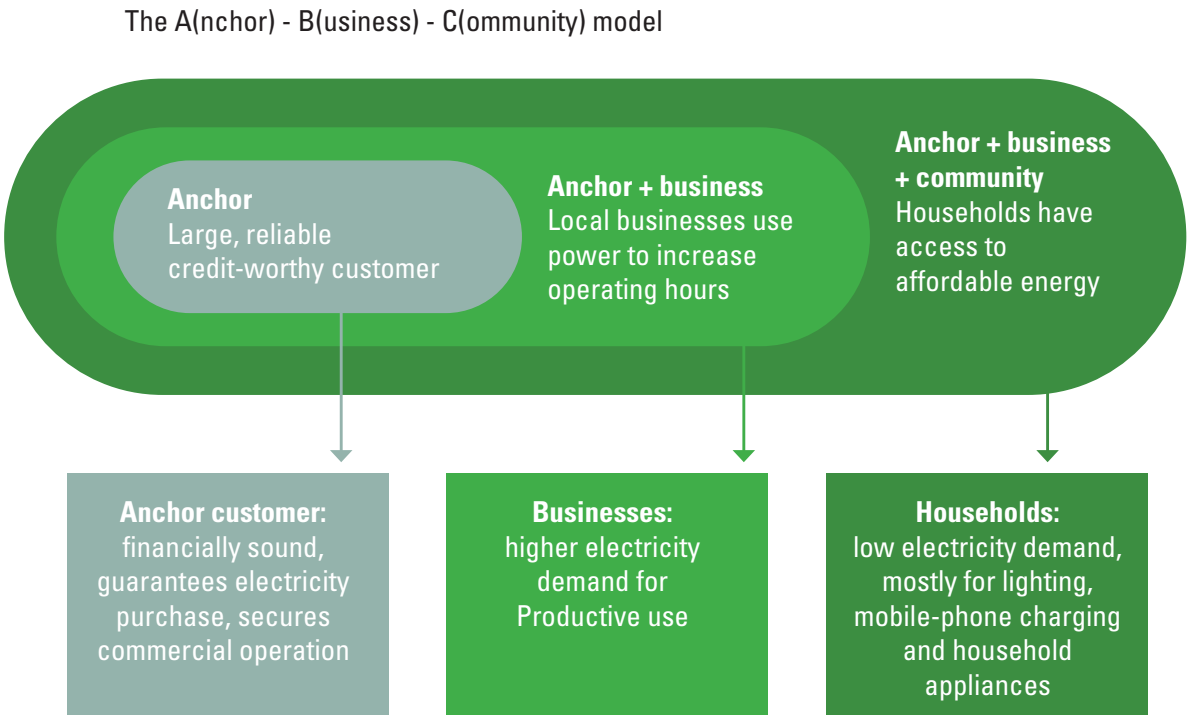
Anchor customers can allow companies to penetrate rural communities through a reliable customer base. An anchor customer represents a predictable daytime baseload where the client requires continuous service in a target rural area. Some examples are telecom towers, retail chains, gas stations, mining companies, and agro-processing industry.[37]

The anchor-business-community (ABC) model allows for a structured approach in utilizing anchor customers to support the rural community in its vicinity. The model builds on three sets of end users sequentially from its presence in the area, namely the anchor, businesses, and community, as shown in figure 4. Businesses are local commercial establishments that critically need energy access, but not continuously, for expanding their operations or increasing productivity, such as local small businesses and stores, schools, clinics, irrigation systems, or charities.[38] All three customers segments need a dependable energy source. When coexisting in a rural area, an ESCO can fulfil that entire demand while having lower business risk. The lowered risk is due to the presence of the reliable anchor's revenue stream. Lastly, affordable solutions can be provided to the wider community (refer to Africa Power Limited as an example in table 2 for further details).

c. Combination or hybrid approach

Business models can also be a combination approach, with multiple parties participating together. For example, Inensus is a private company in Senegal that builds hybrid solar-wind mini-grids in rural communities through the country's innovative micro power economy business model which is implemented through a public-private partnership with the rural electrification authority.[39] In the public-private partnership, 35 per cent is public equity (donor grants) and the remaining 65 per cent is private equity (Inensus).[40] Once the mini-grid is built, the ownership of the public shares is transferred to a community user cooperative, and Inensus is responsible for operating the grid (table 2).

Figure 4. ABC model for IPPs with anchor customers



Source: Kurz, 2014.

2. Community user cooperatives

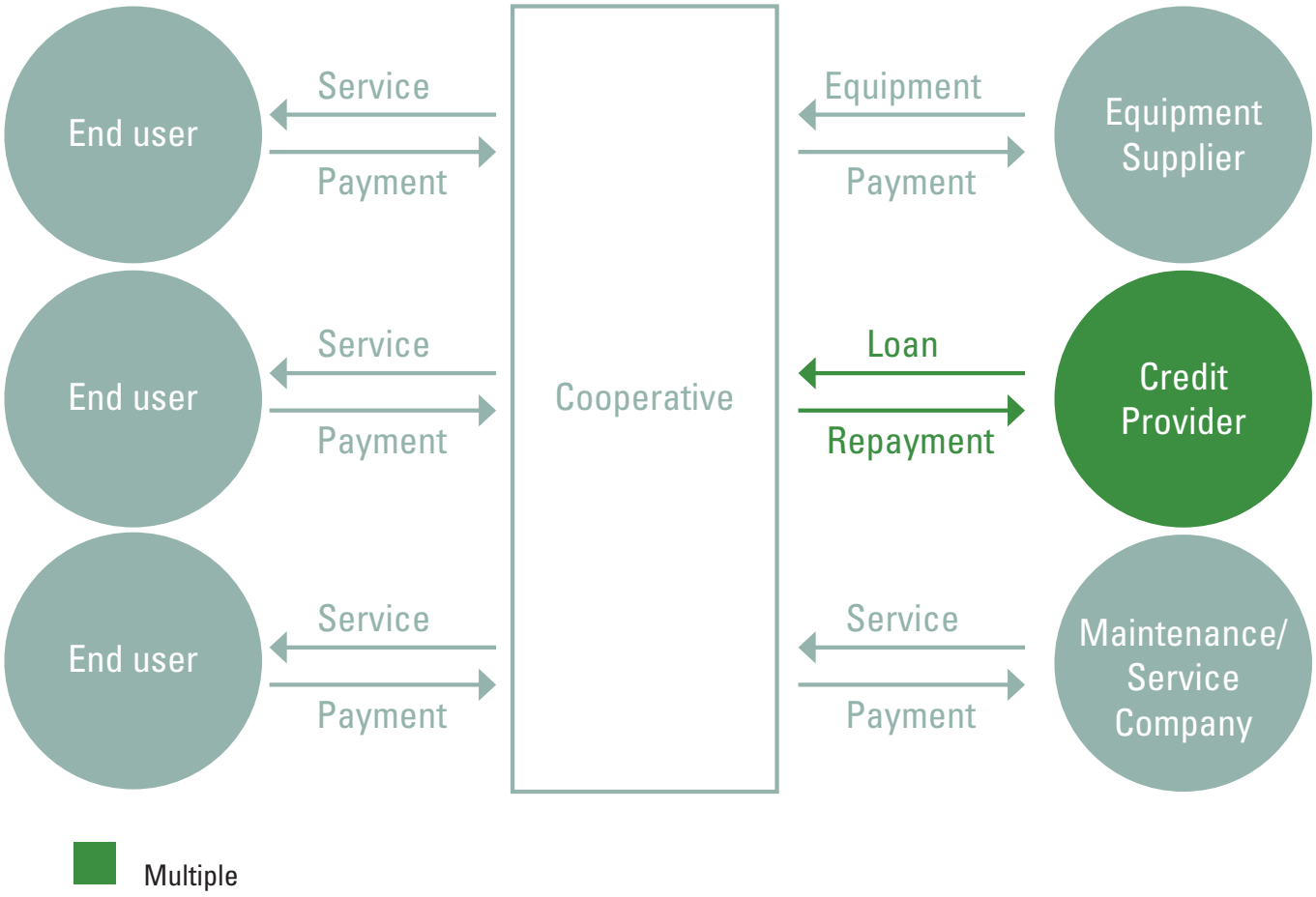
RET options: Any renewable energy power generation and mini-grids. Super-efficient appliances, productive, and WEF nexus RETs can be developed in parallel.

The main features of a typical user-cooperative model are shown in figure 5. These cooperatives share an RET service (mini-grids, community shared solar systems) among the community.

The cooperatives are mechanisms through which projects financed by non-governmental organizations and development agencies can support renewable energy and economic development at the local level.[41] These cooperatives can be community or faith based, and are self-driven to provide affordable energy access to their community, with the funds possibly facilitated by non-governmental organizations, to set up rudimentary distribution systems and isolated power generation.[42] Alternatively, a more structured approach can be adapted that will ensure the designs are of a higher quality and safety, where non-governmental organizations or ESCOs act as the project developers who transfer ownership along with management and operations to the cooperatives in some cases (box 3).

Case studies in sub-Saharan Africa have shown that cooperatives have been effective when they are developed by non-profit actors to provide energy access with an integrated long-term programme to support and empower community development.[43] These programmes included capacity-building and provision to support economic and WEF related activities.

Figure 5. A typical user-cooperative delivery model



Source: ADB, 2015b.

Box 3. Decentralized approach: UNDP solar mini-grids in Yemen

Financed project: UNDP solar mini-grids in Yemen

Recent conflict in Yemen has increased fuel prices drastically, and exacerbated the unreliability of the public grid, damaged infrastructure, and left communities facing poverty and hunger. Before 2015, only 23 per cent of Yemenis had access to energy, with a further deficit in recent years. The crisis has also meant that all levels of businesses and the private sector overall have faced extended periods of power shortages.

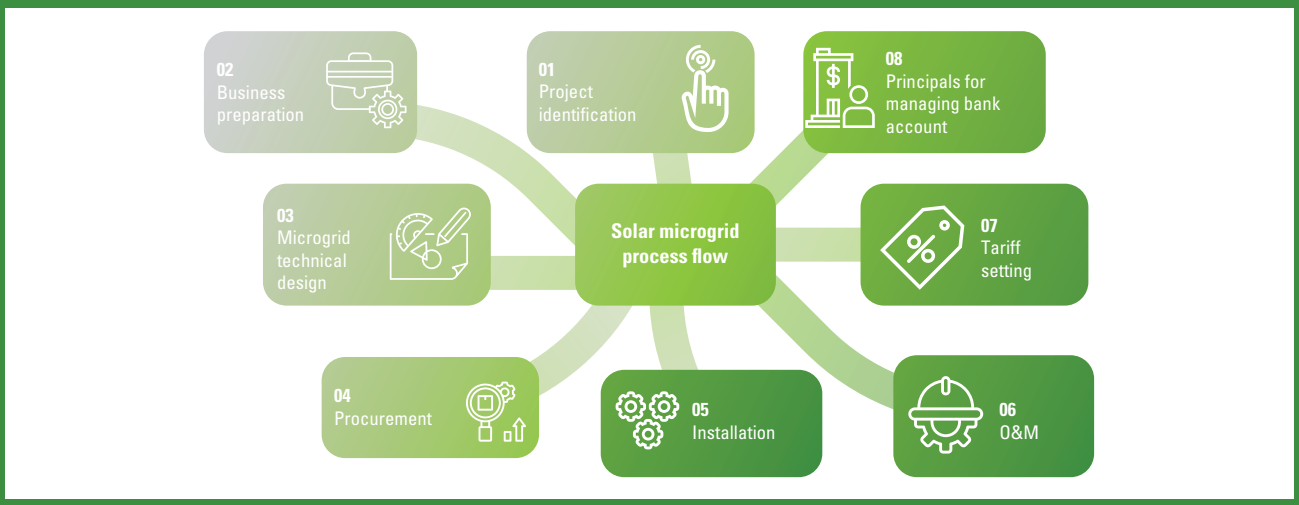
United Nations Development Programme (UNDP) designed and developed low-cost solar mini-grid solutions for the community using its 3x6 approach, which uses skills, resources, and local expertise to support crises affected people to become financially independent, and able to contribute to the local economic recovery to support transition from emergency response to a sustainable development path.[a]

A solar mini-grid in the Abs district, Yemen

Local women working with an ERRY representative

Sources: Ashden, n.d.b; UNDP Yemen, 2020.

UNDP utilizes a standardized delivery model that provides a consistent, efficient, and replicable methodology to set up local mini-grids in the communities, with the involvement of the local development or rural agency. Their operational guideline document for Yemen includes the necessary technical information for solar RET options, along with standardized project phases and their corresponding activities, process flows, and documents adapted to the setting. The figure below shows the process flow for mini-grids setup.



UNDP process flow for setting up a solar PV mini-grid

Abbreviations: O&M, Operations and maintenance.
Source: Ashden, n.d.c.

To support vulnerable populations, UNDP and Enhanced Rural Resilience in Yemen (ERRY) partnered to provide affordable energy to three villages near the frontline of the conflict in Hajjah and Lahj. They were also supported on the ground by Care International and Social Fund for Development. The aim of the project was to provide affordable energy to vulnerable populations while also empowering women and young people economically to help support their families.

Then UNDP partnered with ERRY to train local women and young people to establish, manage, maintain and promote the solar mini-grid businesses. After the initial training, the local trainees pooled their cash grants from the organization to buy the necessary equipment to set up the mini-grids and sell energy to their neighbours. For the three grids, seed grant money of $27,000 was provided and distributed to 30 vetted participants of the training ($900 per participant).[b]

In the Abs district, the solar mini-grid is owned and run entirely by women, which helped them challenge gender norms and create new roles within their communities. Initially, the women faced scepticism and even mockery from some members of the village. However, tasks such as negotiating with tribal leaders and hiring security guards helped them break through the local gender barriers.[c]



Local women operating and maintaining their solar micro grid business in their village in the Abs district, Yemen

Sources: Al Jazeera, 2020; Ashden, n.d.c.

These communities were reliant on diesel generators that were polluting, expensive and susceptible to sudden surges in fuel prices. The introduction of the solar mini-grids has cut their bills by 50 per cent, and the savings can be put towards other valuable resources. Furthermore, the grids have created a monthly income of $70 for the grid owners, and have become a self-sustaining business that can grow and have a waiting list of potential customers.[d] The grids further helped women in the community through improved security by providing lighting in the evenings, and the reduced financial pressure on families lessened the risk of their agreeing to under-age marriages for girls.[e]

Although Yemen is a high-conflict area at the moment, UNDP has seen that none of the micro grids were damaged or stolen because the communities recognized their importance and protected them. This project recently won the Ashden Award in humanitarian energy, which focuses on finding the most exciting climate action projects around the world.[f] The United Nations plans to expand the decentralized community-run microgrids across Yemen in the coming years to power hundreds of schools, clinics and other vital facilities.[g]

The solar mini-grids also brought benefits to the larger community. The power and lighting provided by the mini-grids allowed the community members to be productive after dark. As a result, for example, a woman in Abbs was able to sell her sheep and buy a sewing machine, which she uses at night once her children are asleep. With all three mini-grids, the energy sold helped almost 2,100 end users develop additional income through various activities, such as sewing, welding, selling groceries, and setting up commercial stores. It was estimated that approximately 10,000 community members benefited indirectly from the economic activity generated by the three mini-grids.

Overall, a market study by UNDP of the solar energy systems value chains in Yemen found that the mini-grids were a promising source of employment.[h] The study found that many recent graduates and young people opened stores offering solar RET products and services, existing wholesalers and companies expanded their electrical business to cater for the solar RET market segment, and the project created maintenance work for technicians at the mini-grid stations.

Micro grid business owners in the Abs district, Yemen

Sources: Ashden, n.d.c; Al Jazeera, 2020. a UNDP, 2016. b UNDP Yemen, 2020. c Ibid. d Ibid. e Ibid. f Ashden, n.d.b. g UNDP Yemen, 2020. h UNDP Yemen, 2020b.

3. Standalone RETs

RET options: WEF nexus-related and productive RETs, standalone systems.

Retail models can be used in businesses where RETs are sold as products. A supply chain for their manufacture and distribution needs to be established. This model can be used for a diverse range of RETs, such as lighting products, standalone systems, agri-food related (dryers, irrigation, development and innovation of traditional and heritage foods), or clean cooking.

The EMSA framework has developed market maps for solar PV lanterns, SHS, and biomass improved cookstoves that can aid in efficiently developing delivery models and the understanding of what interventions and mitigations are needed.[44] The following examples are considered for delivery models:

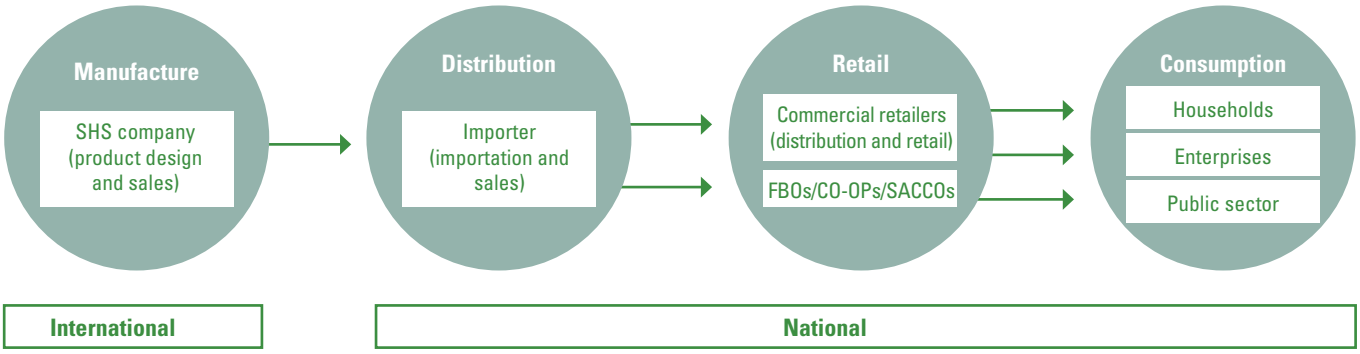
Distributed dealer model (e.g., solar PV lighting, SHS)

In a distributed model, several companies make up the supply chain. Figure 6 shows a typical model, which can have variations where companies can be responsible for more than one role.

Integrated supply chain model (e.g., solar PV lighting, SHS, WEF and productive RETs)

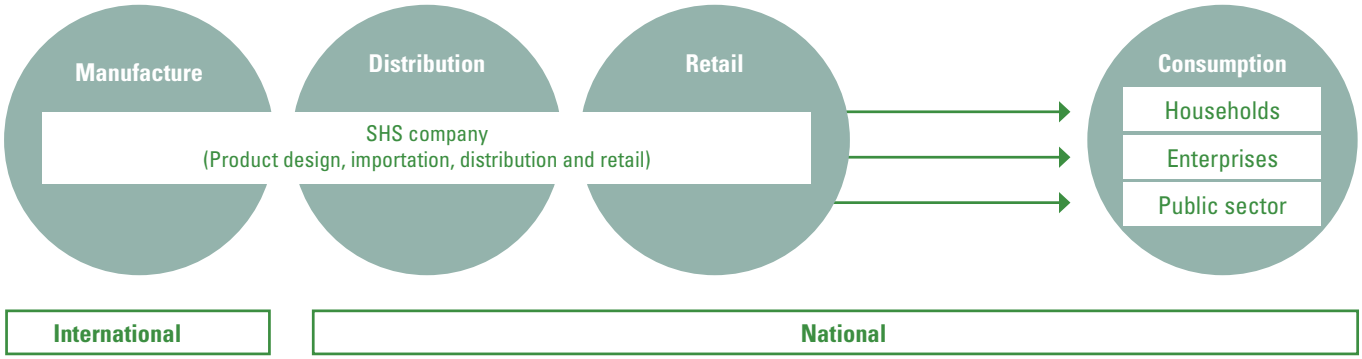
In this business model, the company is responsible for the entire supply chain of the RET product. This includes the design, manufacturing, distribution, and sale of its products directly to the end users in the rural communities.

Figure 6. Distributed dealer model for solar lighting products



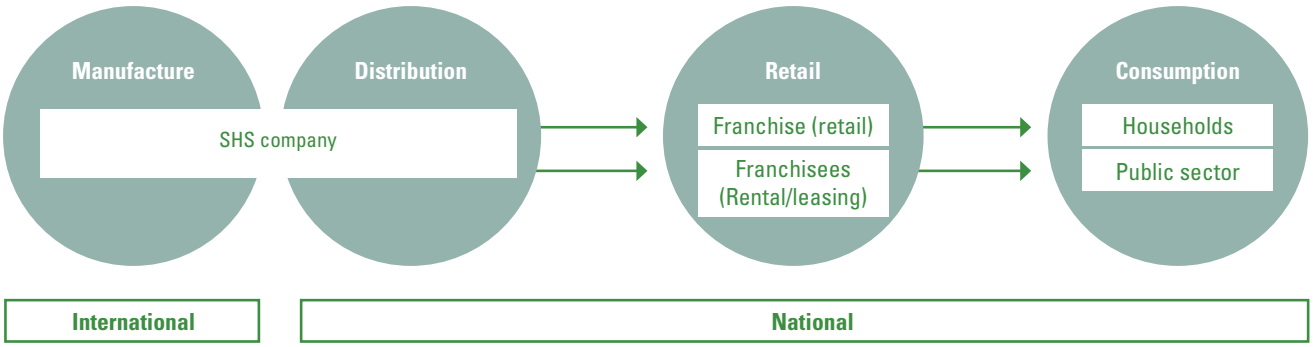
Source: EUEI PDF, 2015.

Figure 7. Integrated supply chain model for SHS



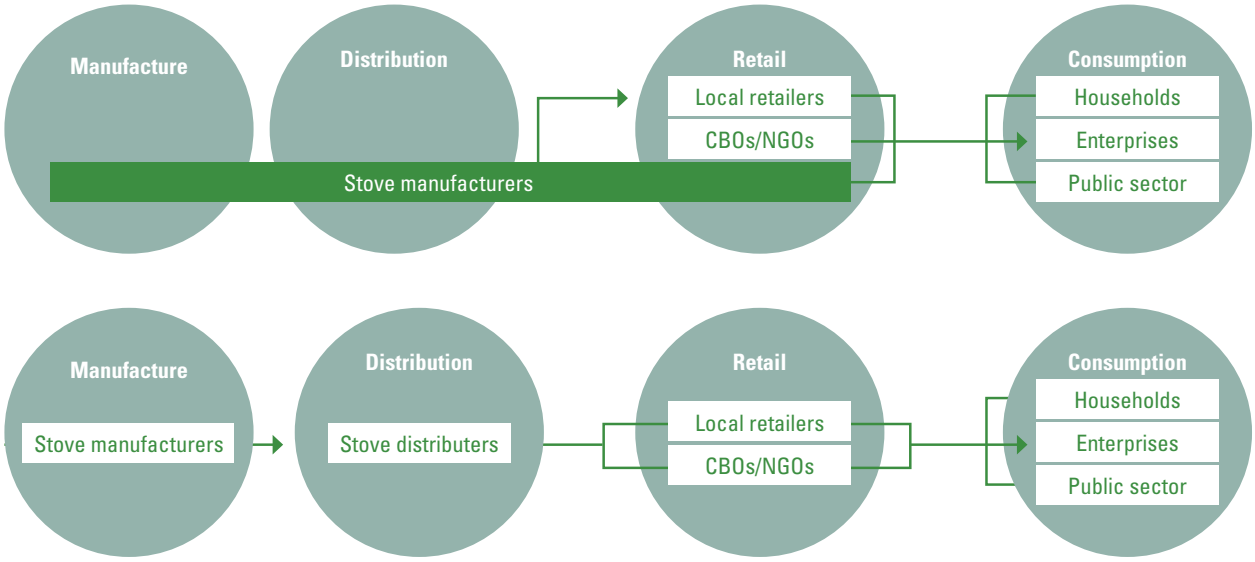
Source: EUEI PDF, 2015.

Figure 8. Fee-for-service or franchise model for SHS



Source: EUEI PDF, 2015.

Figure 9. Locally manufactured cookstoves, with centralized distribution (top) and decentralized distribution (bottom)



Abbreviations: CBO, Community-based organization; NGO, Non-governmental organization
Source: EUEI PDF, 2015.

Fee-for-service model or franchise (e.g., SHS)

In this model, the company acts as an ESCO where the product is not sold to the end users but offered as a service, for a fee. The company continues to own the RET. This model is used to attempt to reduce access barriers for rural customers who cannot afford to purchase RETs.[45]

Locally manufactured RETs (e.g., standalone RETs such as solar dryers, cook stoves, Zeer-pot for evaporation cooling)

Some RETs can also be manufactured locally within a country to meet the needs and context of the demographic (e.g., local cooking style or stove types) at an established level of quality,[46] while ensuring they are sustainable and using modern renewable energy. The manufacturing can be done by a company at a central site, and then distributed to various retail sites within rural communities and made available to the end users. Alternatively, the whole supply chain can be decentralized with dispersed, local manufacturing in rural areas.

Manufacturing could also be done at smaller decentralized sites by local artisans, community associations, or community members trained through capacity-building programmes. However, quality control measures would need to be in place to ensure the product quality to meet efficiency and emission standards.[47] Support would be needed to help manufacturers with any technical design or quality control issues. Examples of both models for cookstoves are shown in figure 9. A brief discussion of a local decentralized manufacturing of ICS in Rwanda from the EMSA framework guide is discussed in box 4.

Box 4. Case study: Local decentralized manufacturing of ICS in Rwanda

In Rwanda, almost 98 per cent of all households use biomass-fuelled cookstoves, which pose a serious health risk from harmful emissions in homes, especially in rural areas with inefficient stoves and ventilation. The Rwandan Government is aiming to provide modern, cleaner, safer and affordable stove options. The delivery model developed for this approach is shown in the figure below.

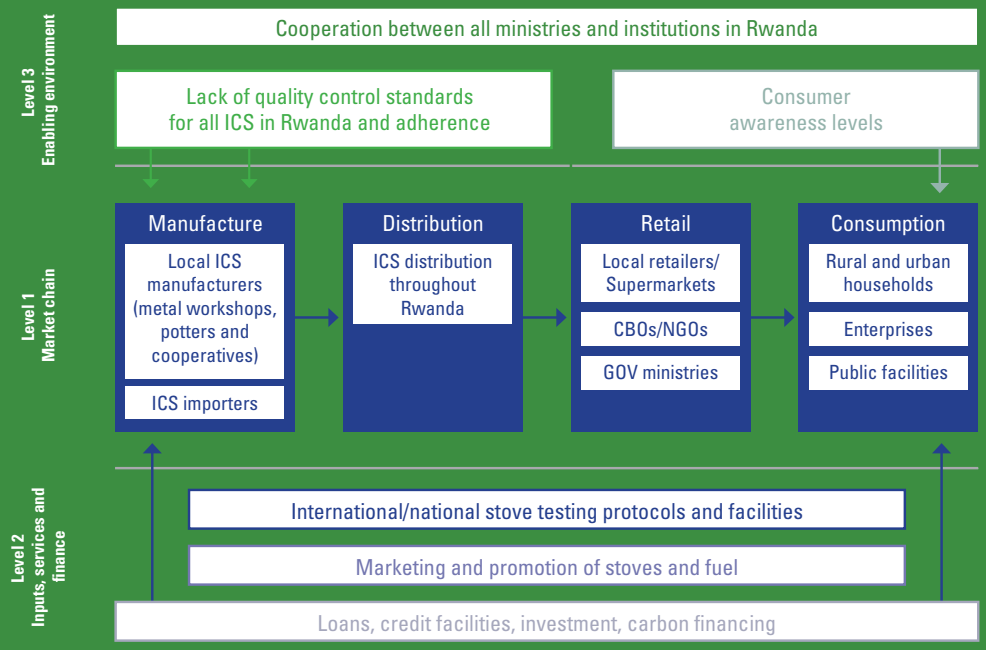
The Rwandan Ministry of Infrastructure has been supporting local production of Canarumwe wood-fuelled ICS in rural areas, specifically designed to meet the cooking habits and needs of the typical end user. The manufacturing of ICS is carried out by small cooperatives at informal production sites in decentralized locations in most districts. Production quality is ensured through strict adherence to dimensions and quality controls, specifically designed moulds and improved ceramic liners. The cookstoves are mainly distributed and retailed by the manufacturers. Furthermore, the ministry of local government and non-governmental organizations are also involved in the promotion and retail of the stoves at subsidized prices. The cookstoves are mainly used by households and public institutions, such as schools, restaurants and health-care centres.

The EMSA framework helped identify the contextual key issues in the delivery model represented by the number codes in the figure below. This then helped propose potential support interventions needed in response, for example:

Market chain issue 1 (M1): The informal nature of ICS manufacturing and limited business and marketing skills has meant they cannot scale without external support. They also lack adequate access to equipment, raw materials, workspace, storage and technical skills. The proposed intervention is to offer technical and financial assistance to ICS manufacturers to formalize their business models, along with access to production equipment; to facilitate access to training, testing and information services to increase ICS design quality to meet performance and user demands; and to help establish ICS manufacturers association for better coordination between market actors, shared learning, and skilled training.

Input and services issue 2 (S2): Poor marketing capacity for ICS in Rwanda. The proposed mitigation is to increase technical assistance to enhance relationships between ICS distributors and retailers and marketing service providers.

The case study in the EMSA framework report details all the issues and the recommended mitigations related to this model and should be referred to for more details and as a walkthrough of the Framework process.



Rwanda local manufacturers decentralized ICS market map

Sources: EUEI PDF, 2015.

F. End user financing

The affordability of RET solutions for rural households is one of the main issues when addressing the long-term viability of projects, and their ability to offer real accessibility of new energy sources and productive technologies needed by communities.[48] Consequently, affordability from the demand-side perspective of a rural community is a critical aspect of the delivery model and an opportunity for innovation. End user financing can be offered as an integrated part of the business model. The model will either fall within the service or ownership category. In the former, the user pays for the service, and RET remains the property of its provider. In the latter, the end user eventually ends up owning the product. The willingness and ability-to-pay of the rural community members established upfront through the baseline assessment is the basis on which to design financing packages. Some of the options are shown in figure 10, which include the following:[49]

One-hand business model: The RET business provides a RET product and micro financing options under one umbrella. Typically, the end user contractually becomes the full owner of the RET product once payments are complete.

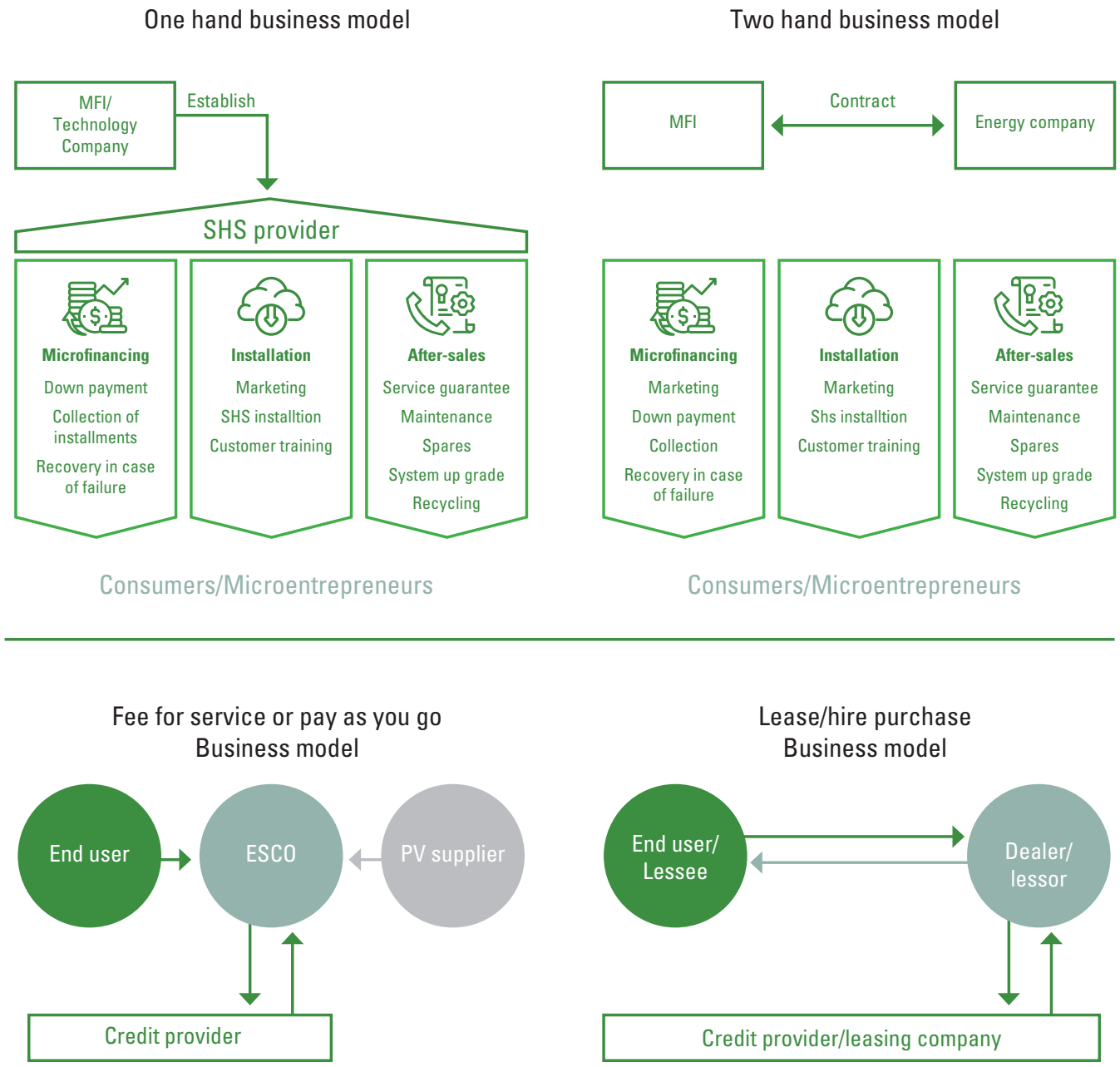
Two-hand business model: The services offered to the end user are the same as the one-hand model, but a contracted micro finance institution (MFI) or credit organization handles the consumer financing, and the energy company handles the product installation and service. The end user typically pays a down payment either directly to the energy company or MFI, and the remaining payments are collected by MFI at regular intervals for a limited term (e.g., two to three years).

Free-of-service or PAYG: The end user decides upfront, based on a package, how much electricity they need and pays a flat rate at regular intervals, or the end users pay for electricity consumed based on a flexible PAYG billing structure.

Lease/hire purchase business model: An RTO approach where the end user (lessee) pays a regular fee for a limited time (e.g., two to three years). The company (lessor) remains the owner of the product during the rental period. Once the payments are complete, the ownership is transferred to the end user.

A detailed discussion on financing options is included in section 3 of the present report.

Figure 10. Private market driven business models that offer end user financing

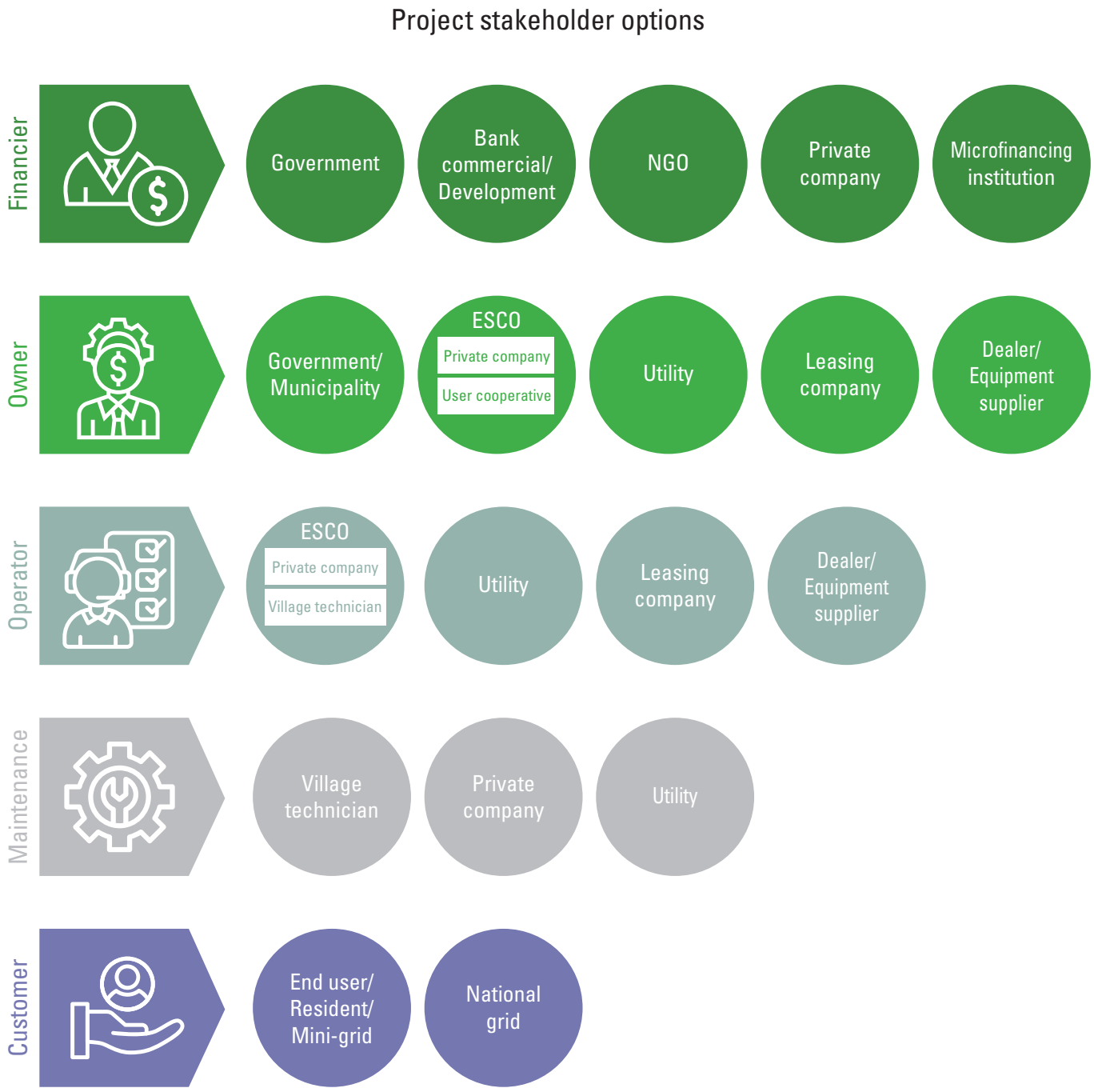


Source: Bergasse, 2015.

G. Stakeholder mapping

Identifying who the main stakeholders are and how they interact are necessary for developing the delivery model. Figure 11 shows stakeholder options for a private business model, where the specific stakeholders in the five main categories can be mapped, namely the financier, the owner, the operator, the maintainer, and the customer.[50] This can also be done for other business models and used together with the EMSA framework in developing the model.

Figure 11. Typical map of project stakeholders for a private RET project



Source: ADB, 2015b.

H. Examples of successful decentralized solutions

The success of a delivery model depends on understanding and meeting the end user's specific requirements. Table 2 includes examples of models that have innovatively provided services to rural communities, created a sustainable business model and, in many cases, scaled up their solutions to a wider population, both regionally and internationally.

Table 2. Examples of successful sustainable businesses offering decentralized solutions to rural communities

Delivery model	Example	Country	RETs	Ownership	Description	Further References
IPP and anchor client	Africa Power Limited/ Sincronicity Africa Power (SaFP)	Tanzania	SHS, Solar PV lighting	Private (profit)	Approximately, a third of the Tanzanian population has access to electricity, while the penetration of telecom within the country is 62 per cent which can facilitate access for RETs as anchor customers.[a] Africa Power is an IPP that uses mini-grids to supply power to the telecom towers. With its presence in the rural communities through towers, the company sells SHS and other solar PV products to households, micro enterprises, and community facilities. The rural customers use a PAYG model.	Africa Power, n.d.
Private enterprise	Zola Electric (previously Off Grid Electric)	Côte d'Ivoire, Ghana, Rwanda, Senegal, South Africa, Tanzania	SHS	Private (profit)	Zola Electric's model uses the growing availability of mobile money in East Africa to sell solar-powered electricity as a daily service. The customer pays using cell phones with a minimum payment of one day's use. A network of local agents finds customers, installs the SHS, and provides ongoing customer support. The use of tailored smartphone apps linked to a complex database allows for the customer system and payment information to be integrated. Cloud-based servers keep data secure. It has also found a niche market in urban areas with poor and interrupted grid service (2014 Ashden award, UNFCCC momentum for change award, Zayed sustainability prize).	Ashden, n.d.d, United Nations Climate Change, n.d.a
Independent Power Producer (IPP)	TANWAT (private business) and TENESCO (public utility)	Tanzania	Biomass-fuelled power generation	PPP: private power producer + public utility for distribution	Tanganyika Wattle Company (TANWAT) sold its surplus electricity from its biomass (wood waste) fuelled co-generation plant through a standardized power purchase agreement to a nationally-run off-grid mini-grid. It was able to switch to the national grid once it arrived in the area under the same agreement. Initially, TANWAT produced electricity for its use, but the project organically grew due to the regulatory framework incentives. The company is now considering plans to expand its cogeneration plant to enhance its revenue stream.	EUEI PDF, 2014; Odarno and others, 2017
Financed project/non-governmental organization or agency	Jhirghakhola Improved Water Mills for Electrification (IWME) project	Nepal	Pico-hydro (IWME) for grain milling, power, and irrigation	User cooperative	Through a government-run rural development initiative, traditional water mills common in rural Nepal were upgraded to provide irrigation, grain milling, and electricity to the rural communities. The electro-magnetic components of the windmill are produced locally within Nepal through established private industries supported by the Centre for Rural Technology (CRT/N), which also plays a role in capacity-building. The project was implemented by CRT/N and participating local communities. Technical and capital financial support was provided by international development partners. On completion, operations were handed over to a user cooperative that owns, manages and maintains RETs. As part of the project, CRT/N provided capacity-building to the user committee. A subsequent case study of the project by IRENA documented numerous socioeconomic benefits to the community, with noted benefits in women's health, wellbeing and education. CRT/N won the 2007 Ashden Award for this initiative.	ESCWA, 2019; ESCWA, 2020a

Delivery model	Example	Country	RETs	Ownership	Description	Further References
Social enterprise	S4S technologies	India, Nepal	Solar dryers	Private (profit)	The S4S patented solar dryer cuts up to 40 per cent of drying time compared with other dryers. S4S works with non-governmental organizations in the area to develop dryer entrepreneurs. It also uses a buy-back scheme to buy crops from farms then trains entrepreneurs, usually landless women farmers, to dry them. (2020 Ashden Renewable Energy for Development Award winner).	Ashden, n.d.g; Millenium Alliance, n.d.
	TaTEDO	Tanzania	SHS, ICS	Private (profit)	TaTEDO is recognized for providing its rural customers with innovative and customized solutions, developed by understanding the specific needs of the community through extensive dialogue with its members in all project phases, from conception to execution.	Ballestros and others, 2013
	Husk Power	India, Tanzania	Biomass fuelled mini-grids, super-efficient appliances, SHS	Private (profit)	Husk Power was named the "2020 micro grid company of the year" by the Indian Energy Alliance Services. It has successfully scaled up its mini-grid programme to 100 min-grids in India and Tanzania, with plans to expand to Nigeria, which represents a 10-fold increase from the number of grids in 2018. According to the company's research, its micro-enterprise customers (rural farmers) saw a 33 per cent increase in profits through access to their mini-grids.[b] (2011 Ashden Energy for Development winner).	Ballestros and others, 2013; IFC, 2011
	Solar Aid (international charity)/Sunny Money (social enterprise)	Kenya, Malawi, Tanzania, Uganda, Zambia	Solar lighting	Private: profit and non-profit partnership	SolarAid and SunnyMoney distribute portable solar PV lights. SolarAid's model is based on a regulated not-for-profit (registered charity) business model, which has demonstrated leading achievement of widespread distribution and uptake of pico-solar lighting products. As per its Chief Executive Officer, SolarAid lights are many communities' first encounter with PVs which raised awareness and acceptance of larger solar products, such as Zola SHS. The programme uses school headmasters as distributing and market agents, who hold influence and respect within their community and also help create awareness. (2013 Ashden Energy for Development, Renewable Energy Award winner, and 2013 Google Global Impact Challenge winner).	EUEI PDF, 2015; Miller, 2015; Clean Energy Solutions Center, 2015; Ashden, n.d.f
	Frontier Markets	India	Solar lighting systems	Private (profit)	This company sells solar lighting through its Solar Saheli programme, which equips women with skills and employment to sell SHS. The network of Solar Sahelis helped the company overcome cost and awareness challenges within rural communities (2016 Ashden Award winner).	Ballestros and others, 2013; International Finance Corporation, n.d.; Frontier Markets, n.d.; Ashden, n.d.e

Source: a Accenture, 2015.
b Husk Power Systems, 2020.

3. Financing options for rural end users

Most households in rural areas have low or variable income, and access to RETs can be unaffordable. This is especially the case for the higher-cost systems such as mini-grids, SHS and high efficiency ICS, which are relatively expensive for many.[51] Furthermore, these households generally lack access to conventional banking loans and services, primarily because of the high operational costs of the banks and traditional financial institutions, and the lack of end user material collateral or credit records.[52] As such, rural communities require alternative financing to access and afford RET energy products and services. By offering flexible, appropriate, and appealing financing models, the energy needs of rural communities can be met effectively, while allowing renewable energy companies to recover their costs.

For a comprehensive solution, the financing mechanism for rural end users needs to be offered as part of the delivery model, with both centralized and decentralized approaches. It can be included directly into the model or as a parallel programme. The form of financing depends on whether a service or a product for ownership is delivered.

The time period over which the payments are spread is also important, and a range of options is needed. Payments for smaller RETs, such as solar lighting, are short term, while the payments for larger RETs like mini-grids take longer. Customer and payment management systems, such as customer databases or cloud-based platforms, also need to be an integral part of the model to ensure operational sustainability.

A. Service model

In this model, rural customers are provided a service or access to a product that they pay for with a service fee. The RET system itself is not sold to the community members, and the company ensures the correct operation and maintenance of the RET system. Service providers can include concessionaires, ESCOs, non-governmental organizations, and user cooperatives.

Fee-for-service is where rural end users pay a fee based on usage or energy savings. There can also be an upfront connection fee. Differentiated price packages can be offered based on usage to create a wider range of affordable options, and to offer versatility in allowing individual users to upgrade as they progress upwards.

Payment flexibility can range from fixed rates at fixed frequency to payments based on usage adjusted at customizable frequency. Under a standard utility service type contract, end users pay a tariff based on the package and electricity usage. There are usually renewal time periods at regular frequency where end users can change packages based on their power needs. Smart meters allow companies to monitor usage remotely through cloud-based systems that can be integrated with cell phone payment applications.[53] It also allows companies to automatically lock the system if payments fail and then resume service once received. Pre-paid cards can also be used as another mode of payment.

Service providers can include concessionaires, ESCOs, non-governmental organizations, and user cooperatives.

B. Ownership model

Rural end users can be financed through ownership schemes to purchase their RET equipment. There are several options to implement this. RET products can be bought directly for cash in retail sale models for customers that can either afford to do so, or for smaller RETs such as simple solar lighting products. However, in the majority of cases, payment mechanisms break payments down into regular instalments over defined periods of time to be accessible and affordable for communities.

In recent years, the **PAYG** or **RTO** models have gained popularity in rural electrification schemes and small-scale renewable energy technologies deployment. In these plans, the end user usually pays an up-front purchase fee with a flexible and customizable monthly, weekly or daily fee if the end user would like to use the system.[54] After a certain period of payments, the end user becomes the owner, and the system unlocks automatically and indefinitely. This sense of ownership, complemented with the enabled energy savings, can bring a sense of pride and responsibility, and incentivize end users to manage and maintain RETs as their own property for long-term operation and benefit. This model has clear advantages for low-income households, allowing them to make payments that are smaller than those in other plans, while giving them greater control over their consumption and therefore their spending.[55] These features mirror the consumption pattern for non-electrical energy products, such as candles and kerosene lamps, allowing companies to expand their base further compared with a fixed rate approach.[56]

The flexibility offered in the PAYG plans varies in companies based on RET and their customer base.

Payments are typically made through pre-paid scratch cards and mobile payment services, allowing for savings in transaction costs.[57] Smart metering is used in a similar way to the fee-for-service models to automatically lock or unlock the system.

Micro finance schemes are an attractive and commonly used alternative in off-grid projects and small-scale RET projects. Rural end users are offered microloans by MFIs, directly or through the RET business, to pay at least part, if not all, of the capital cost of the equipment. The businesses typically funded through these schemes are small-scale businesses, such as local distributors. MFIs are characterized by their focus on projects and businesses that will generate productive economic activities or support agricultural activities.[58] Loans are generally made at relatively high interest for a short time period, which are repaid from the additional income generated by RET. Transaction costs with MFIs can be high, although reduced compared with traditional financing. This scheme also requires companies to have significant working capital to initially purchase RETs.[59] Refinanced loans against their purchased RET to help pay school fees or other immediate financial needs have helped RETs become more appealing to rural end users.[60] There is also the possibility of a positive feedback loop in which the energy savings help offset costs where the freed-up income can be used to repay the loan faster. This allows the original capital to be available sooner to MFIs to serve other beneficiaries.

Local community-based organizations at sites assessed for the baseline assessment in Jordan, including the selected pilot sites (table 1), utilized **revolving loans** to assist rural communities. Revolving loans involve an organization or individual maintaining a reserve of funds, which is used to loan money to borrowers. The borrower is expected to pay the money back within a defined period of time to restock the fund. A service fee or interest can be charged to cover the administration costs. However, in Jordan, the loans are interest-free. The success of the scheme depends on the repayments, and relies on the social organization and peer or group pressure to ensure follow through.

Semi-formal mechanisms can also be considered. **Village bank models** are popular options in Latin America and Africa. Here, the implementing agency establishes individual village banks with 30 to 50 members, and provides them with external seed capital to onward financing members.[61] The loans are short term and paid in weekly payments. **Credit unions** are non-profit financial cooperatives that are owned and controlled by their members.[62] They work on a principal of mutuality and provide credit lending. These are popular in Asia, particularly Sri Lanka. **Self-help groups,** a popular scheme in India, are made up of 10-15 members that pool their savings and use them for lending to the community.[63]

C. Innovative examples

Ashden is a London-based charity that rewards and promotes local sustainable energy in Europe and the developing world through its annual Ashden Awards. Awards are given to organizations and businesses that deliver local sustainable energy schemes with social, economic and environmental benefits.

2020 Ashden winner: Solshare in Bangladesh has developed a peer-to-peer solar energy exchange platform called SolBazaar, which allows households and businesses to trade electricity with their neighbours. The company's technology allows users with existing SHS to connect their RETs to a shared network, where they can sell excess energy and buy additional energy from each other. Households that do not have SHS can plug into the network and run appliances without purchasing a SHS of their own and at a fraction of the cost of buying a new one. Solshare's technology has brought energy access to households living in extreme poverty, who could not have afforded it otherwise. The social return on investment calculated by IIX Global estimates that every $1 invested has resulted in $4.85 of impact.[64]

2018 Ashden winner: Angaza is an African technology company that serves business in frontier markets. The company has rapidly grown its market share by helping manufacturers integrate PAYG enabling technology into their RET products, and selling cloud-based software platform for distributors. The embedded technology enables Angaza to monitor and control RETs, such as SHS and solar pumps, remotely. Angaza's cloud platform allows distributors to monitor loan accounts, access business analytics, and optimize sales, along with other activities. By enabling PAYG, these distributors are able to offer affordable options to a greater base of end users.[65]

4. Scale-up of RET deployment

By their very nature, small-scale RET implementations are decentralized to cater to dispersed and remote rural communities. However, once the concept of RET deployment has been proven, the potential for scale-up at a regional or national level needs to be considered. The resulting economies of scale can improve RET affordability, especially the relatively more expensive technologies such as mini-grids and SHS. Common deployment measures, such as process workflows, manufacturing or import, capacity-building, and capital financing of the RETs, can be streamlined and standardized at scale.

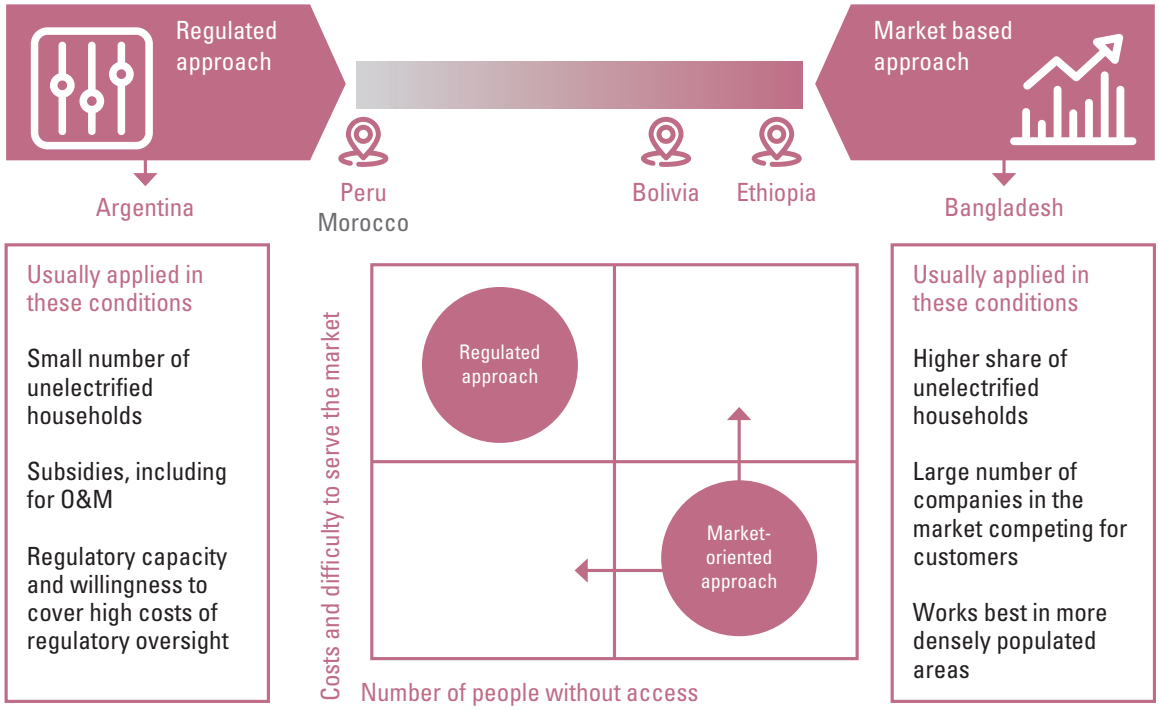
A. Regulated or market-driven approach

Large-scale deployment can take either a decentralized or centralized approach. Both approaches can be advantageous depending on the context. A centralized model has a central entity, such as the public utility, development agency, or government entity, that is responsible for the strategy, deployment, and regulation of RETs. In a decentralized model, a rural development agency is set up in a supportive role (funding, capacity-building, awareness), and RET deployment is managed through policy and regulations to encourage a bottom-up growth of the market segments. Decentralized and centralized approaches can be considered as opposite poles and real-world solutions fall on spectrum in between, adopting hybrids to best meet their needs. The following are some examples:

- Tanzania has adopted a decentralized approach where national policy and regulations support the bottom-up growth of the RET market segments, with the rural development agency providing support such as funding and facilitation (section 4.B).
- Bangladesh created an independent entity, Infrastructure Development Company Limited (IDCOL),[66] to provide centralized financing, capacity-building and planning, and implemented a decentralized market-driven deployment for its SHS, solar pumps, mini-grids, improved cookstoves and biofuel projects.
- Kenya adopted a centralized regulated approach for solar mini-grids, and deployed them as part of the national electrification plan administered by the Ministry of Energy. For SHS systems and other small-scale solar RETs, it adopted a decentralized and unregulated market-driven approach.[67]
- In Nepal, CRT/N centrally handles strategy, capital financing, process flows, local manufacturing contracts for IWME with tendered companies, installation of RETs in partnership with rural communities, capacity-building, and training (table 2). The operation is then handed over to trained rural community user-cooperatives.
- Morocco delivered SHS to off-grid rural communities through a centralized, regulated, concession model administered through the public utility, Office National de l'Électricité et de l'Eau Potable.

The World Bank compared successful models of off-grid RET deployments from different countries with varied degree of regulations and private sector involvement to distinguish where a regulated approach versus a market-orientated approach would be more suitable.[68] A centralized approach is utilized if the institution structures are strong, and

Figure 12. Off grid deployment options with varying degree of regulation



Source: World Bank, 2017b.

can administer the higher administration costs, applications are in relatively smaller regions, and subsidies for operations and maintenance can be provided by the Government. A decentralized, market-based approach is used where there are large numbers of communities that require RET access, located in densely populated areas, and where market competition can be developed with a larger number of companies entering the RET market segment. The findings of the World Bank study for off-grid energy access RETs are summarized in figure 12, the outcomes of which can be adapted to small-scale RETs in general.

In addition, the World Bank report recommends that a wider range of RET solutions and flexible business models should be used within one country, and can be run sequentially or in parallel.[69] This is to address the varied needs of a diverse population with different characteristics, such as income segments, geographical population density, and housing patterns. The economies of scale can be leveraged by distributing the cost over a larger population and scaling up the scope by developing a wider range of RETs, business approaches, and interventions in parallel, complementing each other.[70]

In the case of small-scale RETs for productive use, a decentralized market-based approach is more suitable given that Arab rural areas tend to be densely populated, with many small companies offering these solutions. The competition helps reduce costs for users, and the economy of scale supports the solution providers.

B. Decentralized or distributed model

A decentralized approach has gained traction and popularity in recent years, especially in the sub-Saharan Africa and Asia-Pacific regions where there has been significant investment towards rural electrification and SDG 7 targets by utilizing small-scale RETs. This typically involves setting up an REA that is complemented with a rural funding programme. Countries that have followed this approach, such as Mauritania and Tanzania, have done so as a result of major reforms to the electricity

sector in response to strong pressure from the World Bank in the 1990s on national utilities to be unbundled and privatized.[71] As a result, national utilities are only responsible for a small part of the financial burden in providing rural access to electricity. REAs are responsible for implementing rural electrification and development plans, either through partnering with private entrepreneurs and local cooperatives, or through a bidding process of contracts with local or international companies.[72]

A scaled-up business model can be developed through the EMSA framework following the methodology from section 2. The key aspect to address is policy and regulation development that supports bottom-up market development. Successful policy approaches have made RET markets viable in countries such as India, Kenya and Tanzania.

A gradual transition can be adopted to develop a sustainable private sector driven approach with government support through public-private partnerships, supporting IPPs with distribution and retail, and other enabling interventions and policies. Distributed social enterprises offer innovative solutions that combine social benefits and economic sustainability in their model, and can bridge gaps from government and market failures. As social enterprises build and support the market for small-scale RET solutions for productive use, more private for-profit companies enter and help mature and further grow the market.

The success of a decentralized approach within a country hinges on its ability to attract private investments to RET for productive use market segments, both from national and international investors. Cohesive direction that defines a clear and unambiguous role for RETs and a supportive policy and regulatory environment is needed to inspire confidence and motivate investors, while ensuring rural beneficiaries' needs are met and protected.

Capacity-building efforts also need to be considered both in government entities and rural communities. These measures should facilitate and support entrepreneurship, training and skill development, and access to markets and financing for rural community members through public sector planning.[73]

C. Centralized model

In this approach, a centralized body administers all or some components of RET deployment. Rural development programmes and policies utilize and mainstream the use of productive small-scale RETs, such as ICSs and solar pumps. In this case, deployment utilizes the EMSA framework and follow the methodology from section 2 to develop a business model.

Three delivery models are considered, which have been adapted to the different development tracks in the present report (i.e., centralized or decentralized), as follows:

a. **Government/public sector:** In this case, the delivery of electricity access, or small-scale RETs for productive use, is provided through publicly owned and managed entities using public funds. The regulations for public delivery models are implicit, with the organizational hierarchy providing oversight and control as opposed to an explicit regulatory framework;

b. **Private sector (non-governmental):** The private sector can be incentivized through supportive policies, including subsidies, simplification of administrative process for establishing manufacturing plants (for ICSs), or service centres (for SHS);

c. **Public-private partnerships:** In this approach, the delivery is by an entity that is either partly owned by public and private entities, a mix of publicly and privately owned entities, or financed by a combination of public and private investments.

Rural development programmes and policies utilize and mainstream the use of productive small-scale RETs, such as ICSs and solar pumps.

D. Case study: Bangladesh Infrastructure Development Company Limited programme

The Bangladesh IDCOL programme to provide energy access with SHS is one of the world's most successful and largest programmes of its kind. The energy generated was used for productive activities to support rural communities.

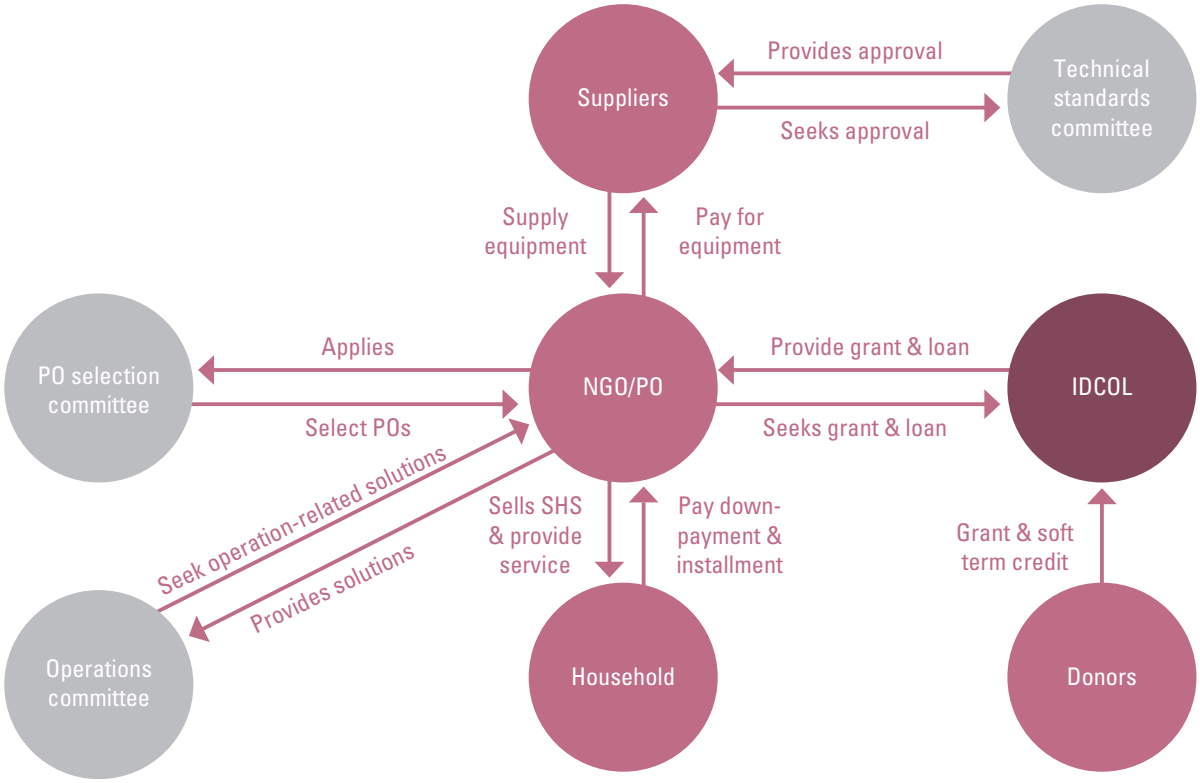
In 2005, the rural population accounted for 80 per cent of the country's total population. Yet, only 25 per cent had a grid connection. Increased and affordable electrification was urgently required to cultivate economic development and alleviate poverty in rural communities that rely primarily on traditional subsistence farming. Rural regions in Bangladesh had limited infrastructure, with dispersed settlements over river delta plains with numerous rivers and canals, which meant that grid extensions were too expensive, and small-scale RETs were more suitable.

In 2002, the National Energy Policy set the goal to provide universal electricity access by 2020.

In response, a national SHS initiative was initiated in 2003 by IDCOL to provide access to communities beyond the reach of rural electricity cooperatives. IDCOL is a special purpose company launched by the Government of Bangladesh in 1997, which was licenced as a non-bank financial institution that is mandated to promote the private sector and provide financing for renewable energy projects.[74] It acts as a central conduit for funding from international donors.

The project was set up so that IDCOL formed public-private partnerships with selected local partner organizations responsible for promoting and selling the SHS. Partner organizations select private customers, extend them micro finance loans, install the SHS at the customers' premise, and then provide after-sales services. In parallel, IDCOL set the technical standards and training for SHS, ensured quality control and certified products, and provided soft loans and grants to partner organizations. The delivery model is shown in figure 13.

Figure 13. Bangladesh IDCOL SHS programme structure



Abbreviations: PO, partner organization.
Source: Haque, 2013.

Figure 14. Family installing SHS on their home. Technician installing SHS on a home rooftop. School children excited about a SHS being installed

Source: Haque, 2013.

Figure 15. SHS supporting local economic activity: lighting for a women-run handicraft workshop. Sewing machine power for a night working tailor

Source: Haque, 2013.

Under the program, the cumulative expenditure of IDCOL was approximately $696 million. As at January 2019, about 4.13 million SHS have been installed in remote areas under the scheme, providing 18 million people with solar energy, or 12 per cent of the total population of the country who had previously relied on kerosene lamps for lighting.[75] IDCOL planned to fund 6 million SHS by 2021, with an estimated electricity generation capacity of 220 MW.

To date, the programme has saved 1.14 million tons of kerosene, worth approximately $411 million. Moreover, the 4.1 million SHS already installed will save another 3.6 million tons of kerosene, worth $1,300 million over the next 15 years. A social impact study confirmed benefits for the rural end users by increasing the availability of their income per capita food expenditure by 9.3 per cent, per capita non-food expenditure by 4.7 per cent, and total per capital expenditure by 5.1 per cent through time savings owing to SHS now used towards productive activities.[76]

Some of the conditions that made the model successful are unique to Bangladesh.[77] The strong grassroot MFIs already present with penetration in rural areas were effectively leveraged for the SHS programme. Rising incomes have helped reduce the need for subsidies over the years. This is primarily due to improved agricultural productivity and large influx of capital from Bangladeshi workers abroad, which have made SHS more affordable. High population densities have also enabled economies of scale. However, there are many lessons that are transferable, as follows:[78]

» A competent and passionate champion is important. IDCOL was both an enthusiastic promoter of SHS and an effective implementer

given that professional management was overseen by a qualified board.

- Understanding of the willingness and ability to pay by the rural end users. Bangladesh overcame the affordability barrier by offering microcredits, subsidies and product choice.
- Action is needed to gain the trust of the rural communities in new technologies they have not experienced before. The IDCOL programme addressed this by ensuring technical quality, providing community awareness and training, fostering a sense of ownership, and reducing their risk perception with buy-back guarantees.
- The programme was successful as it evolved over time to reflect market trends and new technologies.
- With the success of the delivery model, IDCOL decided to expand the approach to other RETs. The delivery model has also been successfully adapted to solar mini-grids, solar irrigation, improved cookstoves, and biogas projects for bio-fertilizer and power generation for rural households.[79]

5. Policy and regulations

Creating a supportive and enabling environment through policy and regulations that is driven by a clear strategy is key to the success of any RET delivery model to achieve other SDGs through an inclusive approach. The policy and regulation framework is needed to facilitate the adoption and scale-up of RET deployments.

The RET strategy defines the overarching goals and direction with respect to a centralized or decentralized approach, whilst policy and regulations define the incentives in place along with the rules and procedures that govern development projects, and that guide and promote investments for specific business models, including for small-scale RETs.

On this basis, business models can assess projects' economic viability and their social and environmental impact. An appropriate policy framework is a driving force in creating a favourable environment for specific market segments and business models.

The top barrier most RET projects face is access to finance. From a policy perspective, mobilizing private finance is one of the main determining challenges for small-scale RET-based projects, because the traditional commercial finance sector is most familiar with large-scale projects, making it difficult to engage in small-scale rural investments.

Another challenge facing small-scale RET deployment in rural areas is user acceptance and sustainability in terms of longer-term operation and maintenance.

Identifying key issues and proposals with enough potential to increase financing is an urgent need to maximize the positive potential of small-scale RET-based projects. Similarly, adequate awareness, guided by the small-scale RETs operational toolkit, is required along with improved mechanisms that allow the mobilization of resources and identification of schemes that are more suitable in the long term.

Transparency, reliability and consistency in policies are essential to inspiring the confidence of the private sector, and to attracting donors and investors both nationally and internationally. Specific interventions and supportive policy changes needed for both centralized and decentralized schemes for a specific market segment can be identified through their delivery model frameworks.

The process for developing policies, specifically for small-scale RET-based projects, is an iterative and dynamic process, relying on feedback and consultations with the key stakeholders. It must evolve to reflect changes in the needs of rural communities, market conditions, and technological improvements.

A. General recommendations for policymaking

The following are some of the recommendations, including those based on case studies and feedback from rural programme developers:[80]

- Create a legitimate role for small-scale RET-based projects within national policies and plans for the development of rural communities and women's empowerment in the Arab region.
- Develop a strategy using a strong-evidence baseline and reliable statistics to inform the direction the policies take, including statistics on potential beneficiaries, their current income, how small-scale RETs will transform their lives and impact health and the environment. Progress and performance of the programmes should also be measured through updated and inclusive metrics.[81]
- The types of projects, beneficiaries and business models will differ significantly in terms of what is required for regulations and implications. Each type will require a clear and well-tailored framework and regulations for the various participants so as to attract investments and donations.

- Policy frameworks should engage and involve market participants and rural communities throughout the development and implementation stages, and make sure their needs are met and balanced together with environmental considerations. Renewable energy associations and local cooperatives should be strengthened and recognized as key stakeholders.
- Policy advisory support should be provided in a neutral fashion, and therefore be channelled through independent bodies to avoid conflict of interests.
- At a higher level, regional exchange between countries should be considered for knowledge exchange, which can significantly accelerate policy reform. Institutional partnerships and collaborations that present synergistic opportunities to support rural development should be forged.

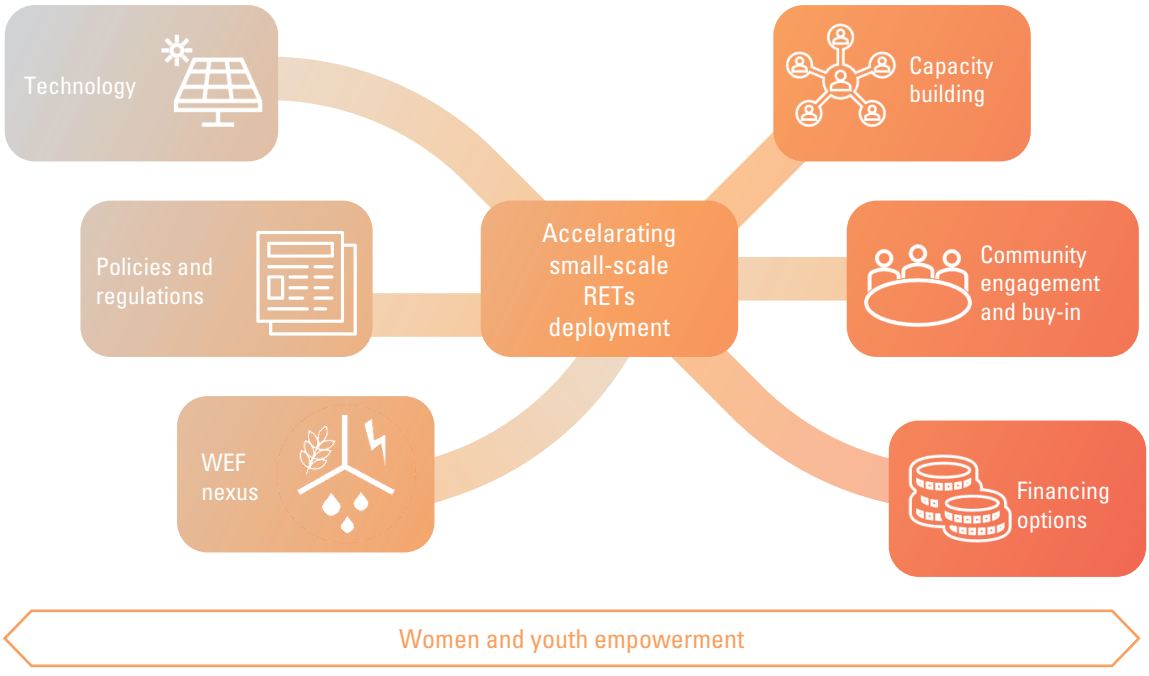
B. Tertiary level policies supporting development

For policies to be effective, efforts in community development and capacity-building are crucial for implementation and uptake of small-scale RETs. Tertiary level policies are geared towards enabling supportive development and capability-building efforts that complement RET access and affordability policies for sustainable and progressive solutions (figure 16).

Gender supportive and inclusive policies are also key. There are numerous benefits for the private sector by expanding markets and diverse workforce, and for rural communities by improved quality of life, health outcomes, and pathways for women towards self-determination.[82] Furthermore, studies have found that women represent a critical market for lighting and clean cooking products and services and, as entrepreneurs, have catalysed small-scale RET markets.[83]

Policies to encourage WEF nexus-related productive activities together with affordable RET access can encourage development activities supported by the private sector.[84] Incentivizing such development activities requires refining talents and building capacity by instilling self-confidence and the ability to identify and act on areas of improvement.

Figure 16. Elements of an enabling environment for small-scale RETs

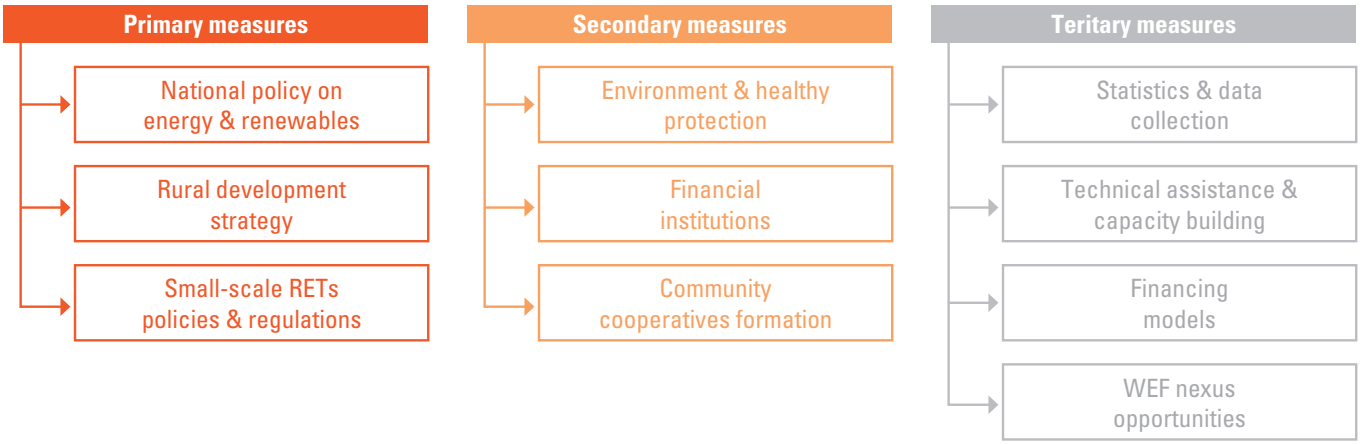


Source: Based on IRENA, 2018.

C. Example of market segment policies

Mainstreaming small-scale RETs for rural communities through national strategies that define targets, such as rural communities development, women's empowerment and environmental impact, is an important first step. It provides a strong foundation for market development and incentivizes other stakeholders to provide small-scale RET-based products and services.[85] Figure 17 shows a set of measures to accelerate the scale-up of small-scale RET deployment, inspired by the IRENA policy framework for mini-grids developed by the IRENA mini-grid policy guide.[86]

Figure 17. Measures to accelerate scale-up of small-scale RETs



Source: Based on IRENA, 2018.

6. Conclusions and recommendations

The present report sets out guidelines for the deployment of small-scale RETs in rural communities in the Arab region. It builds on the small-scale RETs operational toolkit, which provides guidelines on RET selection based on specific applications.

An integrated business model approach is followed, considering elements such as affordability, the WEF nexus, rural development, women's empowerment, community participation and buy-in, environmental protection, financing mechanisms and capacity-building.

Developing viable business models depends on the requirements, scale and context of a specific project. Therefore, it is recommended to establish a baseline analysis, including demographics, energy requirements, available reneable energy sources, and any other relevant factors.

Feasible RETs for identified opportunities should be selected using the small-scale RETs operational toolkit. A delivery model framework is created by defining the market chain, taking into consideration components such as enabling environment, ownership and capital financing. Lastly, potential barriers and mitigation measures are identified using an energy market map based on the EMSA framework methodology.

Successful business models must be financially sustainable within the constraints of the project, while adopting an integrated approach to support and benefit rural communities. Affordability of the small-scale RETs is a critical aspect of the delivery model. Flexible financial models, such as the service or ownership models, are offered depending on the end users' specific circumstances.

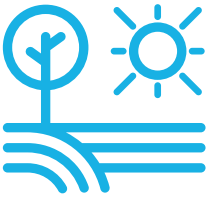
RET economies of scale can improve affordability and accessibility for rural communities. The scale up of small-scale RET deployment can be done via a regulated approach or a market-driven approach. Each option suits different conditions, such as a small number of end users for the former and a larger number for the latter.

An effective policy framework is a driving force in creating a favourable environment for specific market segments and business models. Policies should reflect changes in the needs of the rural community, the market conditions, and technological improvements. Efforts in community development, capacity-building and gender supportive policies are crucial for implementation and uptake of small-scale RETs.

Policymakers and operators and/or end users must work together to make sure natural resources are adequately managed within the context of small-scale RETs, productive use, and rural development. A good example of this is preventing over pumping of aquifer water using solar PV pumps.

The following recommendations are summarized from a regional workshop on the theme **"Business models for the integration of renewable energy technologies into rural development"**, a webinar held by ESCWA on 25 October 2021.

A delivery model framework is created by defining the market chain, taking into consideration components such as enabling environment, ownership and capital financing.



In the context of small-scale RETs for productive use, **assist rural communities in evaluating their energy needs** to have the right baseline and to design an adequate solution for the intended purpose;

Adopt financial, social and environmental indicators when monitoring projects to measure the impact of the small-scale RETs on rural communities. The data gathered from it can show the real impacts RETs have had on rural communities and their quality of life, as can convince stakeholders of the viability of these systems, in case of success. In case of suboptimal results, the information helps pinpoint challenges so that adequate mitigation actions can be taken;

Include continuity of the projects in the integrated business models to ensure sustainability. Often times, successful projects came to a halt soon after the external players (local or international organizations, for example) leave. Measures to ensure sustainability include capacity-building and selecting the right solution(s) for the specific location and community;

Foster collaboration through a framework that brings government, public and private players together to implement policies effectively. This will help, amongst other things, in facilitating projects implementation and sustainability;

Understand the challenges faced by local communities, especially women and young people, to make sure the solutions proposed are suitable for the community. This will help ensure opportunities are fully and adequately realized;

Promote awareness of the value chain related to small-scale RET integration with agriculture and other productive activities in rural communities. This will maximize benefits throughout the value chain, such as encouraging ethnic food offerings and local artisanal products;

Provide mentoring and capacity-building opportunities to financial institutions so they better understand the viability of small-scale RETs and, as a result, offer adequate financial instruments. This lack of awareness has often been the reason for refusing to finance small-scale RETs-based projects, and/or for offering inadequate financing models;

Provide access to green and micro financing and ensure affordability is embedded within the integrated business model to encourage rural communities to adopt RETs to improve their lives and livelihoods. Consider also risk-sharing mechanisms, particularly where financing institutions and investors hesitate to provide funding due to the small scale of the projects or to their lack of awareness of the economics of this type of technologies;

Embed the gender component in the business model to support the role of women as beneficiaries and owners of small-scale RETs. This role will empower women and help realize their full potential;

Upscale programmes such as REGEND to replicate success stories and maximize value for target communities. The more a programme is replicated, the more its impact lasts and the benefits from it are sustained.

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Endnotes

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The REGEND project aims to improve livelihoods and economic benefits in rural communities, particularly among marginalized groups, and to promote social inclusion and gender equality. It seeks to satisfy energy needs and showcase the effectiveness of the bottom-up approach in achieving results by addressing energy poverty, water scarcity and vulnerability to climate change and other natural resources challenges. Pro-poor investments are promoted using appropriate small-scale renewable energy technologies to facilitate productive activities and stimulate entrepreneurial development.

The objective of the present toolkit is to provide a guideline for the deployment of small-scale renewable energy technologies in rural communities in the Arab region. The toolkit provides general information, an integrated approach, available options, and considerations for creating a viable business model based on a desk review of similar initiatives. The toolkit also provides steps to implement a suitable business model, demonstrates the possible financing options for rural end users, and recommends policies and regulations to serve as an enabling environment for small-scale renewable energy applications in rural areas of the Arab region.

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