

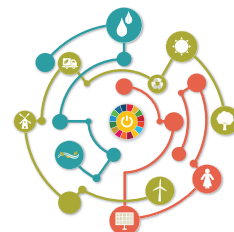


Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND)

Best practices toolkit



Shared Prosperity Dignified Life





Shared Prosperity **Dignified Life**



VISION

ESCWA, an innovative catalyst for a stable, just and flourishing Arab region

MISSION

Committed to the 2030 Agenda, ESCWA's passionate team produces innovative knowledge, fosters regional consensus and delivers transformational policy advice. Together, we work for a sustainable future for all.



Best practices toolkit

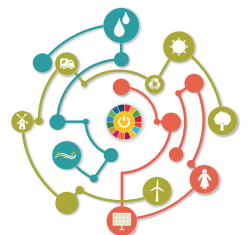
Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND)



Shared Prosperity **Dignified Life**



Sweden
Sverige



© 2024 United Nations
All rights reserved worldwide

All queries on rights and licences, including subsidiary rights, should be addressed to the United Nations Economic and Social Commission for Western Asia (ESCWA), e-mail: publications-escwa@un.org.

The findings, interpretations and conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations or its officials or Member States.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Links contained in this publication are provided for the convenience of the reader and are correct at the time of issue. The United Nations takes no responsibility for the continued accuracy of that information or for the content of any external website.

References have, wherever possible, been verified.

Mention of commercial names and products does not imply the endorsement of the United Nations.

References to dollars (\$) are to United States dollars, unless otherwise stated.

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

United Nations publication issued by ESCWA, United Nations House,
Riad El Solh Square, P.O. Box: 11-8575, Beirut, Lebanon.

Website: www.unescwa.org.

2400374E

Cover photo from right to left:

- Ms. Fathia Bougtif, Farmer from Tunisia, and one of the beneficiaries of REGEND
- REGEND Solar PV system in Chorbane, Mahdia, Tunisia
- Capacity building workshop on food production in Achaari, Maan, Jordan

Acknowledgements

Authorship

The Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND) Best Practices Toolkit is a product of exceptional collaboration between the United Nations Economic and Social Commission for Western Asia (ESCWA) and the Swedish International Development Cooperation Agency (Sida) in the framework of REGEND. This report was developed by the Energy Section in the Climate Change and Natural Resources Sustainability Cluster (CCNRSC) of ESCWA. The lead authors are Radia Sedaoui, Chief of the Energy Section (CCNRSC), and Jessica Obeid, Energy Expert and ESCWA Consultant. Support was also provided by Omar Kaaki, Research Assistant (ESCWA), and Elie Abou Jaoudeh, Economic Affairs Officer (ESCWA).

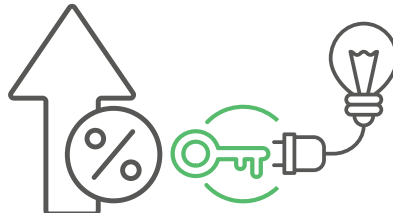
Review and consultation

The expert review process was coordinated by ESCWA and included a hybrid expert group meeting, organized in Beirut in January 2024, which convened REGEND beneficiaries, members of the local facilitating team, members of the project team at national and regional levels, and other experts to discuss and provide feedback on the toolkit. Substantive inputs were provided by the following experts: Khaled Bedoui, KB Consulting, Tunisia; Mohamed Zied Gannar, Executive Director, Gannar Sustainable Energy Consulting, Tunisia; Samer Zawaydeh, Independent Engineer, Jordan; Seham Maitah, President, Shabat Batir Charity Association, Jordan; Jamila Al-Jazi, President, Al-Jawhara Charity Association, Jordan; Maher Dmour, Head of the South Region Department, Ministry of Energy and Mineral Resources, Jordan; Mouhamad Khatib, President, Alriif Honey, Lebanon; Paul Saoud, President, Live Akkar Association, Lebanon; and Jil Amine, Economic Affairs Officer (Sustainable Development) and Omar Kaaki, Research Assistant, ESCWA.

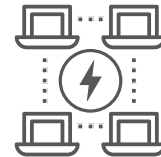
The meeting was also attended by the following experts: Amira Shaher Abdelhameed, Statistician, Central Agency for Public Mobilization and Statistics, Egypt; Arwa AbuKashef, Engineer, Ministry of Energy and Mineral Resources, Jordan; Asma Rouabhia, Global Focal Point, SDG 7 Youth Constituency, Tunisia; Bashar Zeitoon, Sustainability Advisor, Jordan; Carlos Abi Fadel, Community Volunteer, Arayya Municipality, Lebanon; Fadi Jabr, Secretary General, Arab Federation for Food Industries, Jordan; Hesham Al-Momani, Director, Ministry of Energy and Mineral Resources, Jordan; Hussam Alherafi, Sustainable Energy Economic and Policies Expert, Regional Center for Renewable Energy and Energy Efficiency (RCREEE); Karim Saadoune, ANVREDET, Algeria; Maged Mahmoud, Technical Director, Regional Center for Renewable Energy and Energy Efficiency (RCREEE); Majd Tarawneh, Project Coordinator, Greentech, Jordan; Mamun Absi Halabi, Consultant, United Arab Emirates; Manar El Kebir, President, EcoWave, Tunisia; Mazen Alhalawani, Trainer, Green Orient, Lebanon; Mohamed Shata, Chief Operating Officer, Carbon Impact Lab, Egypt; Mohammad Jamal, Business Development Project Engineer, Greentech, Jordan; Mostafa Dawoud, Director of Mineral Resources Department, Arab Industrial Development, Standardization and Mining Organization (AIDSMO), Morocco; Najoua Zhar, Sustainable Development Expert, Union of Arab Chambers, Lebanon; Shada El-Sharif, Founder and Senior Advisor, SustainMENA, Jordan; Syham Bentouati, Managing Director, Nafas International, Oman; Wassila Boulaiche, Chef de Departement, l'Agence Nationale de Valorisation des Résultats de la Recherche et du Développement Technologique (ANVREDET), Algeria; Yosr Ben Toumine, Industrial Engineer, National Engineering School of Tunis (ENIT), Tunisia; and Zaid Ayash, Regulatory Section Manager, Ministry of Electricity, Iraq.

Key messages

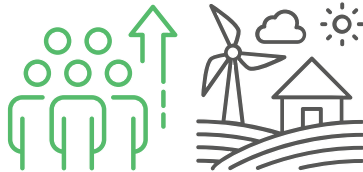
The Arab region boasts a high rate of access to electricity.



Despite disparities in the reliability of the service, the region is on track to meet its target of achieving **universal access to electricity by 2030**



However, the greatest share of the population without access to electricity is found in rural areas.



In addition, access to financing, employment, high-level education and training, and clean cooking fuels constitute some of the challenges faced by rural communities.



Small-scale renewable energy systems are transformative for rural development, offering a range of opportunities for enhancing the rural economy



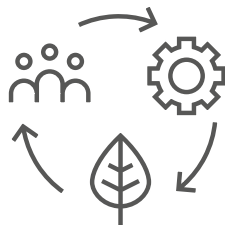
by improving the conditions of the productive activities while contributing to energy, water and food security, poverty reduction and a lower unemployment level.



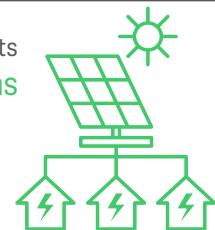
However, their use in Arab rural areas has been in limited applications, and they are thus far from attaining their transformative potential.



Designing for durability and sustainability.



The design and engineering of renewable energy projects need to be tailored to the specific conditions that are present, identify potential challenges and the availability of adequate infrastructure and technical expertise,



and secure long-term maintenance contracts to support these systems and ensure long-term success and sustainability.

Monitoring is an engine for project effectiveness.



Monitoring tools should be developed to meet the project's performance indicators and revised throughout the project implementation



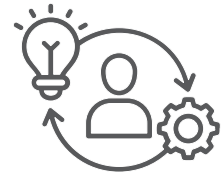
to address any developing challenges or changing circumstances and ensure maximum transparency and accountability, including on gender issues.



Implementing a reporting and assessment protocol



between the implementing agency and the beneficiaries as a critical component of the follow-up framework assists in the projects' impact assessment and captures valuable lessons learned that can inform future initiatives.



Innovative financing mechanisms



such as



microfinance



revenue-based financing schemes



financial incentives



targeted financing for women or young people

are needed to make renewable energy technologies accessible to rural communities.

It is crucial to assess end users' willingness and capacity to pay, identify and account for specific requirements in the planning process to ensure the financial viability of the project.

A communication strategy and plan are necessary



to bridge the communication gap between various stakeholders, build effective and sustainable partnerships for coordination, disseminate project results, share lessons learned and best practices



and provide accurate access to relevant information and ownership.



Contents

Acknowledgements	3
Key messages.....	4
Abbreviations and acronyms	9
1. Background.....	10
A. Renewable energy as an enabler and catalyst for rural development	12
B. The need for integrated and inclusive business models in small-scale renewable energy development.....	14
C. REGEND approach and business model	14
D. Operationalizing REGEND at the national and regional levels.....	15
2. Economic, social, environmental and policy impact.....	22
A. Impact on energy access and affordability	26
B. Impact on income-generating activities	26
C. Impact on gender and livelihoods	29
D. Environmental assessment	31
E. Policy impact	33
3. Challenges	34
A. Political and security risks	37
B. Operating environment risks.....	37
C. Strategic risks	40
D. Administrative risks	42
4. Best practices: developing integrated small-scale renewable energy	46
Key messages	48
A. Integrated approach for the business model	50
B. Partnerships and engagement	53
C. Demand-driven governance models	56
D. Legal, regulatory and policy support.....	58
E. Gender mainstreaming strategy and plan	60
F. Flexible and adaptive approach to technical and financial aspects	63
G. Capacity and knowledge building.....	70
H. Sustainability and scalability.....	72
5. Conclusion	76

Endnotes	79
Bibliography	81

List of tables

Table 1.	List of beneficiaries and respective projects implemented by the REGEND initiative for Al-Achaari Village in Jordan.....	16
Table 2.	List of beneficiaries and respective projects implemented by the REGEND initiative for Batir Village in Jordan	17
Table 3.	List of beneficiaries and respective projects implemented by the REGEND initiative for Akkar Al-Atika Village in Lebanon	18
Table 4.	List of beneficiaries and respective projects implemented by the REGEND initiative for Chaqdouf village in Lebanon.....	19
Table 5.	List of beneficiaries and respective projects implemented by the REGEND initiative for Chorbane Village in Tunisia	20
Table 6.	List of projects implemented by the REGEND initiative in Algeria	21
Table 7.	List of modules under the ESCWA e-learning platform.....	21

List of figures

Figure 1.	Share of renewable energy in Arab countries' energy mix, 2021	13
Figure 2.	22-kWp solar PV on-grid ground-mounted system for farm of Saleh Afash in Al-Achaari, Jordan	16
Figure 3.	25-kWp solar PV hybrid on-grid rooftop system, with a 90-kWh battery capacity in Akkar Al-Atika, Lebanon, serving the cooperatives building, municipal building and health clinic...	19
Figure 4.	10.4-kWp solar PV water pumping system for farm of Abdallah Ben Mansour in Chorbane, Tunisia	21
Figure 5.	REGEND Theory of Change.....	25
Figure 6.	Examples of impact on income-generating activities from the targeted countries	27
Figure 7.	25-year lifetime CO ₂ emissions reduction and monetary savings	32
Figure 8.	Best practices pillars	50
Figure 9.	REGEND key partners	54
Figure 10.	Gender mainstreaming strategy throughout the project cycle	60
Figure 11.	Gender data for the stakeholders, consultants and workshop attendees	62
Figure 12.	Gender data for workshop attendees per country	71

List of boxes

Box 1.	Success story: community-based organization in Jordan transforms into a hub for women and young people.....	17
Box 2.	Savings on energy bills in Akkar Al-Atika Union of Beekeepers Cooperative leads to business expansion	26
Box 3.	New production lines and increased productivity: the cases of Jordan and Tunisia.....	28
Box 4.	Success story of Live Akkar sewing and embroidery workshop in Chaqdouf.....	29
Box 5.	Farmer in Tunisia expands her farming land and brings prosperity to her family through REGEND	31
Box 6.	Technical challenges in rural settings in Tunisia and Lebanon	38
Box 7.	Family resistance to the concepts of gender mainstreaming, equality and empowerment.....	39
Box 8.	Financing disparities for women entrepreneurs	40
Box 9.	Variations in field projects' implementation in target countries	42
Box 10.	Rural development regulatory challenges in Jordan, Lebanon and Tunisia.....	43
Box 11.	Institutional instability in Tunisia mitigated by REGEND.....	44
Box 12.	Impact of COVID-19 on sourcing solar PV systems' components.....	45
Box 13.	REGEND overarching Theory of Change	51
Box 14.	Solar Securitization Pilot for Rwanda	65
Box 15.	Solar Sister	67
Box 16.	Savings and credit cooperative organizations.....	67
Box 17.	Pay-as-you-go	68

Abbreviations and acronyms

AIDMO	Arab Industrial Development and Mining Organization
ANME	Agence Nationale pour la Maîtrise de l'Énergie
AOAD	Arab Organization for Agricultural Development
APIA	Agence de Promotion des Investissements Agricoles
CGDR	Commissariat Général au Développement Régional
CRDA	Commissariat Régional de Développement Agricole
CTVA	Cellule Territoriale de Vulgarisation Agricole
DTU	Technical University of Denmark
EDL	Electricité Du Liban
FAO	Food and Agriculture Organization
GCC	Gulf Cooperation Council
GDA	Groupement de Développement Agricole
JD	Jordanian Dinar
kWh	kilowatt-hour
kWp	kilowatt-peak
LARI	Lebanese Agricultural Research Institute
LAS	League of Arab States
LCEC	Lebanese Center for Energy Conservation
LDCs	least developed countries
MEMR	Ministry of Energy and Mineral Resources in Jordan
MFI	microfinance institution
MOA	Ministry of Agriculture
MSME	micro-, small and medium-sized enterprise
NGOs	non-governmental organizations
PEST	political, economic, sociocultural and technological
PV	photovoltaic
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
REGEND	Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region
RMF	René Moawad Foundation
SDGs	Sustainable Development Goals
Sida	Swedish International Development Cooperation Agency
SMSA	Les Sociétés Mutuelles de Services Agricoles
STEG	Société Tunisienne de l'Électricité et du Gaz
SWOT	strengths, weaknesses, opportunities and threats
TAMFI	Tanzania Association of Micro finance Institutions
TND	Tunisian Dinar
UNDP	United Nations Development Programme
ESCWA	United Nations Economic and Social Commission for Western Asia
WEF	water energy food



01

Background



The Arab region boasts a high rate of access to electricity. Despite disparities in the reliability of the service, the region is on track to meet its target of achieving universal access to electricity by 2030.¹ Yet, several challenges remain, namely ensuring access to reliable electricity for rural and remote communities. In 2021, 90.8 per cent of the population in the Arab region had access to electricity² as compared to 88.4 per cent in 2010,³ making the region the most electrified in the developing world, despite the instability in many of its countries. However, the greatest share of the population without access to electricity is found in rural areas.

Rural areas often have lower access to necessities such as electricity, clean fuels and

modern cooking technologies as compared to urban centres. At the regional level, 97.5 per cent of urban residents have access to electricity, while only 81.7 per cent of rural populations have access.⁴

The urban-rural divide worsens in conjunction with other disadvantages, particularly impacting rural residents in least developed countries (LDCs) and conflict-affected regions. These populations are the least covered in terms of access to resources and services. The Sudan, for example, has one of the lowest access rates to electricity among Arab States, with 55.4 per cent.⁵ In Yemen, another conflict-affected country, nearly all the urban population has access to electricity whereas only two thirds of the rural population has access.

A. Renewable energy as an enabler and catalyst for rural development

Reliance on unsustainable and polluting sources of energy causes damage to the environment and poses hazards to rural communities, particularly rural women. Women are often more exposed to household air pollution caused by unclean energy sources and cooking fuels. This is largely due to their traditional roles as primary keepers of households whereby they experience a greater exposure to harmful pollutants.

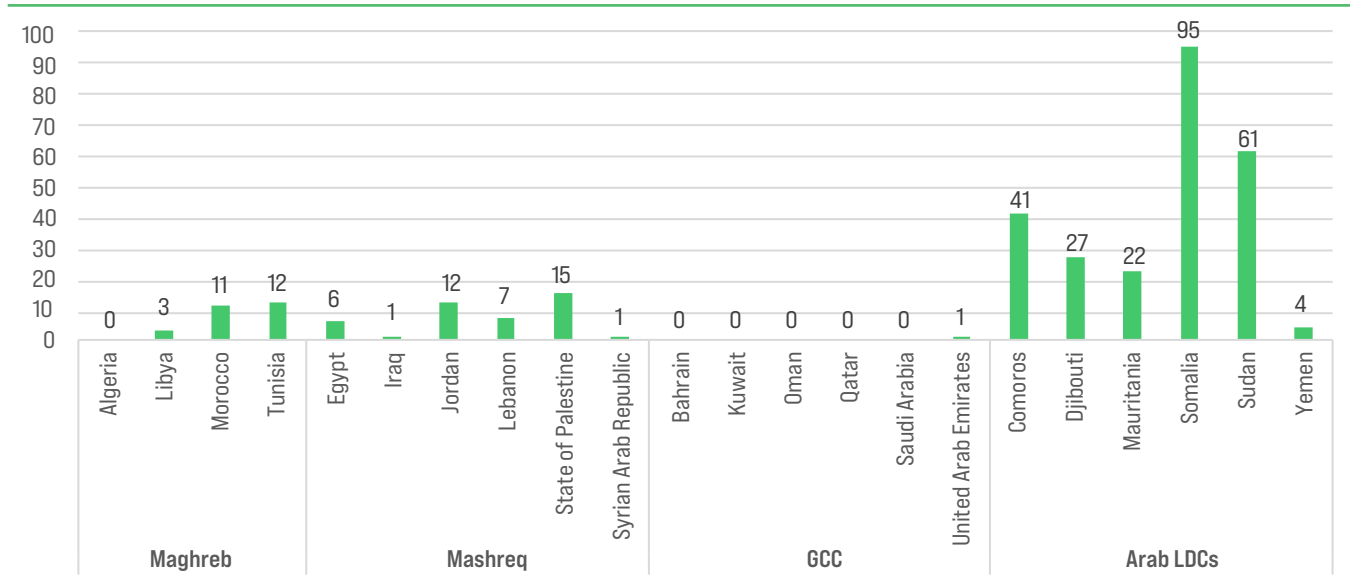
Renewable energy technologies present a feasible and environmentally friendly method of electrifying rural areas. They can save on grid extension costs and supply reliable electricity to conflict-prone locations. Nonetheless, they remain a largely untapped opportunity for the sustainable development of the Arab region.⁶ Despite the annual increase in renewable energy capacity in Arab States, renewable energy constituted only 5.1 per cent of the total energy consumption in 2020,⁷ a slight increase from 4.6 per cent in 2019,⁸ yet much lower than the global

average, calculated at 19.1 per cent.⁹ In terms of per capita electricity generation from renewables, this corresponds to 48.7 watts, compared to a global average of 268.1 watts, in 2021.¹⁰



Reliance on unsustainable and polluting sources of energy causes damage to the environment and poses hazards to rural communities, particularly rural women. Women are often more exposed to household air pollution caused by unclean energy sources and cooking fuels.

Figure 1. Share of renewable energy in Arab countries' energy mix, 2021 (Percentage)



Small-scale renewable energy systems are transformative for rural development, offering a range of opportunities. Not only do they provide an affordable and reliable electricity supply, they also allow local communities to thrive economically while creating new jobs and fostering technological advancement. However, the use of small-scale renewable energy technologies in Arab rural areas has been in limited applications such as displacing diesel generators in water irrigation applications¹¹ or supplying electricity for a school or clinic. Small-scale renewable energy technologies are thus far from attaining their transformative potential in Arab rural areas.

In the context of a worsening global and regional economic outlook, small-scale renewable energy systems have the capacity to revitalize the rural economy by improving the conditions of the productive activities. Small rural businesses can significantly strengthen their competitiveness by incorporating renewable energy solutions into their productive activities. These sustainable energy applications effectively lower operating and production costs by reducing energy expenses, which represent a substantial portion of overall expenditures. This not only helps reduce financial burdens but also improves the economic viability and profitability of these businesses. The most compelling

advantage of renewable energy technologies is therefore the potential for a significant increase in profits. This translates directly into new revenue streams, allowing small businesses to expand.

Additionally, integrating renewable energy technologies can lead to more business opportunities, both domestically and internationally. The growing demand for sustainable solutions creates new opportunities to tap into new markets. Furthermore, incorporating renewable energy technologies opens avenues for creating more employment opportunities to design, install and maintain these technologies, as well as jobs resulting from business expansion.

An in-depth study of the limited entrepreneurial activities of rural women confirms that despite several socioeconomic, financial and cultural barriers, rural women have demonstrated the ability to generate value and income from small businesses and through cooperatives. Thus, rural women are poised to benefit greatly from investments in renewable energy technologies and entrepreneurial skills development.¹² On a holistic level, deploying small-scale renewable energy technologies in rural communities in the Arab region can contribute to energy security, food security, poverty reduction, economic growth and lower unemployment.

B. The need for integrated and inclusive business models in small-scale renewable energy development

The disparity in access to basic services between urban and rural areas is not limited to electricity supply. Access to financing, employment, high-level education and training, and clean cooking fuels constitute some of the challenges faced by rural communities.

Productive activities need investments and financing to survive and thrive. The lack thereof strains business owners and makes it more difficult for them to look for new opportunities and markets. With less financing, fewer opportunities are created and consequently fewer jobs. This explains why, in most countries, unemployment rates are higher in rural areas than in urban centres and more developed regions.

Similarly, education and capacity-building are an integral part of providing opportunities to citizens in rural areas so that they can obtain higher paying jobs and have better futures.

This disparity in access to basic services between rural and urban areas within the same country is a pressing issue that needs to be addressed. Yet, most national strategies have not managed to reduce the disparities between them or curb the rural exodus.¹³

Renewable energy technology systems for electricity play a pivotal role in improving livelihoods in rural areas, but they cannot be the solution to every challenge that rural residents

face. Thus, using an integrated and multi-sectoral approach is of paramount importance. This integrated approach can address capacity-building, the water-energy-food nexus and productive activities, among other areas of concern. A renewable energy technology system, used to power lights and other passive activities, will have an economic value based on the amount of electricity it is saving. More attractively, a renewable energy technology system combined with a revenue-generating activity, such as manufacturing, will have an economic value of the electricity saved plus the value of the produced goods. Thus, when combined with productive activities, the value of renewable energy technology systems increases exponentially, as reflected in the impact of the Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND).

This report highlights best practices and lessons learned from implementing the REGEND business model. It also disseminates and showcases knowledge and information generated from REGEND at the policy and technical levels to support initiatives that stimulate private sector investment, entrepreneurial development, poverty reduction, and women and youth empowerment, with an emphasis on job creation and developing robust value chains in a nexus approach to encourage a sustainable economy.

C. REGEND approach and business model

In accordance with the human rights-based approach adopted by the United Nations, the Economic and Social Commission for Western Asia (ESCWA) seeks to ensure that all its

programming furthers the realization of human rights, as laid out in the Universal Declaration of Human Rights and other international human rights instruments. A human rights-based

approach is premised on human rights principles, namely universality, indivisibility, equality, non-discrimination, participation and accountability. The diverse nature of the Arab region necessitates a customized approach at the national and regional levels to account for diversity in natural resource availability, economic activities and sociopolitical contexts. Funded by the Swedish International Development Cooperation Agency (Sida), REGEND follows a business model that:

- ▶ Offers technologies and access, as enablers, throughout all phases of the business model.
- ▶ Provides a regional platform to build synergies among national, regional and international stakeholders.
- ▶ Identifies best practices and disseminates and showcases knowledge and information at the policy and technical levels to support initiatives that stimulate private sector investment, entrepreneurial development, poverty reduction, and women and youth empowerment, with an emphasis on job creation and developing robust value chains in a nexus approach to encourage a sustainable economy.
- ▶ Applies a participatory and bottom-up style as an effective method for rural development initiatives by facilitating private and public sector investments, and collaboration between

community-based organizations and community members for a long-term planning process.

- ▶ Emphasizes gender empowerment by targeting women through capacity-building and knowledge sharing, and as beneficiaries of sustainable energy initiatives that create green jobs. REGEND was specifically designed to empower rural women by giving them control over energy resources, developing their entrepreneurial skills, and ensuring their participation in local decision-making in the area of their livelihoods.
- ▶ Focuses on integrating community development with the provision of modern renewable energy.

The REGEND approach also involves the dissemination of operational and policy toolkits, success stories, case studies and lessons learned across the Arab region with the objective of facilitating inclusive and just energy transitions and creating an enabling environment for mainstreaming the approach in development planning at the national and sectoral levels. Moreover, REGEND empowered reverse knowledge transfer whereby rural community members, mainly women whose capacity has already been built and whose business models are successful, contributed to the development of other rural communities. This is an outcome that needs to be upscaled.

D. Operationalizing REGEND at the national and regional levels

With the goal of developing a new holistic and inclusive approach to rural development, REGEND used a bottom-up approach to understand the needs of the community and to identify the projects with the highest impact. The project team visited the communities, spoke with the key stakeholders and residents, and asked them to identify the initiatives that they believe had the most impact on their livelihoods.

The REGEND initiative then developed a multi-sectoral approach centred on renewable energy systems, tailored for each community. So far, 33 projects have been implemented in Jordan, Lebanon and Tunisia, with a total installed solar photovoltaic (PV) capacity of 270 kWp, supporting 2,900 beneficiaries, directly and indirectly. The following tables describe the measures implemented for each community.

Table 1. List of beneficiaries and respective projects implemented by the REGEND initiative for Al-Achaari Village in Jordan

Jordan: 17 projects – Total installed capacity: 73 kWp; 850 beneficiaries	
Jordan: Al-Achaari Village	
Beneficiary	Project description
Community projects	<p>Capacity-building:</p> <ul style="list-style-type: none"> • Good agricultural practices • Food manufacturing, health and safety • Operation and maintenance of solar systems • Packaging, labelling and marketing of food products
Al-Jawhara community-based organization	<ul style="list-style-type: none"> • 12-kWp solar PV on-grid rooftop system • 500-litre solar water heater system • Renovation of electrical works (wiring and panels) • LED lighting retrofit • Rehabilitation of building envelope insulation • Supply of production equipment: <ul style="list-style-type: none"> • Freezer • Two dough kneaders • Two milk shakers • Packaging machine and supplies • IT equipment • Four air conditioning units
Farm of Saleh Afash Al-Jazi	<ul style="list-style-type: none"> • 22-kWp solar PV on-grid ground-mounted system • Water drip irrigation system
Residence of Shayesh Saleh Afash Al-Jazi	4-kWp solar PV on-grid rooftop system
Residence of Abed Al-Aziz Fayed Khalaf Al-Jazi	3-kWp solar PV on-grid rooftop system
Residence of Falah Kasi Suleiman Al-Jazi	3-kWp solar PV on-grid rooftop system
Residence of Mrs. Aouda Anad Al-Jazi	3-kWp solar PV on-grid rooftop system
Residence of Ali Maleeh Sfouk Al-Jazi	3-kWp solar PV on-grid rooftop system

Figure 2. 22-kWp solar PV on-grid ground-mounted system for farm of Saleh Afash Al-Jazi in Al-Achaari Village in Jordan



Box 1. Success story: community-based organization in Jordan transforms into a hub for women and young people

REGEND has provided a complete refurbishment of the headquarters of the Jawhara community-based organization in Jordan which included the installation of solar PV systems for electricity needs, solar water heating systems for water heating, IT equipment for various administrative activities, air conditioning units for cooling and air quality, and other equipment for various productive activities.

The upgrades transformed the organization into a community hub that has encouraged women and young people in Al-Achaari to visit the organization and get involved in its offerings. Shortly after the completion of REGEND field projects, the organization officially transformed into a social and economic hub providing programmes for young people and various productive activities.

Table 2. List of beneficiaries and respective projects implemented by the REGEND initiative for Batir Village in Jordan

Jordan: Batir Village	
Beneficiary	Project description
Community projects	<p>Capacity-building:</p> <ul style="list-style-type: none"> • Good agricultural practices • Food manufacturing, health and safety • Operation and maintenance of solar systems • Packaging, labelling and marketing of food products
Shabbat Batir Al-Khayriya community-based organization	<ul style="list-style-type: none"> • 4-kWp solar PV on-grid system mounted on an elevated structure • 200-litre solar water heater system • Renovation of electrical works (wiring and panels) • LED lighting retrofit • Rehabilitation of building envelope insulation • Supply of production equipment: <ul style="list-style-type: none"> • Freezer • Two dough kneaders • Two milk shakers • Packaging machine and supplies • IT equipment • Two air conditioning units • Industrial cooking stove • Washing machine • Two caravans, each measuring 3.6 x 6 m
Farm of Rida Salah Al-Maaitah	<ul style="list-style-type: none"> • 10-kWp solar PV on-grid rooftop system • Water drip irrigation system
Residence of Salem Abed Rahim Al-Shurafa	4-kWp solar PV on-grid rooftop system
Residence of Mohammad Abed Karim Al-Hindawi	4-kWp solar PV on-grid rooftop system

Table 3. List of beneficiaries and respective projects implemented by the REGEND initiative for Akkar Al-Atika Village in Lebanon

Lebanon: 7 projects – Total installed capacity: 65 kWp; 1,000 beneficiaries	
Lebanon: Akkar Al-Atika Village	
Beneficiary	Project description
Community projects	<p>Supply and installation of 400 solar PV lighting kits with batteries for energy-poor households.</p> <p>Capacity-building:</p> <ul style="list-style-type: none"> • Renewable energy and energy efficiency technologies • Food manufacturing, health and safety • Financial management and accounting • Project design and proposal writing • Digital marketing using social media platforms • Sustainable and effective methods in embroidery and weaving • Operation and maintenance of the solar systems
Women's agrifood cooperative	<ul style="list-style-type: none"> • Connection to the 25-kWp solar PV system • Supply of production equipment: <ul style="list-style-type: none"> • Commercial cooking stove • Two portable/floor commercial cooking stoves • Commercial fridge • Two fans • Dual-mode space heater
Union of Beekeepers Cooperative	<ul style="list-style-type: none"> • Connection to the 25-kWp solar PV system • 200-litre solar water heater system • LED lighting retrofit • Supply of production equipment: <ul style="list-style-type: none"> • Sugar grinder • Sugar kneader • Three syrup barrels
Agricultural cooperative	Connection to the 25-kWp solar PV system
Akkar Al-Atika Municipal Building	<ul style="list-style-type: none"> • Connection to the 25-kWp solar PV system • Supply of production equipment: <ul style="list-style-type: none"> • Two kishkek grinders • Pomegranate juicer • Pomegranate peeler • Desktop computers • Office chairs and tables • Projector and screen • Food mixer
Local health clinic	Connection to the 25-kWp solar PV system

Figure 3. 25-kWp solar PV hybrid on-grid rooftop system, with a 90-kWh battery capacity in Akkar Al-Atika Village in Lebanon, serving the cooperatives building, municipal building and health clinic



Table 4. List of beneficiaries and respective projects implemented by the REGEND initiative for Chaqdouf Village in Lebanon

Lebanon: Chaqdouf Village	
Beneficiary	Project description
Community projects	<p>Capacity-building:</p> <ul style="list-style-type: none"> • Renewable energy and energy efficiency technologies • Food manufacturing, health and safety • Financial management and accounting • Project design and proposal writing • Digital marketing using social media platforms • Sustainable and effective methods in embroidery and weaving • Operation and maintenance of solar systems
Municipal building	<ul style="list-style-type: none"> • Supply of production equipment: <ul style="list-style-type: none"> • Two kishek grinders • Kishek drier • Pomegranate juicer • Desktop computers • Office chairs and tables • Projector and screen • Food mixer • Freezer and fridge • Cooking stove • Fan
Live Akkar NGO and its Sewing and Embroidery Workshop	<ul style="list-style-type: none"> • 10-kWp solar PV hybrid on-grid rooftop system, with a 17.7-kWh battery • 200-litre solar water heater system • LED lighting retrofit • Supply of production equipment: <ul style="list-style-type: none"> • Sewing machine (electronic embroidery) • Sewing machine (automatic buttonhole)

Table 5. List of beneficiaries and respective projects implemented by the REGEND initiative for Chorbane Village in Tunisia

Tunisia: 7 projects – Total installed capacity: 132 kWp; 1,050 beneficiaries	
Tunisia: Chorbane, Mahdia	
Beneficiary	Project description
Community projects	<p>Capacity-building:</p> <ul style="list-style-type: none"> • Renewable energy and energy efficiency technologies • Packaging, labelling and marketing of food products • Operation and maintenance of solar systems • Distilling medicinal and aromatic plants • Entrepreneurship in the agricultural sector • Cattle breeding • Good agricultural practices • Laws and regulations of development groups • Municipal planning, management and finance • Improving the yield and quality of food tree plantings
Municipal building	IT equipment
SMSA (El-Faouz)	<ul style="list-style-type: none"> • 65.5-kWp medium-voltage on-grid solar PV system • Supply of production equipment: <ul style="list-style-type: none"> • Commercial cooking stove • Two portable/floor commercial cooking stoves • Commercial fridge • Two fans • Dual-mode space heater
GDA pour l'eau potable	16.6-kWp medium-voltage on-grid solar PV system
Cellule de Vulgarisation Agricole	IT equipment
Agricultural Development Complex for Rural Women	Six egg incubators
Mutual Agricultural Services Company (El-Faouz)	Six milk cooling tanks
Farm of Fethia Bougtif	4.8-kWp solar PV water pumping system
Farm of Abdallah Ben Mansour	10.4-kWp solar PV water pumping system
Farm of Ali Baccouche	7.04-kWp solar PV water pumping system
Farm of Houssine Ltaief	7.04-kWp solar PV water pumping system
Farm of Salah Belmabrouk Amor	7.04-kWp solar PV water pumping system
Farm of Hedia Bedoui	6.6-kWp low-voltage on-grid solar PV system
Farm of Leila Slama	6.6-kWp low-voltage on-grid solar PV system

Figure 4. 10.4-kWp solar PV water pumping system for farm of Abdallah Ben Mansour in Chorbane Village in Tunisia



Table 6. List of projects implemented by the REGEND initiative in Algeria

Algeria	
Tissemsilt, Laghoaut and Beni Abbas	
Beneficiary	Project description
Community projects	<p>Capacity-building:</p> <ul style="list-style-type: none"> • Renewable energy and energy efficiency technologies • Packaging, labelling and marketing of food products • Food production • Oil extraction • Entrepreneurship in the agricultural sector • Good agricultural practices • Improving the yield and quality of food tree plantings

To expand the regional reach of the REGEND initiative, several courses in Arabic were made available on the ESCWA e-learning platform. The capacity-building courses ranged from an introductory session on renewable energy to rural agriculture-specific sessions, such as on solar dehydration of agricultural products. The REGEND online course is available at: <https://learn.unescwa.org/course/small-scale-renewable-energy-applications-rural-areas-arabic>.

Table 7. List of modules under the ESCWA e-learning platform

E-Learning platform
International
<p>Capacity-building:</p> <ul style="list-style-type: none"> • Renewable energy • Good agricultural practices • Rural development and women’s empowerment • Agricultural food production • Water-energy-food nexus • Fertilization by irrigation

The image features a background of an aerial landscape with green fields and some orange geometric shapes. The text is overlaid on a large green polygon.

02

Economic, social,
environmental and
policy impact



REGEND accomplished the following targets:

1

Increasing policymakers and local institutions' understanding of the socioeconomic, political and environmental dynamics of rural communities in Arab countries, and knowledge of how small-scale renewable energy technologies support gender mainstreaming and entrepreneurial development while addressing the water-energy-food and climate change nexus.

2

Enhancing the capacity of public, private and financial institutions in ESCWA member States to apply integrated business models for the implementation of small-scale renewable energy technologies in the productive sectors of rural areas.

3

Improving opportunities for rural economic development in Arab countries through the creation of an enabling environment for the private sector and women entrepreneurs to invest in income-generating activities by increasing the use of small-scale renewable energy technologies.

4

Sustaining the regional initiative beyond the project time frame.

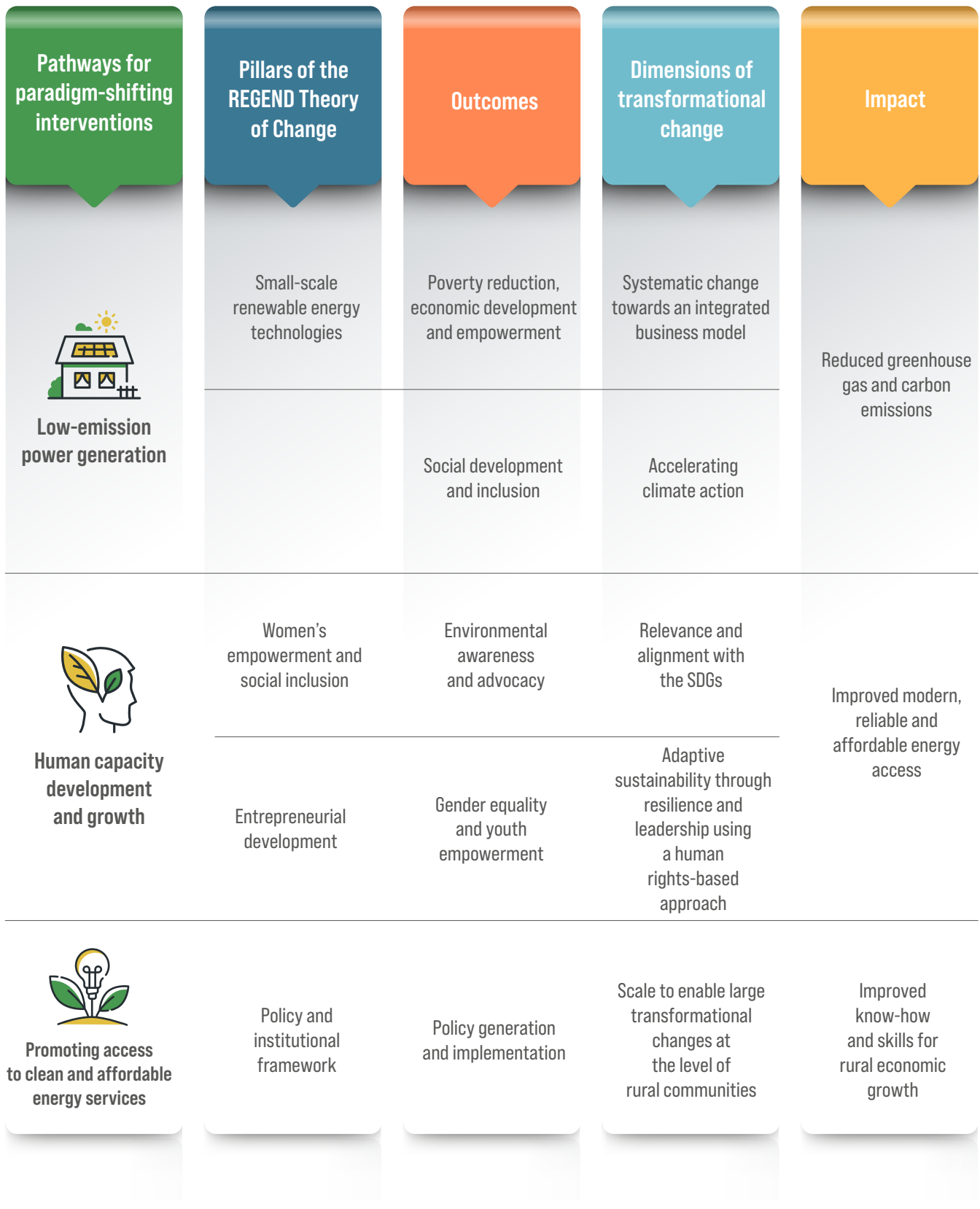
A Theory of Change (detailed in figure 5) was developed to achieve the initiative's multidimensional impact. It equates increased economic benefits, social inclusion and gender equality in Arab rural communities as outcomes of addressing energy poverty, water scarcity, vulnerability to climate change and scarcity of other natural resources. To achieve this, the project worked to promote the use of small-scale renewable energy technologies for productive activities and entrepreneurial development in Arab rural areas.

Ten outputs were developed to meet these targeted accomplishments. REGEND has achieved all its

planned outputs and has exceeded them in some project components.

The deployment of small-scale renewable energy as an enabler and catalyst for rural development required an integrated approach and the development of a customized business model through multi-level interventions and activities, which can be scaled up regionally and internationally to deliver a multitude of positive outputs and impacts. These include: (1) increased energy access and reduction in energy bills; (2) higher revenues and incomes; (3) more developed entrepreneurial skills; (4) scaled-up businesses; (5) healthier environments; and (6) adequate policymaking and adoption.

Figure 5. REGEND Theory of Change



A. Impact on energy access and affordability

During the preparation stage, several key performance indicators were identified and selected to measure the impact of REGEND. To determine the energy-related impact, the following indicators were used:

- ▶ Provision of reliable electricity.
- ▶ Reduced cost of electricity.
- ▶ Decreased dependence on expensive and polluting sources of electricity.
- ▶ Increased renewable energy penetration and contribution to countries' national targets.

Box 2. Savings on energy bills in Akkar Al-Atika Union of Beekeepers Cooperative leads to business expansion

In Akkar Al-Atika's Union of Beekeepers Cooperative, the solar PV system with battery storage system installed through the REGEND initiative has displaced both the on-site diesel generator and the national electricity grid. This switch to renewable energy has zeroed the cooperative's electricity bills and ultimately empowered it to scale up its operations, from serving local and regional beekeepers to reaching beekeepers across the country, especially for honey wax printing and humidity removal.

The higher customer reach is attributed to the significantly lower prices compared to the market as a result of the lower operating expenses from the savings on electricity bills. The demand from other regions in Lebanon has also soared due to the lack of reliable electricity supply in similar institutions to power energy-intensive honey-making equipment. For safe processing of honey and ensuring a disease-free product, an energy-intensive process is required. The soaring gasoline and electricity prices contributed to redirecting more customers within the northern region to the cooperative, which operates its equipment on renewable energy.

The increase in market share has led to higher profits, even with the selling price averaging 73 per cent lower than the market rate.

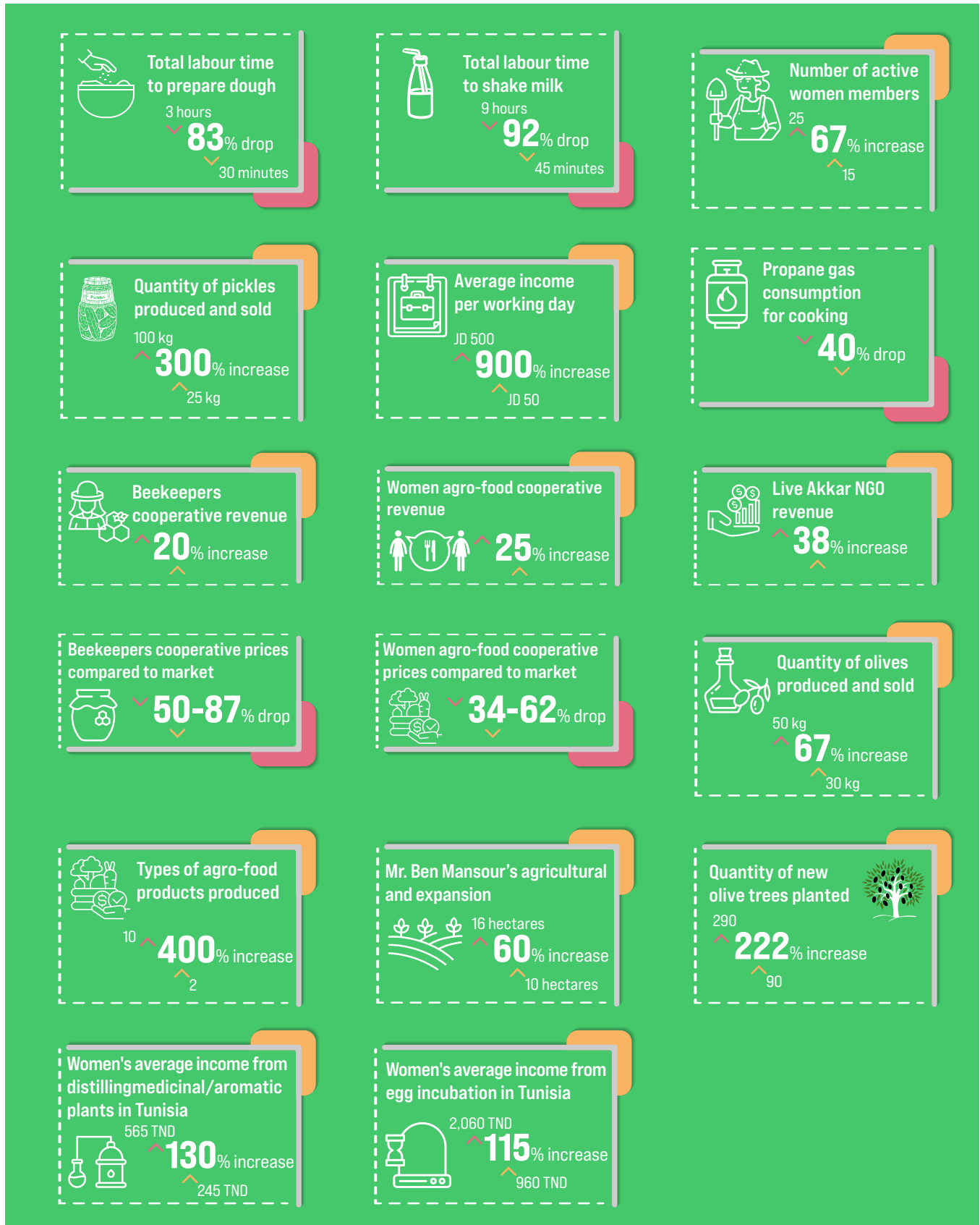
B. Impact on income-generating activities

The substantial savings on electricity bills from the solar PV systems, installed through REGEND, have enabled most beneficiaries to sell their products at a more competitive rate. The combination of capacity-building workshops and the procurement of new equipment improved productivity and allowed the introduction of new products and production lines. It also opened new markets, boosting the income of the community. Through the integrated approach that REGEND offers, the communities increased productivity, efficiency and revenue.

Accordingly, the indicators that have been used to assess the impact on income-generating activities are categorized as follows:

- ▶ Savings on operating costs.
- ▶ Increased productivity.
- ▶ Sales at more competitive rates and increased market shares.
- ▶ New production lines and revenue streams.

Figure 6. Examples of impact on income-generating activities from the targeted countries



Box 3. New production lines and increased productivity: the cases of Jordan and Tunisia

Jordan:

- ▶ New production lines and revenue streams: Beneficiaries in Jordan have recorded significant increases in volumes of dairy and agricultural products. The quantity of olives produced has increased by 67 per cent annually, from 30 to 50 kg.
- ▶ Increased productivity: The new production equipment procured by REGEND for the farms has led to a 30-minute reduction in labour and processing times, hence increasing productivity.

Regular food production at Al-Jawhara community-based organization in Al-Achaari, Jordan



Tunisia:

- ▶ Increased productivity: An expansion of cultivation areas was witnessed along with improved yield and quality of crops. For instance, Ben Mansour's farm expanded the cereal cultivation area by 60 per cent, from 10 to 16 hectares, while Mr. Baccouche's farm doubled the vegetable cultivation area from 1.5 to 3 hectares.

Farm of Abdallah Ben Mansour



C. Impact on gender and livelihoods

By adopting a gendered approach, REGEND is specifically designed to empower rural women by giving them control over energy resources, developing their entrepreneurial skills and ensuring their participation in local decision-making, especially in matters concerning their livelihoods. In the rural context, women are recognized as forerunners and leaders in environmental conservation, and their knowledge can contribute greatly to building resilience to climate impacts. Furthermore, the work of REGEND on productive activities in the agricultural and agrifood sectors focuses on identifying entrepreneurial opportunities for women. As experiences from other regions have shown, when provided with the same access to resources as men, women can increase agricultural yields by 20 to 30 per cent.¹⁴

Major benefits for livelihoods and the rural community were reported by REGEND beneficiaries across the participating countries, ranging from job creation and higher social inclusion rates for women to better living standards.

For households and the broader community, access to processing equipment means that they can produce their own agrifood products, which translates into additional income, food security and lower priced products. The capacity-building activities that were carried out increased the quality, volume and diversity of the product range. Roughly 80 per cent of the capacity-building attendees were women, several of whom became trainers and are carrying out capacity-building workshops for the broader community. The beneficiary organizations started hosting on-site workshops led by various local and international organizations.

The health clinic of Akkar Al-Atika, one of the largest in its region, was able to survive financially by being connected to the REGEND-installed solar system. This clinic charges a symbolic rate of \$2 per visit and employs 20 doctors and 12 staffers, 40 per cent of whom are women.

Box 4. Success story of Live Akkar sewing and embroidery workshop in Chaqdouf

The Live Akkar sewing and embroidery workshop in Chaqdouf has scaled up operations and increased its market share. Amidst the worsening crises in Lebanon, shrinking foreign currency reserves necessary for fuel imports, unavailability of electricity supply from the national grid, and reliance on diesel generators, the supply of electricity has become largely unaffordable, particularly for rural communities. The solar PV system with lithium-ion batteries installed by REGEND at the workshop has positioned the latter as the only of its type in the area with a reliable power supply, increasing the demand for their sewing and embroidery products.

The greater demand – now year-round rather than seasonal – has prompted the workshop to expand its premises and product range. Consequently, revenues have increased by 45 per cent annually.

The workshop's thriving reputation has driven new funding from a local NGO, the René Moawad Foundation, which has equipped the workshop with a quilting machine to add further production lines.

During this expansion, the dedication of Live Akkar's team was readily apparent. The head of the organization removed the office room to accommodate the sewing machines previously procured by ESCWA, transforming the space into several sewing rooms dedicated to different product types.

The solar energy system installed on the roof of the Live Akkar Association



Workers in the workshop, using embroidery equipment powered by solar energy



Box 5. Farmer in Tunisia expands her farming land and brings prosperity to her family through REGEND

The 4.5-kilowatt solar PV water pumping system installed through REGEND at Fethia Bougtif's farm in Chorbane, Tunisia, allowed her to expand her agricultural activities from her 4-hectare land to an additional 8 hectares of her in-laws' land. This expansion increased her cultivated area by 200 per cent and involved her extended family in farming activities.

With the additional land and ample water supply, Bougtif can significantly boost her agricultural production and income. The system's benefits extend beyond increased yields; it also allows her to diversify her crops, enabling her to introduce carrots for the first time. This diversification ensures a more stable agricultural output throughout the seasons, leading to a sustainable income year-round.



Ms. Fethia Bougtif

D. Environmental assessment

REGEND was designed to contribute to environmentally sustainable development in the Arab region, and to assess the projected environmental impact of its outputs and activities on targeted communities, countries and people. This approach is also reflected in the poverty, gender and conflict analyses of REGEND, which give particular attention to the dynamics between various environmental factors and poverty, conflict, and the fulfilment of the human rights of men and women.

The positive impact of REGEND on environmental protection is far-reaching. It encompasses a multitude of factors ranging from the reduction of high volumes of CO₂ emissions, and greener productions, to more efficient water irrigation and land cultivation.

In Jordan, the drip irrigation system has enabled an overall savings in quantities of irrigation water

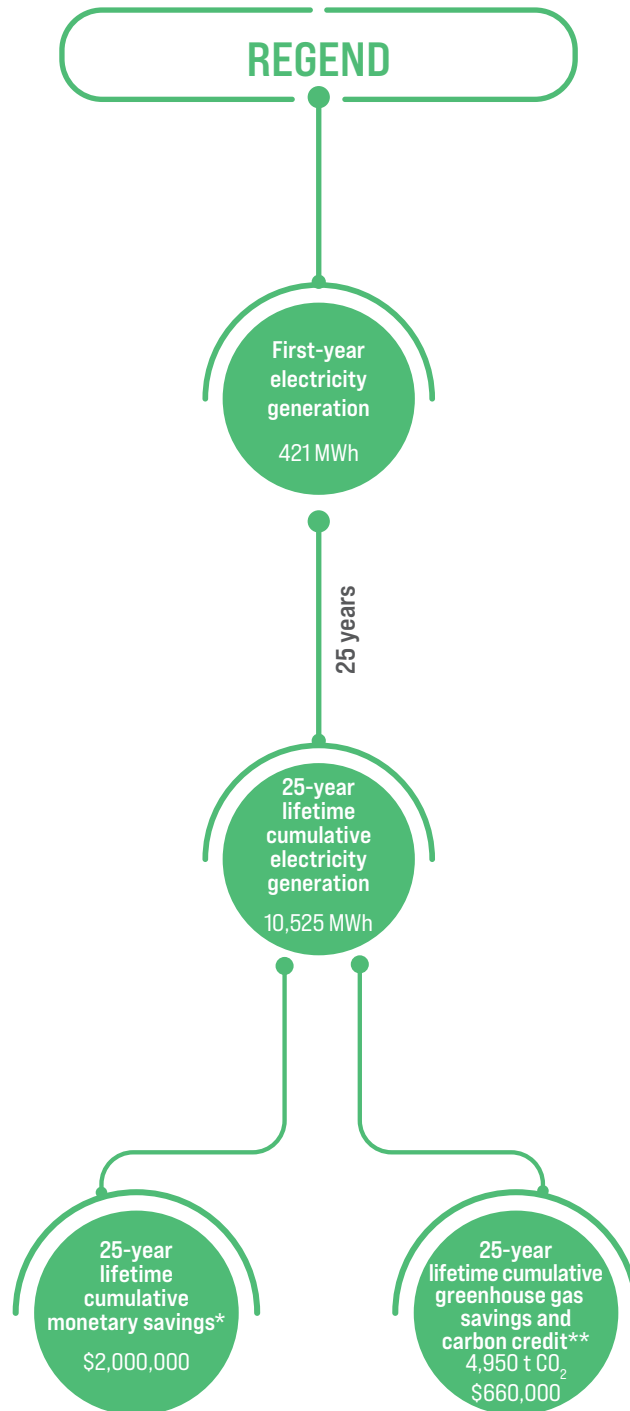
of 632 m³ per year. In Lebanon, the women's agrifood cooperative is pursuing cleaner cooking options, with significant reductions in gas consumption.

The total CO₂ emissions reduction and monetary savings calculated over the 25-year lifetime for the systems installed in the targeted countries are provided as follows:



REGEND was designed to contribute to environmentally sustainable development in the Arab region.

Figure 7. 25-year lifetime CO₂ emissions reduction and monetary savings



Notes:

* These figures are based on the average price of electricity at the end user during the first year of implementation of REGEND in the three targeted countries (Jordan, Lebanon and Tunisia).

** According to the Intergovernmental Panel on Climate Change, a price level of \$135–\$5,500 in 2030 and \$245–\$13,000 per ton of CO₂ in 2050 would be needed to drive carbon emissions to stay below the 1.5°C limit. This figure uses \$135 per ton of CO₂ as a reference for the calculation of the carbon cost.

E. Policy impact

The policy recommendations provided by REGEND toolkits include the need to design and implement effective strategies for upscaling renewable energy technology projects to ensure that rural areas are not left behind in the face of multiple economic and food-water-climate challenges. These strategies should address regulatory and policy barriers and help mitigate the financial and technical risks associated with these projects. Effective national strategies should consolidate policies across various interlinked sectors including – but not limited to – energy and water, agriculture, environment, health, education and planning.

This framework will provide a clear roadmap for addressing key deficits, from building an enabling environment to capacity-building, clearly assigning roles and responsibilities among national and local authorities and in turn properly distributing government resources to execute plans. A clear and efficient policy support framework allows a level playing field for the deployment of small-scale renewable energy systems in rural settings.¹⁵ This support framework is a critical enabler for attracting greater external financing and private sector participation, both of which are needed to drive growth in the sector. Developing a holistic national strategy needs to have specific targets and milestones for deployment and access to electricity, with a focus on rural economic growth and women and youth empowerment through small-scale renewable energy systems in rural areas.¹⁶

ESCWA, through REGEND, has actively contributed to developing these toolkits and policy support guidelines by working closely with partners to develop and disseminate case studies in each of the targeted countries on policy regulatory reforms and the financial and legal frameworks necessary for the advancement of small-scale renewable energy technologies. ESCWA has leveraged its convening power and commitment to collaboration to host policy dialogues and influence the policymaking environment in the

Arab region to include gender mainstreaming and support for an integrated approach to small-scale renewable energy deployment in rural areas. This was also pursued through organizing focus groups and expert meetings as well as multi-stakeholder forums by involving the members of local facilitating teams in each of the targeted countries. Regional and international events also provided platforms for disseminating knowledge and sharing experiences.

Consequently, progress has been made in some countries, including Jordan and Tunisia. Jordan is recording an increase in the installation of small-scale solar PV systems for water pumping for agriculture irrigation and fresh water purposes in vulnerable communities. This is the result of a new government decision to include the projects managed by local charitable associations or cooperatives in poverty areas as eligible entities for the funding of on-grid and off-grid solar applications from the Fils Al Reef financing programme. The decision came into force through the collaboration of the various partners that ESCWA assembled as the project stakeholders and facilitating members of REGEND.

In Tunisia, where REGEND was the first initiative to apply renewable energy technologies for farming activities, the Commissariat Général au Développement Régional (CGDR), which is the institute mandated with rural development, has launched a call for tender for the supply and installation of renewable energy systems for water pumps in the Mahdia municipality. After witnessing the results of the REGEND field projects, representatives from the CGDR noted that REGEND has developed their capacity to create similar projects across various rural areas. Two other official institutes, the Agence Nationale pour la Maîtrise de l’Energie (ANME) and the Agence de Promotion des Investissements Agricoles (APIA), have signed a memorandum of understanding to develop a sustainable financing instrument aligned with the Tunisian solar programme.



03

Challenges



As with any project of this nature and scope, the implementation of the REGEND initiative entailed a combination of political and security, strategic, operational, and administrative risks and challenges. The majority of these challenges were accounted for in the risk log matrix in the preliminary stage of the initiative's development. The risks were mitigated by facilitating close

coordination among project team members, maintaining open lines of communication with beneficiaries and partners, and troubleshooting potential problems before they materialized so that an effective and targeted response could ensure minimal disruption to the projects' implementation. The following list identifies the most significant project risks and challenges:

1

Political and security risks associated with changes in Government, political instability or crises affecting decision-making processes in one or more of the ESCWA member States, which could impede project activities.

2

Operating environment risks associated with the impact of the COVID-19 pandemic, and technical challenges related to data reliability and the development of renewable energy technologies that fit the specific requirements of rural settings. These challenges are compounded by low local capacity and collaboration, and the risks of loss, damage and/or malfunctioning of installed equipment.

3

Strategic risks related to the long-term viability and adaptability of renewable energy initiatives in response to changing demands and opportunities, which may affect the commitment and engagement of partners and countries in project activities. These include the elevated capital costs of the renewable energy systems and beneficiaries' requirements, the challenges in accounting for system expansion and changes in circumstances. In addition to insufficient commitment from stakeholders, these strategic risks impact the planning and decision-making that ensure the sustainability of the initiative.

4

Administrative risks associated with foreign currency exchange rate fluctuations, which may reduce the total funds available for project implementation.

The risk log matrix was periodically reviewed and monitored. Annual project progress reports reflected any changes in circumstances and

measures taken, if needed, to alleviate impact and ensure the completion of project deliverables.

A. Political and security risks

The impact of political instability and security risks in implementing countries cannot be overstated, and their occurrence could have hindered the timely execution of REGEND projects.

Tunisia underwent a government resignation while REGEND projects were being implemented. Additionally, public sector engineers went on strike from March till June in 2021, demanding higher wages to match the rising cost of living. These factors impacted the pace of the contractual work.

In Lebanon, an uprising started in the fall of 2019, resulting in widespread road closures across the country, and eventually leading to the resignation of the Government and the formation of a new cabinet after months of delays. The government instability did not impact the project's timeline. However, the overall instability was compounded

with several workers' demonstrations and strikes, including within the national electricity utility, Electricité Du Liban, which delayed for a few weeks the application for new bi-directional meters for the projects' beneficiaries as part of the net-metering scheme. Additionally, the road closures caused some minor delays, as the REGEND team faced difficulties in reaching the site locations to finalize the specifications of the field projects and procurement of productive equipment.

In August 2020, a major explosion shook the Beirut port and caused significant fatalities, injuries and extensive material damage throughout the city, including the United Nations House where ESCWA is headquartered. Consequently, staff were advised to work remotely until repairs to the building were completed, causing minor setbacks in operations.

B. Operating environment risks

1. COVID-19 pandemic

The COVID-19 pandemic is one of the few challenges that could not have been foreseen. The resulting mobility restrictions hindered stakeholder engagement, thus negatively impacting REGEND activities in multiple countries. The execution of field projects at the country level was slowed due to curfews, which prevented face-to-face meetings, site visits and work, particularly in rural communities.¹⁷ The restrictions also halted in-person regional meetings for an extended period.



The execution of field projects at the country level was slowed due to curfews, which prevented face-to-face meetings, site visits and work, particularly in rural communities.

2. Data availability and reliability

The availability of reliable, accurate data and statistics from official sources on the national and local levels is pivotal in the implementation and execution of renewable energy projects, particularly small-scale systems in rural areas, as it can affect decision-making, assessment and project design. In the absence of adequate data on the national, local or project-specific levels, data must be collected using a variety of techniques, including qualitative research, surveys, interviews, focus group meetings with different stakeholders, and market research in the targeted areas. Yet, significant discrepancies often remain, making the collected data considered at best as sampling data.

Data collection from the PV systems through remote monitoring may also face challenges. In addition, weak data and communication infrastructure can lead to Internet disconnections, disrupting remote monitoring and data collection.

3. Specific requirements of rural settings

Successfully designing and engineering a project in a rural setting needs to take into consideration the conditions present, as well as the availability of adequate infrastructure and technical expertise



The availability of reliable, accurate data and statistics from official sources on the national and local levels is pivotal in the implementation and execution of renewable energy projects.

to support these systems. The rural conditions can include recurrent power outages, corrosive ammonia emissions, weak ceiling structures of buildings, weak networks and other infrastructure shortcomings, and lack of construction plans and shop drawings. These conditions need to be addressed in the early stages of the project to prevent costly redesigns and frequent site visits.

Additional risks such as loss, damage and malfunction of equipment can impact purchases and installations. As these risks are particularly acute in remote areas, they need to be factored in at the project development stage.

Box 6. Technical challenges in rural settings in Tunisia and Lebanon

Prior to securing a grid connection, it is vital to have a strong and reliable grid infrastructure in place, especially for on-grid renewable energy technology systems. This prerequisite ensures the efficient integration of the renewable energy systems into the national grid. Yet, in most rural areas, the grid is weak, and upgrades are deferred due to low financing capacity of the utilities. As a result, customers experience significant delays in obtaining grid connections and the commissioning of on-grid solar PV solutions. This was experienced in Tunisia, where four solar PV system projects for milk cooling in farms faced delays in obtaining grid-connection approval from the national electricity utility, the Tunisian Company of Electricity and Gas, due to deferred upgrades to the electrical grid infrastructure connected to the farms.

Additionally, telecommunication networks may also be vulnerable to threats. In Lebanon, despite the careful consideration given to voltage surges in the solar PV system design and implementation, and the installation of all the necessary surge protection devices, a lightning strike affected the communication network. This network feeds into the PV system through the inverters to provide Internet for remote monitoring and thus resulted in damage to the system.

4. Low local entrepreneurial and collaboration capacity

These risks are related to the availability of skilled labour, local knowledge and the ability to effectively collaborate with other beneficiaries, local communities and stakeholders. The needs assessments carried out in the first phase of the REGEND initiative highlighted weaknesses among beneficiaries, particularly rural women, in many skills necessary to start and run businesses. Major gaps were recorded in management expertise and in marketing and branding skills.¹⁸ Moreover, awareness about renewable energy technologies and their applications in rural areas was reported as low. Lack of coordination and collaboration has also been reported within local communities and in productive activities and initiatives in rural areas.¹⁹ These challenges can impact the successful implementation, operation and maintenance of renewable energy technologies in rural areas.

5. Social risks and community resistance to gender mainstreaming

Risks associated with the sociocultural and community dynamics encompass attitudes towards gender roles and gender equality. These risks can therefore affect the implementation of gender-responsive projects, as well as stakeholder engagement in rural areas.



In Jordan, the unemployment rate of women is 1.5 times that of men. In Akkar, Lebanon, the unemployment rate of rural women exceeds 43 per cent.

Societal resistance towards women's empowerment and involvement in projects remains a major challenge and limitation for the successful and sustainable implementation of small-scale renewable energy technologies in rural settings. Women entrepreneurs, particularly those operating in rural areas, face several challenges, starting with societal resistance, specifically from immediate family members, mainly fathers, husbands or brothers, who are opposed to their involvement in businesses and productive activities. Thus, rural women often embark in business activities when they are divorced or widowed, and become heads of households.²⁰

Due to these sociocultural barriers, there is a high rate of unemployment among women in rural areas, where a high percentage of them work in an informal setting through their households.²¹ In Jordan, the unemployment rate of women is 1.5 times that of men.²² In Akkar, Lebanon, the unemployment rate of rural women exceeds 43 per cent.²³

Box 7. Family resistance to the concepts of gender mainstreaming, equality and empowerment

A Tunisian woman entrepreneur was deprived of the opportunity to benefit from REGEND due to family resistance. Her father rejected her participation and refused to let her sign the application form or any handover form.

Similar adversity was witnessed in Lebanon during the assessment phase, when husbands prevented their wives from discussing their productive activities, going so far as to take credit for the agrifood products themselves. Consequently, these women did not benefit from REGEND.

This inequity stemmed from the family's refusal to allow project stakeholders, such as project teams or contracting companies, to visit their households or women's businesses for project assessment and implementation.

Box 8. Financing disparities for women entrepreneurs

The provision of financing for women entrepreneurs has recorded significant improvement in some cases, such as Enda Tamweel in Tunisia. Enda Tamweel is a microcredit institution targeting micro-enterprises and has extended credit to 50 women beneficiaries of REGEND to help them expand their productive activities.

However, the majority of women face greater difficulties than men in securing financing for their projects. This is predominantly a rural problem, as financing and funding opportunities are scarcer and the ability to repay loans is lower than in urban areas.

6. Gender disparities in access to finance

Limited access to finance is a key hindrance to women's involvement in productive activities.²⁴ This is further exacerbated by the gender disparity in the provision of loans for micro-, small and medium-sized enterprises (MSMEs).

Traditional societal roles and cultural barriers to women's access to finance dictate a certain dependency of women on men for financial support.²⁵ The concept of working women is

still frowned upon in many rural areas, as these women entrepreneurs are presumed to be abandoning their household chores and duties towards their families when getting involved in productive activities or renewable energy project developments.

Furthermore, platforms supporting women entrepreneurs and providing them with financial literacy are rarely available. Even when they are, the awareness of these platforms is low among the rural community.

C. Strategic risks

1. Elevated capital costs

Securing upfront capital financing has been identified as a significant obstacle hindering the market entry of renewable energy technology business models. However, the success of the integrated small-scale renewable energy approach relies largely on the renewable energy technology market's capability to attract private investments. Additionally, beyond securing the capital financing for the renewable energy technology, ensuring adequate financial provisions for productive equipment and efficiency measures are also vital for optimal impact. In rural areas, most households generate low or uncertain income levels, making it difficult to afford capital expenditures for renewable energy technologies. Access to systems like

rooftop solar PV systems and solar home systems can be particularly unaffordable for a significant share of the rural population.²⁶

Infrastructure projects, particularly in rural areas, have a high upfront cost due to the location and nature of the projects. Moreover, the capital expenditures required for renewable energy projects can differ substantially from project to project. Several factors, including the project's location and the size of the plant, have a major impact on these costs. A thorough evaluation of the specific project's requirements yields an accurate estimate of the necessary investment. The common trait, however, is that the upfront cost is high. Adding risk premiums for contractual work in remote areas, together with national security risks, further increases the systems' cost.

The importance of capital financing cannot be overstated in the various stages of the business model. It is crucial to identify and account for the specific requirements in the planning process to ensure the financial viability of the project. While REGEND has provided a full grant for the energy projects, additional financing was made available for equipment requested by the beneficiary, post-implementation. REGEND was able to manage the budget and provide this financing thanks to the flexible provisions included at the inception phase and the savings from reduced travel costs during the COVID-19 pandemic.

2. Insufficient commitment from local partners and key stakeholders

A productive use of small-scale renewable energy projects aimed at rural development and women's empowerment requires a high level of commitment by local project partners and key stakeholders.

Despite efforts to create a sense of ownership, low levels of commitment may emerge and create a risk of unnecessary delays, complications and even the potential failure of the project. These challenges may be overlooked but must be considered and addressed early on to guarantee successful outcomes. Those who risk being most impacted by any delays or issues in implementing the project are the beneficiaries themselves.

3. Challenges in accounting for expansions

Despite having the growth of productive sectors as a key goal of REGEND, accounting for this growth and potential expansion plans during the design and implementation phases of the project presents significant challenges. The overarching challenge lies in the inability to predict the growth prospects, especially in the absence of reliable historical data that would enable the development of a regression model and reliable forecasting tools.

During the inception phase of the field projects, REGEND planned for a modest degree of project

expansion, along with the associated increase in power demand, and delivered training workshops for the beneficiaries and other interested stakeholders to support the system after the maintenance period. Protocols for system usage were also disseminated to the stakeholders.

Yet, the actual expansion two years following project completion exceeded the provisions allocated for in the systems. The sewing workshop in Chaqdouf, in northern Lebanon, received additional high-load equipment, which was intended to allow new production lines and, therefore, additional revenues. The protocol for use, however, was not respected. In the case of Tunisia, an additional water pump from a new well was installed, which also placed an additional significant load on the solar PV system.

While the beneficiaries have adapted to demand-side management and learning which equipment to run simultaneously, this does not eliminate the need for a proper expansion framework following system installation whereby the protocol for use is respected. A key challenge remains for such projects reliant on grants, as beneficiaries tend to demand more and more, without necessarily having a scalability and revenue growth strategy in place.

4. Accounting for variation orders and changing circumstances

Projects are seldom implemented exactly as they were planned at the design stage, as variations and changing situations occur during site development, incurring additional costs. These circumstances could be on the national level, such as increased power rationing, or the local beneficiary level, such as expansion of site operations. Both situations have been recorded in Lebanon during the implementation of REGEND.

Higher overhead costs than initially planned for should also be accounted for. They could result from such variables as changing local conditions or a higher number of required site visits for data collection in the absence of data availability.

Box 9. Variations in field projects' implementation in target countries

With the increasing power rationing from the State-owned electricity utility, Electricité Du Liban, and the neighbourhood private generator, after the design phase, the solar PV system in the sewing and embroidery workshop in Chaqdouf, in northern Lebanon, necessitated battery storage systems. As this was not part of the initial least-cost design, amendments, with associated costs, were necessary for the system to include battery storage. A variation order to add back-up storage to the site was made as part of the REGEND initiative.

5. Sustainability challenges

The sustainability of the project hinges on the scalability of the business model and the enduring positive impact on the beneficiaries and the local community.

The scalability factor is limited by the absence of political commitment for the development of rural areas, the empowerment of women and the deployment of decentralized renewable energy systems. This is further exacerbated by the absence of strong dedicated institutions for rural development, and by weak coordination and follow-up among stakeholders.

On the other hand, ensuring a lasting impact is highly dependent on the beneficiaries and municipality's sense of ownership. It also relies on their commitment to the implemented activities and the proper management of funds incurred by the savings on energy bills to further expand the businesses and revenue streams.

On the narrower level, the sustainability of the small-scale renewable energy technologies is dependent on the optimal operating mechanisms and the absence of damage, vandalism or sabotage.

As the components of the solar systems are predominantly imported, ensuring the quality and durability of these pieces of equipment is crucial. The financial burden of replacing any damaged or malfunctioning component of the system is significant and may be an unaffordable option for the beneficiaries. This, in turn, creates a high risk of projects becoming obsolete and non-functioning after a period if they do not receive adequate operating and maintenance services.

Nonetheless, risks of malfunctioning, or deliberate or accidental damage, are part of any project implementation, particularly in remote areas. These threats unfortunately have the potential to disrupt the operation of the project and hinder its long-term sustainability.

D. Administrative risks

1. Low regulatory integration of renewable energy technologies and gender mainstreaming in rural development

Integrating renewable energy within rural

development presents a set of regulatory challenges, either due to lack of comprehensive rural development regulatory and institutional frameworks or fragmentation within rural development, or lack of collaboration and communication between the different institutions.

Box 10. Rural development regulatory challenges in Jordan, Lebanon and Tunisia

In Jordan, laws related to rural development, renewable energy and gender lack alignment and coherence. There are also duplicate mandates between associations, cooperatives and local community development centres. Addressing this multiplicity of laws and overlapping of mandates would enable local women-led associations to navigate the legal requirements for setting up and operating productive activities.

In Tunisia, a lack of coordination and synergy between policies related to rural development, such as forestry, and energy policies and strategies exists. This lack of coordination is rooted in the lack of communication across the different relevant institutions. Additionally, the renewable energy strategy focuses on large projects. With the exception of a programme for the residential sector, few mechanisms are dedicated to small-scale renewable energy systems.

In the case of Lebanon, rural development and regulations are closely tied to agricultural planning with little focus on other opportunities. Though multiple regulations might apply to the rural context, they are usually fragmented and encounter challenges when it comes to implementation.

The lack of a comprehensive rural development strategy is a major hindrance, particularly when it comes to fostering a holistic approach that encompasses all sectors.²⁷ Achieving sustainable growth and prosperity for rural areas requires an integrated approach to planning and regulations.

Moreover, women's economic participation in rural areas remains low due to various obstacles such as the lack of gender mainstreaming in laws, the absence of effective laws and policies that support women in the labour force,²⁸ and legal clauses that cause women to lose their inheritance in favour of male relatives.²⁹ These legal barriers prevent many talented and capable women from fully contributing to the workforce and realizing their potential.

2. Lengthy regulatory frameworks, licensing and grid-connection processes

The process of adopting a regulatory framework and the administrative procedures linked to licensing and grid connection present certain challenges when it comes to the swift implementation of on-grid solutions. The administrative procedures, from submitting the initial request to obtaining inspection approval, can be time-consuming, which can delay the timeline of the project's implementation, such as in the case of REGEND implementation in Tunisia.

Additionally, most national energy and infrastructure regulations do not currently encompass the deployment of small-scale renewable energy technologies. As a result, delays and barriers have been caused by lengthy regulatory frameworks and the delayed engagement of electricity authorities in the implementation of small-scale renewable energy.

The implementation process could also be delayed by the administrative procedures at the electricity utilities, specifically in terms of securing grid connection, new electricity meters or bi-directional meters. Often, these procedures are put in place to ensure thoroughness and compliance with regulations but ultimately end up creating hurdles in the absence of efficient follow-up. The delays could be recorded across various steps, from submitting the initial requests and applications to securing inspection approval and, finally, installation.

Even in the case of early engagement with authorities to guarantee a smooth process, if this engagement is not matched by a similar commitment and effective engagement on the authorities' side, then the response is bound to be slow and delayed. Such was the case in Tunisia, where the electricity utility's process for commissioning on-grid solutions was not facilitated as anticipated, resulting in some delays.

Box 11. Institutional instability in Tunisia mitigated by REGEND

During the project's timeline, Tunisia witnessed several changes in leadership within the Ministry of Energy, Mines and Renewable Energies, including the merger of the energy portfolio under the Ministry of Industry and a new Minister taking office. Additionally, there were changes at the National Agency for Energy Conservation, with the Director General and some Assistant Directors being replaced. Yet, this has not impacted the implementation of REGEND, as the risks posed by these changes were considered in the risk matrix at the inception stage and regularly monitored and updated by ESCWA through REGEND. As such, these risks were immediately mitigated through the existence of the steering committee, the local facilitating team and the partners who remained in continuous direct communication with the beneficiaries and authorities to address these changes.

3. Organizational instability in key institutions and partner organizations

Organizations experience various changes in staff and leadership. The lack of proper information and awareness among newly appointed management team members and personnel can jeopardize the scope and timeliness of the project, resulting in delays in implementation and impacting the overall performance of the project.

Organizational instability may also be caused by political instability, leading to institutional disruptions such as delays in government formation or protests by workers in national institutions. The potential implications of a new Government's appointment on project implementation timelines cannot be overlooked. Delays in obtaining permits or addressing pending regulations may arise, causing uncertainties in the planning and investment processes for small-scale renewable energy technologies. This situation could potentially lead to policy inconsistencies that hinder progress and obstruct the growth of these vital sectors.

In circumstances where there is change in institutional leadership, appointing individuals who lack knowledge and understanding of the project would be detrimental. It could result in communication breakdowns, inadequate support, and potentially lead to significant delays during

the project's implementation phase. It is crucial to have well-informed team members who can contribute effectively and ensure a smooth execution of the project.

4. High procurement and supply chain disruption risks

One of the key challenges encountered in procuring small-scale renewable energy systems is the elevated imports risks. This can make it challenging to acquire and access the supplies required for project execution. Most of the components needed for the installation of small-scale renewable energy systems are imported from foreign countries, which creates a high procurement risk associated with potential supply chain disruptions, and lengthy customs clearance processes, especially for batteries.

Moreover, any event in the global markets could impact international trade, leading to significant delays in sourcing required components, as was the case during the COVID-19 pandemic. Consequently, this kind of situation can lead to a setback in the timely execution of important projects. Furthermore, and due to the imported nature of the equipment, the costs associated with implementing the project would rise significantly as a result of any disruption. This increase in expenses could potentially make the project unfeasible, especially considering its small scale and remote location.

Box 12. Impact of COVID-19 on sourcing solar PV systems' components

Global supply chains, including those for renewable energy, experienced significant disruptions due to lockdowns during the COVID-19 pandemic. This impacted the availability and cost of solar PV components, particularly components imported from China.

The lockdown measures, logistics challenges and manufacturing slowdowns made it difficult to source these components due to their scarcity. As a result, the renewable energy industry recorded extended waiting times and a sharp increase in prices ranging from 15 to 40 per cent for solar PV panels and other components. Consequently, renewable energy projects across the globe faced a slowdown.

5. Low availability of financing mechanisms for small-scale renewable energy technologies in rural areas

The issue is further aggravated in developing small-scale projects in rural areas, as it becomes more difficult to find adequate financing for the implementation of the project due to its nature and location. Financing renewable energy projects, aside from being a challenge in itself, is an even greater challenge when financing small-scale ones and those for small businesses in rural areas.

The commercial profitability of these projects compared to their development cost is a major defining element in their financing and implementation. Small-scale projects generally have very low commercial profitability in comparison to their capital expenditures, rendering the probability of finding adequate financing for these projects very low.³⁰

6. Inflation and exchange rate fluctuation risks

As inflation increases and the risks of economic crises rise in many Arab States, the risks of exchange rate fluctuations heighten and reduce the ability to attract financing for renewable energy projects, particularly small-scale ones located in rural areas.

Linking costs and requiring payments in United

States dollars may seem the most strategic way to mitigate these risks for developers of and investors in small-scale renewable energy technologies, as it ensures that their cash flows remain stable. This, however, creates a burden of the extra costs resulting from a depreciating local currency – a burden that often cannot be borne by the beneficiaries, especially amidst the shrinking purchasing power of the rural community.

7. Unfavourable credit terms

Most rural households often face limited access to traditional banking loans and services, and many are even unbanked. This is primarily due to the high operational costs associated with bank transactions. The situation is worsened by the banks' heavy requirement for collateral and credit records.

The prevailing exorbitant cost of financing is often reported as the key hurdle that hinders progress for small businesses.³¹ Rural businesses and MSMEs are often undercapitalized and lack good credit scores. Thus, the probability of these businesses generating constant cash flow and a profitable return on investment is low. To mitigate these risks, lenders often raise interest rates or ask for collateral to secure loans. However, this poses severe challenges for rural businesses, particularly those run by women, who cannot meet the requirements for material collateral. These limitations can restrict rural businesses' access to debt financing, which may be essential for growth and expansion.



04

Best practices: developing
integrated small-scale
renewable energy



Key messages

An integrated approach for the business model

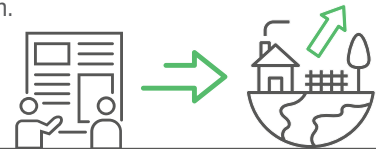


is instrumental and achieved through multi-level interventions that include the water-energy-food-climate nexus. This approach fosters economic growth, empowers women and young people to deliver a multitude of outputs and impacts, and encourages cross-sectoral collaboration.

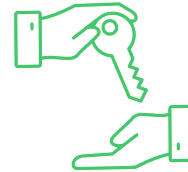
Partnerships and engagement.



Participatory and bottom-up approaches are effective methods for advancing rural development initiatives from the inception phase of a project to its implementation.



This engages key stakeholders, facilitates private and public sector investments, promotes a sense of community ownership and buy-in, and fosters collaboration between community-based organizations and community members for long-term planning processes.



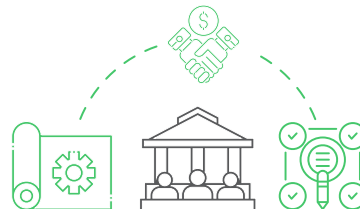
Demand-driven governance models.



At the core of the development of a fit-for-purpose business model lies data collection and holistic needs and gender assessments



which can be used to structure a solid governance framework that encompasses the pillars for the selection of beneficiaries, the decision of projects and activities, and the implementation, monitoring and assessment tools.

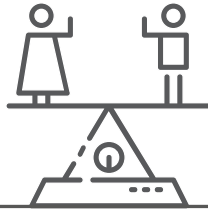


Effective legal, regulatory and policy support



should ensure coherence and the absence of mismatches and conflicts that may hinder cross-sectoral implementation. Effective national strategies should consolidate policies across various interlinked sectors including energy and water, agriculture, environment, health, education and planning.

Gender mainstreaming strategy



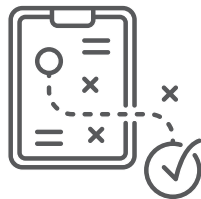
needs to be **developed** and **embedded** in the design, structure and expected accomplishments that would make the project **successful**



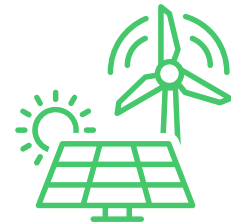
by empowering rural women and giving them control over energy resources as beneficiaries of sustainable energy initiatives, developing their entrepreneurial skills and building their capacities, and ensuring their participation in local decision-making.



A flexible and adaptive approach

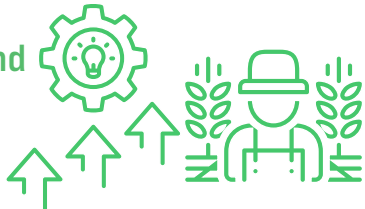


is a major pillar in the implementation of small-scale renewable energy projects, and which covers the technical and financial readiness to adapt to emerging requirements and changing circumstances.



It is imperative to have **detailed site assessments** and to use a **flexible design approach** and **mitigation measures** at the project's inception to ensure **timely implementation**.

Capacity and knowledge building



of rural communities, including training of trainers, is a key pillar of building an ecosystem and ensuring the optimal productive usage of small-scale renewable energy technologies. **This needs to be pursued from the early stages till the phase-out and follow-up of a project.**

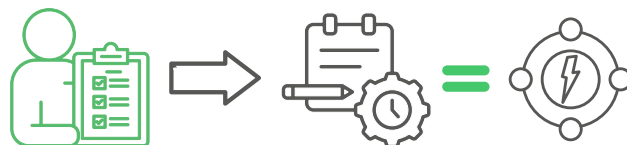
Sustainability and scalability



of the small-scale renewable energy technologies hinges on the existing policy coherence and formulation of adequate evidence-based cross-sectoral policies and support mechanisms.



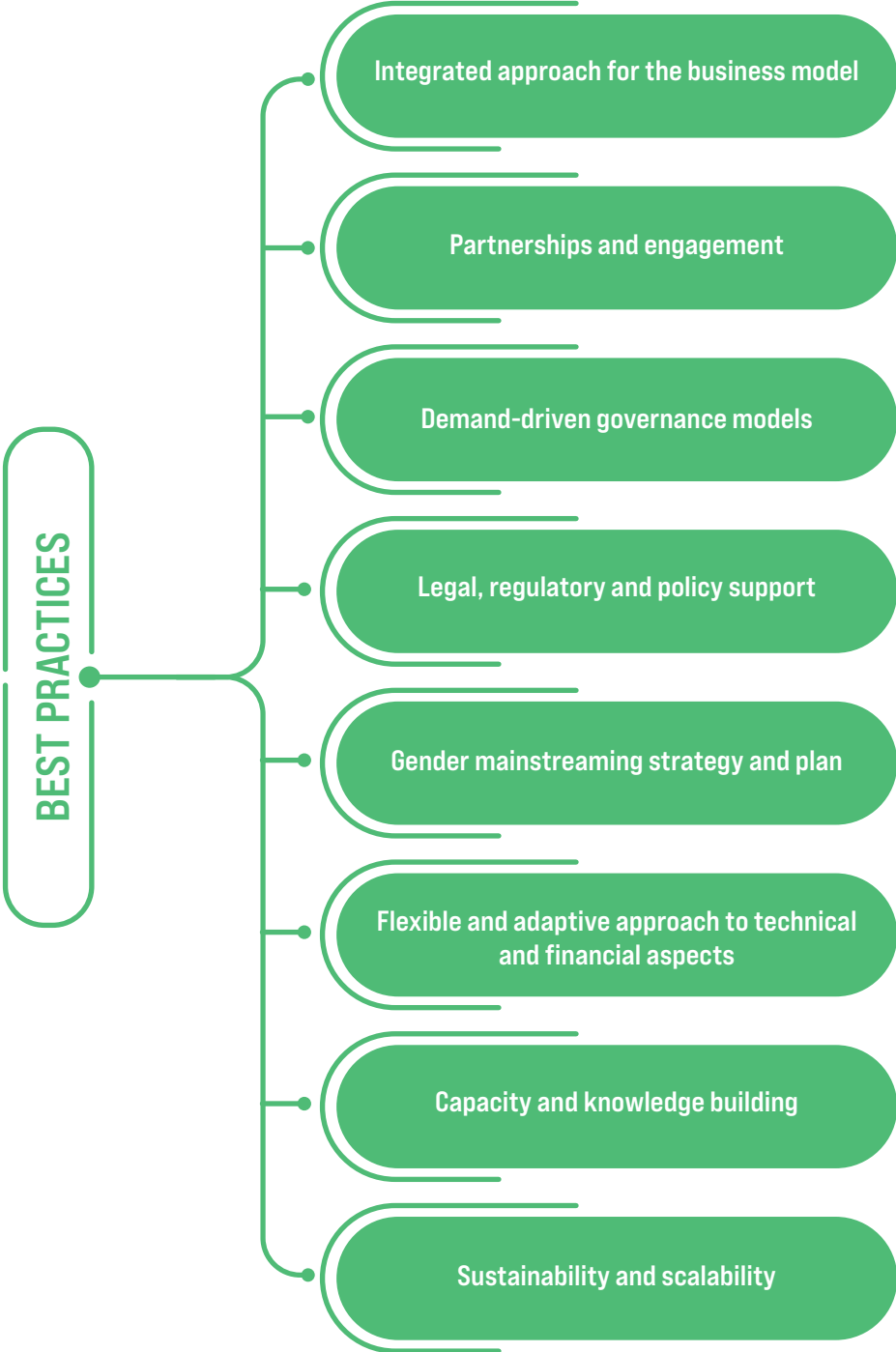
To achieve this, an assessment needs to be conducted to ensure that the project interventions align with the energy policies and the broader development goals, while identifying gaps and inconsistencies in existing policies.



A. Integrated approach for the business model

Building on the integrated approach of the REGEND business model and its Theory of Change detailed in the next section, the following are best practices in the governance and monitoring models.

Figure 8. Best practices pillars



Box 13. REGEND overarching Theory of Change

REGEND was launched by ESCWA in 2018 to improve livelihoods, economic benefits, social inclusion, job creation and gender equality in Arab rural communities by addressing energy, poverty reduction, water scarcity, vulnerability to climate change and other natural resource challenges. This was pursued by using appropriate small-scale renewable energy technologies for productive activities and entrepreneurial development, capacity-building and policy guidelines, with an emphasis on poverty reduction, economic development, social inclusion and building resilience to climate change.



REGEND aims to improve the livelihood, economic benefits, social inclusion and gender equality of Arab rural communities by addressing energy poverty, water scarcity, vulnerability to climate change and other natural resources challenges. This is pursued through using appropriate small-scale renewable energy technologies for productive activities and entrepreneurial development.



Inclusive, sustainable, environmental and economic revival and development of Arab rural communities.



Renewable energy technologies	Human capacity	Women's empowerment and social inclusion	Entrepreneurial development	Policy and institutional framework
<ul style="list-style-type: none"> • Effective and innovative small-scale decentralized and modular renewable energy systems. • Water-energy-food nexus. • Access to productive resources and appropriate and reliable services. 	<ul style="list-style-type: none"> • Model based on know-how. • Trainings, knowledge, skills/ advisory Services. • Bringing change to rural communities from resource-poor living standards to reliable, affordable and modern energy sources. 	<ul style="list-style-type: none"> • Economic power in rural women's hands. • Women mentors • Participative and bottom-up approach. 	<ul style="list-style-type: none"> • Economic transformation, environmental and socioeconomic development priorities. • Entrepreneurial jobs in productive sectors. • Spawn energy-based enterprises around renewable energy-based service providers. 	<ul style="list-style-type: none"> • Pro-poor investments and private sector involvement. • Synergies among national and regional stakeholders. • Innovative incentive mechanisms.



Human rights, gender equality and resilience to climate change.



Untapped renewable energy resources, high unemployment, chronic poverty, water scarcity, food insecurity, energy poverty and vulnerability to climate change of the rural communities of the Arab countries.

The project developed an integrated business model proposition for the productive use of small-scale renewable energy technologies as enablers for rural development and entrepreneurial growth through gender-responsive interventions.

The project was designed through theories of change aiming to achieve four immediate targets listed below as “expected accomplishments”. Each expected accomplishment is segregated into various outputs as follows:

Expected accomplishment 1: Increased knowledge of policymakers and local institutions on the socioeconomic and political dynamics and environmental considerations of Arab rural communities and the understanding of appropriate small-scale renewable energy technologies that support gender mainstreaming as well as entrepreneurial development and address the water-energy-food and climate change nexus.

- ▶ Output 1.1: Baseline study of socioeconomic and political dynamics and environmental considerations linked to productive activities by sector, access to energy services requirements and availability of sources of energy supply, and associated technologies needed to support resilience in rural communities.
- ▶ Output 1.2: Country gender assessment on entry points to energy access, entrepreneurial development and building the targeted Arab rural communities’ resilience to climate change.
- ▶ Output 1.3: Toolkits, fact sheets, booklets and other promotional materials on appropriate small-scale renewable energy technologies and applications.

Expected accomplishment 2: Enhanced capacity of public, private and financial institutions in ESCWA member States to apply business models for the implementation of appropriate small-scale renewable energy technologies in the productive sectors of rural areas.

- ▶ Output 2.1: Conceptual comprehensive business models for the implementation of small-scale renewable energy technologies to support the resilience of the targeted population; developed, tested and disseminated.
- ▶ Output 2.2: Pilot projects implemented in selected local communities in the rural areas of targeted Arab countries to test and fine-tune the comprehensive conceptual business models.

Expected accomplishment 3: Improved opportunities for rural economic development in beneficiary Arab countries through the creation of the enabling environment for the private sector and women entrepreneurs to invest in income-generating activities by increasing the use of small-scale renewable energy technologies.

- ▶ Output 3.1: Policy Toolkit as Regional Strategic Guidelines to improve the enabling environment for the private sector and women entrepreneurs to invest in income-generating activities by increasing the use of small-scale renewable energy technologies in productive activities in Arab rural areas.

Expected accomplishment 4: Regional initiative sustained beyond project time frame.

- ▶ Output 4.1: Establishment of a regional entity to adopt the developed policy frameworks and implementation tools and support a sustainable and durable operationalization of the developed models and policy tools beyond the pilot phase of the initiative.
- ▶ Output 4.2: Training of trainers and establishment of a Network of Arab-Rural Practitioners to build long-term ownership of the project and to ensure the successful achievement of its intended results.
- ▶ Output 4.3: Multi-stakeholder forum on small-scale renewable energy technology use for entrepreneurial development and gender mainstreaming in the productive sector within rural areas of the Arab countries.
- ▶ Output 4.4: Dissemination of information and knowledge of the project outputs.

B. Partnerships and engagement

One of the notable achievements of REGEND is building a strong network of partners and facilitating collaborations between institutions within and between the targeted countries as well as regionally. Collaboration and sharing best practices have proved to be effective in achieving the project's goals, optimizing the project's implementation, providing policy support and gender mainstreaming, and facilitating capacity-building at the local and national levels.

These partnerships were supported by effective coordination and communication frameworks. The inception phase consisted of a preparatory step for project development and was dedicated to identifying optimal national, regional and international partner organizations in the implementation of REGEND.

To ensure strong engagement and ownership of the project objectives, REGEND developed a stakeholder participatory approach during the



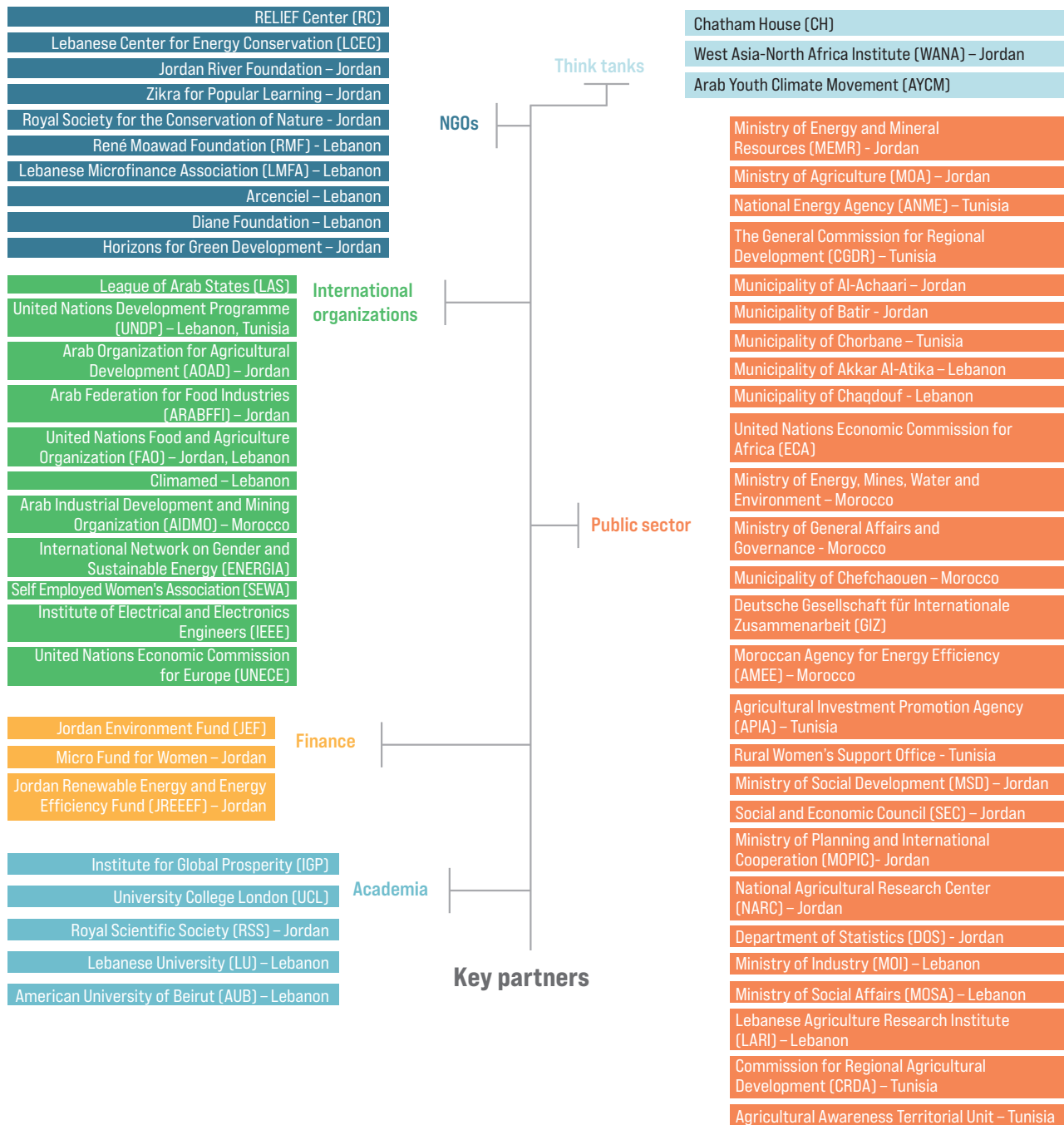
These partnerships were supported by effective coordination and communication frameworks. The inception phase consisted of a preparatory step for project development and was dedicated to identifying optimal national, regional and international partner organizations in the implementation of REGEND.

inception phase, which carried on throughout the implementation stage. In this manner, members of the steering committee were identified, and the steering committee was established involving regional partners in addition to the local facilitating team put in place in each target country to support project implementation. REGEND organized consultation meetings at ESCWA and in each target country to initiate the process and define the scope of work, roles and responsibilities to be included in the letters of understanding signed within the framework of REGEND. High-level meetings, country visits, consultation meetings and dialogue sessions took place with key stakeholders at national, regional and international levels during the inception period and were pursued during the implementation of REGEND activities.

Engaging all stakeholders in an interdisciplinary steering committee from the inception phase enables a greater contextual understanding and ensures that the projects are designed and installed in a way that meets the community development requirements. It promotes collaboration across various entities to ensure a holistic perspective and encourages cross-sectoral working groups, which are essential in the development of projects and policies in the water-food-energy-climate nexus. Stakeholder engagement also fosters community buy-in, ensures a non-duplication of interventions in targeted areas and enables an adaptation to challenging situations.

REGEND partnered with a wide range of entities spanning the public sector, think tanks, academia, non-governmental organizations (NGOs), international organizations and finance institutions to meet the objectives. The key partners are listed hereafter:

Figure 9. REGEND key partners



These partnerships also identified interlinkages between REGEND and other projects to avoid duplication of activities and optimize the use of resources. REGEND strengthened engagements between projects funded by Sida. In Jordan, a partnership between ESCWA and the Royal Scientific Society, and the LU the National Energy

Research Center, led to the co-organization of the workshop on “Access to Finance for Municipalities – Nexus Thinking and Decentralization of Subnational Governments” under the umbrella of REGEND and the Sida-funded MENA Region Initiative As a Model of NEXUS Approach and Renewable Energy Technologies (MINARET).

These partnerships have also guaranteed a continuity of donors' efforts in promoting productive activities in rural areas. The United Nations Development Programme, a partner of REGEND, has expanded the building hosting the three cooperatives' beneficiaries in Akkar Al-Atika, in northern Lebanon, which was powered by a solar PV system and batteries through the REGEND initiative. The solar PV system has ensured the continuity of the cooperatives' activities amidst the economic and energy crises in Lebanon. Additionally, REGEND collaborated with the Arab Organization for Agricultural Development (AOAD) to tailor the materials for the community capacity-building and guidance tools.

Furthermore, REGEND was able to draw lessons from experiences which employ different approaches in order to build a learning and communication bridge between the institutions based outside the rural areas and the rural areas themselves, from one end, and between targeted countries, from the other end.

Engaging with the various partners across the implementation of REGEND has led to stronger partnerships. This has critically broadened the horizons of REGEND and enabled its transition from a regional to an international scale.

On the international level, ESCWA collaborated with the International Network on Gender and Sustainable Energy (ENERGIA), building on the collaboration of both organizations as co-facilitators of the Multi-stakeholder Technical Advisory Group on Sustainable Development Goal 7 (affordable and clean energy). Through REGEND, ESCWA also collaborated with the Self Employed Women's Association (SEWA), Good Water Neighbors (GWN) and ENERGINA, as well as the United Nations regional commissions, in organizing high-level events on gender empowerment (in Bangkok, for example).

On the local community level, early engagement has fostered a sense of community buy-in and ownership of the implemented projects. This

has resulted in increased ownership by the stakeholders and the targeted beneficiaries. Such early engagement has also led to higher participation in the project activities and willingness to undergo thorough capacity-building training; it has also resulted in higher prospects of adequate system operation and maintenance. In general, community buy-in is considered a key element of an enabling environment for small-scale renewable energy technologies.³² Throughout REGEND, this community buy-in was secured through the relationship-building mechanisms with the municipalities, local entities and beneficiaries, regular site visits and meetings, and capacity-building workshops for the beneficiaries and the wider community, with a particular focus on women and young people.

Furthermore, local community engagement has proved to enable a quick response and adaptation to challenges and changing circumstances, such as changes in economic situations and consequently community needs, thereby developing into a valuable feedback and follow-up mechanism. This local engagement has been critical in expanding the scope of REGEND in Lebanon, for example, following the 2019 crises and their implications. Upon completion of the solar PV system implementation in the Akkar Al-Atika cooperatives' building, electricity supply from the national electricity utility had become completely unavailable, threatening a humanitarian crisis in the village's health clinic and a halt of operations at the municipal building. As the community shared these concerns with the REGEND team, the latter instructed the project's contractor to extend power cables from the solar PV system to the municipal building and health clinic, each 100 metres away from the cooperatives' building, to meet the critical load and ensure the continuity of their operations. In adapting to address a bleak situation, a major crisis was averted.

C. Demand-driven governance models

At the core of the development of a fit-for-purpose business model lies data collection and holistic needs and gender assessments to ensure that the interventions and governance model are demand-driven. The success of the REGEND business model delivery has hinged on identifying and meeting the local community's needs and requirements.³³ The needs assessments pave the way for developing a solid governance framework that encompasses the pillars for the selection of beneficiaries, the decision of projects and activities, and the implementation, monitoring and assessment tools.

1. Data collection and needs assessments

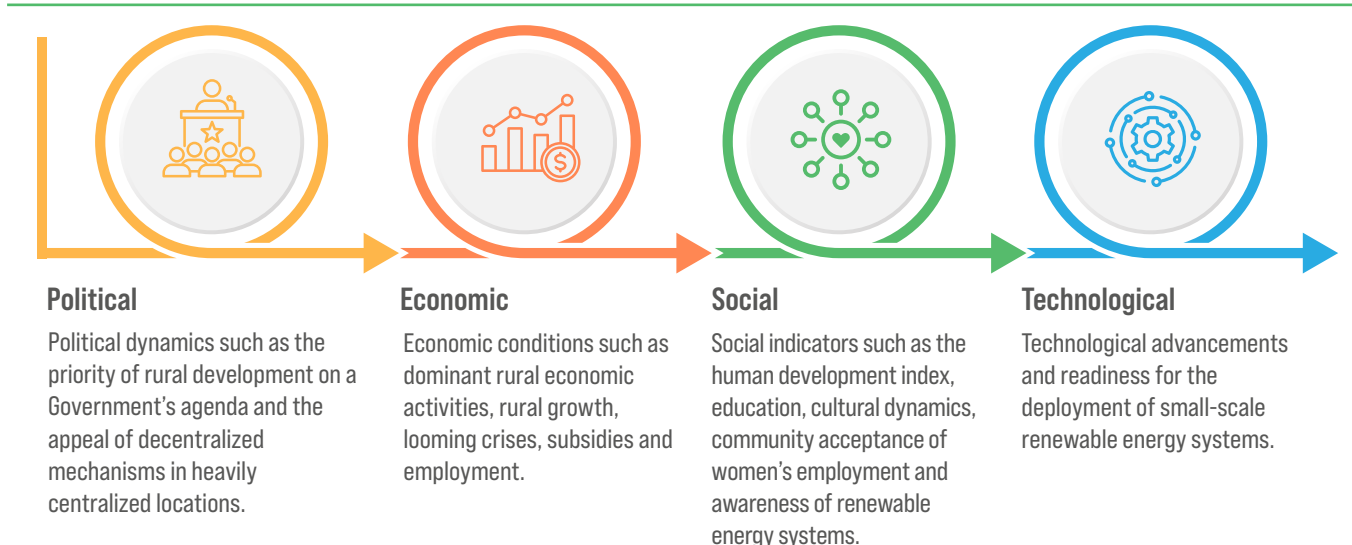
The needs assessments are the foundational step in understanding the overall national outlook and the conditions of rural development; they also reveal the requirements and gaps in gender mainstreaming, service provision and development of the community. The assessments enable an analysis of the socioeconomic, political, environmental and gender-related factors that influence energy access and usage patterns. This is especially vital when the business model integrates the deployment of renewable energy systems as part of the rural community and economic

development, as in the case of REGEND.

REGEND ensured that the assessments are evidence-based, emphasizing the critical role of qualitative and quantitative data collection, field visits and focus groups to bridge gaps, as data availability is limited. Engaging with national and local stakeholders through the partnerships elaborated in the previous subsection enabled the identification of vital factors such as socioeconomic conditions, gender dynamics, energy access, and affordability challenges and opportunities.

The experience of REGEND has showcased that political, economic, sociocultural and technological (PEST) and strengths, weakness, opportunities and threats (SWOT) analyses provide a structured framework for decision-making. Assessing the internal and external factors influencing the project through these frameworks is instrumental in developing a comprehensive understanding of the operating environment in which the small-scale renewable energy interventions will take place.

On the one hand, the PEST analysis assesses the external macro-environmental factors influencing the small-scale renewable energy project and helps unpack the following elements:



On the other hand, the SWOT analysis enables an understanding of the project's potential and limitations. The analysis assesses the following factors:



These assessments along with stakeholder engagement led to the selection of the optimal site identification for project conceptualization and implementation. Additionally, they provide a baseline to measure the impact of the project and ensure adequate evaluation and follow-ups.

This thorough planning approach ensures the ability to tailor renewable energy and other interventions to meet the needs of the rural community, and increases the likelihood of developing successful, sustainable and inclusive projects.

As part of the scope of REGEND, two assessment studies taking into account the previously discussed points were conducted in the first stage:

1. Baseline study of socioeconomic and political dynamics and environmental consideration linked to productive activities by sector, access to energy services requirements and availability of energy supply sources, and associated technologies needed to support resilience in rural communities.
2. Country gender assessment on entry points to energy access, entrepreneurial development, and building the targeted rural communities' resilience to climate change in the Arab region.

2. Selection of beneficiaries

The assessments conducted in the first stage in each country laid the groundwork for the selection of the benefiting local communities using a set of criteria established and validated through a participatory approach through the stakeholder meetings.

The criteria were identified as follows:

- ▶ The regional development index of the proposed region.
- ▶ The existence of renewable energy potential allowing implementation of small-scale applications to support improving the livelihoods of the rural population.
- ▶ The existence of one or more socioprofessional structures able to guarantee the sustainability of the project (e.g. cooperatives, NGOs).
- ▶ The existence of solid structures and community-based organizations able to bring together rural women.
- ▶ The accessibility of the rural community.
- ▶ The overall security situation.
- ▶ A budget dedicated to the pilot projects within the framework of REGEND.

Based on these criteria, and in addition to input from national stakeholders, several rural communities were identified for field visits and interviews with local stakeholders. This fieldwork formed the basis for a SWOT analysis for each selected entity, which has led to the final selection of the beneficiaries.

3. Decision of the projects

The fieldwork formed the basis for the SWOT analysis for each shortlisted site. This process has led to a preliminary decision around the beneficiaries and projects. The beneficiaries and interventions were selected based on the highest positive attributes among the shortlisted sites.

The project interventions were suggested through the SWOT analysis and the extensive discussions with the beneficiaries to implement the highest-impact interventions that meet their respective needs.

The suggested projects were then discussed with REGEND partners (listed hereafter) to reach a final decision on the types of applications and interventions for each beneficiary.

4. Implementation

REGEND has led the project implementation in collaboration with the identified international and regional partners. The activities in each targeted country were realized in coordination with the responsible local facilitating team.

Thus, the implementation of the activities was based on a thorough analysis of the technical capacity of the partnering entity. This analysis has helped in identifying the capacity-building needs and changes to the initial pilot projects' design. The implementation phase has included provisions for maintenance contracts, which were included in the tenders for the installation of the renewable energy systems, and training for local beneficiaries and the community. These items are detailed in the following sections.

5. Monitoring and assessment

The project should adopt a results-based monitoring and reporting approach. To facilitate this, REGEND has developed a set of monitoring and evaluation tools, as well as a results-based framework to ensure that the desired outcomes are achieved in the most cost-effective way.

Monitoring tools should be developed to meet the project's performance indicators and revised throughout the project implementation to address any developing challenges or changing circumstances. Gender-responsive monitoring that relies on gender-sensitive indicators and gender-disaggregated data should be part of the overall monitoring system.

A periodic thorough assessment is vital in measuring the impact of the project against specific indicators.

D. Legal, regulatory and policy support

The sustainability and scalability of small-scale renewable energy technologies as enablers for rural development and women's empowerment hinges on the existing policy coherence and formulation of adequate evidence-based cross-sectoral policies and support mechanisms. To achieve this, an assessment of national

strategies, policies, and legal and regulatory frameworks needs to be conducted to ensure that the project interventions align with the energy policies and the broader development goals, including rural development and women's empowerment, while identifying gaps and inconsistencies in existing policies.

1. Legal and regulatory frameworks

Minding the regional disparities and the urban-rural divide requires a legal framework and strong local governance structures mandated by law to promote rural development. Additionally, the deployment of small-scale renewable energy technologies requires the existence of a supporting legal and regulatory framework.

Yet, in some Arab States, rural development is hindered by the limited legal mandates of the municipalities, and attempts to promote decentralization fail in heavily centralized countries that favour central government control.³⁴ There are limited projects that the municipalities can implement, even when needs assessments have been carried out and the financing has been pledged; this is particularly the case for infrastructure projects.³⁵

Moreover, regulatory and legal uncertainty also limits rural development, especially as the rural population often lacks adequate representation and the ability to organize and advocate for legal frameworks that improve their livelihoods.

Achieving equitable and sustainable development across regions requires efficient decentralization. In the absence of a legal and regulatory framework that supports decentralization, a legal framework that promotes distributed renewable energy generation needs to be developed to legitimize the role of small-scale renewable energy technology projects and integrate them within national policies and frameworks. The legal framework should provide clarity over the mandates and responsibilities of the various national and local entities.³⁶

To achieve an inclusive legal framework, a legal assessment across the various sectors relevant to the water-energy-food-climate nexus should be undertaken to ensure coherence and the absence of mismatches and conflicts that may hinder cross-sectoral implementation.

Policy support mechanisms should involve the various stakeholders, including national and local

entities, renewable energy associations, market participants and rural communities, across all the development and implementation stages.³⁷

2. Cross-sectoral approach to policy

The objective of the policy is to harness the potential of renewable energy to transform rural areas. This will be achieved through cross-sectoral inclusive policymaking. Sustainable energy projects such as small-scale renewable energy technologies should be integrated within rural development plans, as they deliver the reliable and affordable energy services that are at the foundation of the optimal operation of any sector.³⁸ Effective policymaking can promote cost-effective small-scale renewable energy technologies for socioeconomic impact in rural areas through the establishment of private markets.³⁹ To enable this, implementing agencies should build on the installed pilot projects to deliver policy support through case studies, guidelines and toolkits.

Rural development policymaking is essential in improving the livelihoods of rural communities and the economic prospects of rural areas. Sustainable, reliable and affordable energy access through distributed small-scale renewable energy systems should be at the core of rural development policy. Yet, the deployment of small-scale renewable energy technologies has so far been driven by individual initiatives, market push and through energy policy, when available. It has yet to fall within an integrated cross-sectoral policy within a development agenda.

As part of its scope, REGEND developed three case studies on policy regulatory reforms and the financial and legal frameworks needed to promote small-scale renewable energy technologies and applications in rural areas in each of the targeted countries. This has enabled an understanding of the existing frameworks and an enhancement of the policy coherence across the energy, water and agricultural sectors, and the climate impact on strategic sectors,

through informed and evidence-based gender-mainstreamed policy support.

Additionally, REGEND developed a policy toolkit for policymakers with the goal of increasing the deployment of small-scale renewable energy technologies. The toolkit provides best practices and business models, including regulatory and institutional frameworks that create an enabling environment. The toolkit also covers policy options, guidelines for financing, best practices and indicators for facilitating the deployment of

small-scale renewable energy technologies, with the purpose of enhancing livelihoods in rural areas through entrepreneurial activities, human rights and gender mainstreaming.

This all falls within the third target of REGEND: to improve opportunities for rural economic development in beneficiary Arab countries by creating an enabling environment for the private sector and women entrepreneurs to invest in income-generating activities, thus increasing the use of small-scale renewable energy technologies.

E. Gender mainstreaming strategy and plan

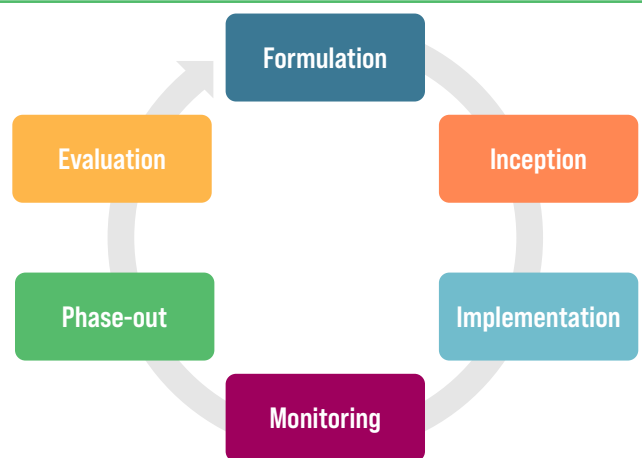
Gender mainstreaming is crucial for driving holistic economic progress. It serves as a fundamental pillar for the overall development of societies and economies.⁴⁰ Gender mainstreaming is also a concept that has received considerable attention in literature on project management, and therefore gender mainstreaming strategies should be integrated in all phases of the REGEND project cycle.

Drawing upon the technical expertise available at ESCWA, the REGEND mainstreaming strategy developed during its inception phase and in areas where the principal objective is not the promotion of gender equality but rather the promotion of other goals, such as poverty elimination, environmentally sustainable development, entrepreneurial development, social inclusion, human rights, peace support operations or economic development. Mainstreaming involved taking up gender equality perspectives as relevant in analysis, data collection and other activities, to ensure that all processes take into account the contributions, priorities and needs of the entire stakeholder group, women as well as men. Gender equality was prioritized in capacity-building, policy development, field projects and operational activities. The plan on how to ensure and monitor gender mainstreaming throughout the project life cycle and all activities

was provided in the means of verification and indicators of achievement of the project.

To ensure REGEND prioritized gender equality, the promotion of women's empowerment was fully embedded in the design, structure and expected outcomes that would make the project successful. Therefore, each of the project activities was assessed internally for engendering opportunities, and a related action plan was drawn up, specifying to what extent gender aspects would be integrated to form part of the activities. The implementation plan of the project consists of three main periods: inception period, main implementation period and phase-out period.

Figure 10. Gender mainstreaming strategy throughout the project cycle



1. Engendering the inception period

The inception phase is crucial for enhancing the embedding of gender issues in the project. REGEND ensured gender balance in the appointment of staff in charge of project management through the consultation process conducted at national, regional and international levels with women's organizations and gender networks, relying on the United Nations System-wide Action Plan on Gender Equality and the Empowerment of Women (UN-SWAP 2.0) and input from gender experts. This emphasis on gender balance also extended to the consultants involved in project activities.

REGEND developed three studies on gender mainstreaming, social inclusion and human rights in each of the targeted countries: [Jordan](#), [Lebanon](#) and [Tunisia](#). The studies assessed the socioeconomic, legal, financial and gender-related challenges associated with energy provision in rural areas. The assessments enabled the identification of opportunities for interventions to support the local community and productive sectors, and to promote the productive use of small-scale renewable energy technologies.

The studies were presented and discussed at national workshops in the three targeted countries – [Jordan](#), [Lebanon](#) and [Tunisia](#) – and at [international forums](#). These discussions identified key recommendations to ensure the use of renewable energy applications in rural contexts for the benefit of women. The project also took the initiative to establish a gender-based advisory network, targeting the development of energy and entrepreneurial skills in rural settings.

Based on these studies and consultation, the project plan and the monitoring and evaluation system were reviewed with an in-depth gender lens using gender-sensitive indicators and ensuring the collection of gender-disaggregated data to the extent possible and where available.

2. Engendering the main implementation period

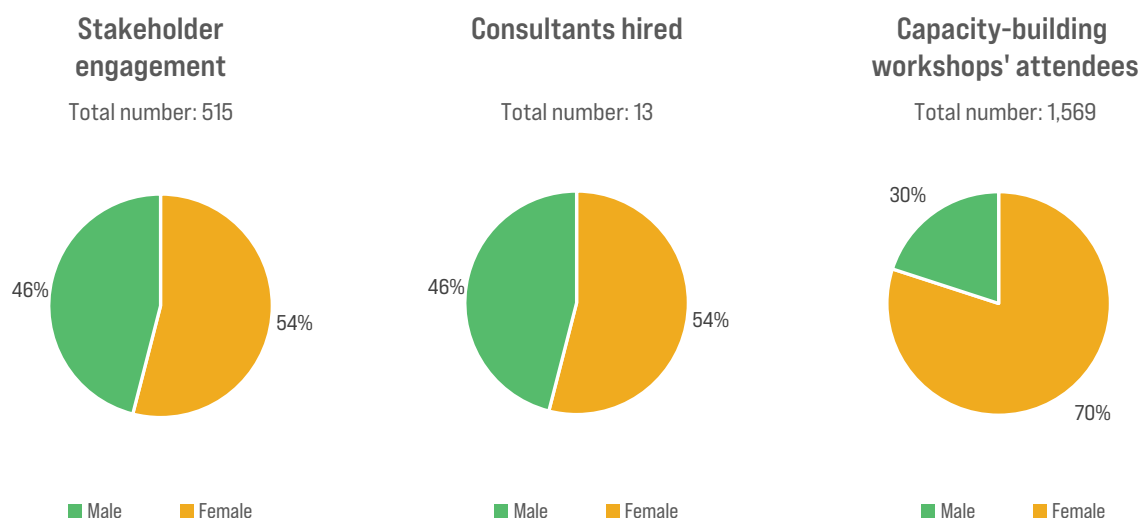
During the main implementation period of the project, mainstreaming of gender equality was enhanced by:

- ▶ Ensuring that at least a critical mass of 30 per cent of women is represented at the highest decision-making level of the project.
- ▶ Being gender-responsive in the results-oriented activities by identifying the implications of the project activities and results for women as compared to men. This includes making adjustments, when deemed necessary, to prevent the project from perpetuating gender inequalities and to ensure that women's empowerment and gender equality will be enhanced throughout the implementation stage.
- ▶ Keeping records on gender-disaggregated project data and being transparent and accountable for the deliveries to men and women.
- ▶ Enhancing ownership by men and women through internal participatory monitoring processes, especially regarding processes to promote gender equality.
- ▶ Including gender-responsive budget analysis of the project in the progress reports in order to link the commitments to gender equality and women's human rights to the distribution, use and generation of the project resources.
- ▶ Ensuring that gender experts review all materials and knowledge products developed for publication in the project.

Consequently, 54 per cent of the 515 stakeholders engaged throughout the project were women. In addition, 54 per cent of the 13 consultants hired for the project were women. Moreover, and as detailed in the capacity-building best practices section, 80 per cent of the cumulative 1,569 capacity-building workshop attendees across the countries were women.

The gender-disaggregated data are presented below:

Figure 11. Gender data for the stakeholders, consultants and workshop attendees



3. Engendering the phasing-out period

The phasing-out period is the last period of the project before external funding ends. Here, the sustainability of the project is tested, becoming more viable when beneficiaries are actively involved throughout the project cycle. To facilitate a smooth and equitable transition, REGEND ensured the following arrangements:

- During this period all responsibilities are handed over to the local and national partners. To ensure that follow-up actions will continue in a gender-responsive way, it is important to pass the responsibilities to gender-aware local partners.
- Maintenance plans were put in place through the local facilitating teams, beneficiaries and training of trainers. The more ownership of the project results by both women and men has been achieved, the easier it will be to put maintenance plans in place that are owned and controlled by both genders.
- The project management ensured that all relevant skills are effectively transferred. This means that to the extent possible, efforts were

made to ensure that both women and men are beneficiaries of capacity-building workshops to enhance technical, entrepreneurial and professional skills. This also means that due consideration was given to confirm that skills and expertise on mainstreaming gender equality in related areas of rural development were effectively transferred.

- To the extent possible, the budget for follow-up through the technical advisory services was ensured after the completion of the REGEND activities by ESCWA. This was reflected in the expansion of REGEND in Algeria and Mauritania using the REGEND business model.

4. Engendering the evaluation stage

The engendering of the project evaluation stage needs to include gender equality issues to be addressed that adhere to certain criteria in terms of relevance, efficiency, effectiveness, impact and sustainability, and that are in compliance with the United Nations rules and evaluation frameworks. Further information can be found at the following link: <http://www.uneval.org/>.

The gender balance or adequate level of gender expertise was ensured during REGEND evaluation by the evaluation team. The evaluation report was based on qualitative and quantitative data disaggregated by sex to measure results and long-term outcomes for both women and men. Gender equality issues were included to the extent possible in all sections of the evaluation report – i.e. in the executive summary, the main text, the conclusions and recommendations, and the annexes – as appropriate, rather than mentioning them only in a separate section devoted to gender.

5. Engendering the monitoring of the project

Monitoring is an engine for project effectiveness. Participative processes to monitor and review the gender-specific results of the project are

being used to ensure maximum transparency and accountability on gender issues. Moreover, it will help bolster ownership of the project's expected accomplishments among women and men and can become an instrument for women's empowerment. Developing a set of gender-disaggregated performance indicators, with gender-disaggregated data, is necessary to facilitate monitoring and evaluation. Accordingly, the monitoring performance is included as a key component of building accountability into the project. The REGEND Log Frame and its means of verification on gender indicators were used and have been updated during the inception phase to further clarify the gender-sensitive interventions, means of verification and indicators of achievement at the level of each output and activities.

F. Flexible and adaptive approach to technical and financial aspects

Flexibility is a major pillar in the implementation of small-scale renewable energy projects in rural areas, and which covers the technical and financial readiness to adapt to emerging requirements and changing circumstances. This principle emphasizes the importance of designing projects with an adaptive approach, allowing for variations as the project evolves and the context changes. It also underscores the necessity of setting aside financial reserves or creating adaptable financing models to cover additional work or the procurement of new equipment that may become essential for the optimal performance of the productive activities during the implementation of the project. Thus, renewable energy systems for rural development initiatives can effectively respond to the dynamic nature of the project, community needs and financial considerations by incorporating flexibility into the project's core strategy. Additional technical and financial considerations are listed hereafter.

1. Financing

Affordability plays a vital role in making renewable energy technologies accessible to rural communities. These small-scale systems will be deployed in communities where poverty is widespread and income levels are low. Building affordable solutions requires overcoming a multitude of financial barriers, which should be done through innovative financing mechanisms such as microfinance and revenue-based financing schemes. This will provide rural communities with sustainable energy solutions without burdens to their finances.

The decentralized renewable energy technologies model has been gaining momentum in areas where there has been an uptake in focus on meeting Sustainable Development Goal 7 targets and investments in rural electrification, such as

in Asia-Pacific and sub-Saharan African countries.⁴¹ The success of the decentralized model, however, hinges on the ability of this market segment to attract investments. Several innovative models are emerging to reduce the financing barriers for distributed renewable energy technology solutions, and to make them accessible to the wider public, including rural communities. Yet, oftentimes, minor public funding remains necessary to support the operating costs of renewable energy technologies in order to make them affordable for rural beneficiaries.

REGEND was uniquely designed and positioned to offer services and products in areas of widespread poverty, where affordability is a challenge. The REGEND business models toolkit provides guidelines and details on various models to identify the optimal business solution for the renewable energy technology deployment for each project.⁴² Special attention should be given to the following items:

a. Assessing end users' willingness to pay

Understanding consumer needs, preferences and their willingness to pay for small-scale renewable energy technologies in rural areas is essential for the successful implementation of sustainable energy solutions. In order to effectively cater to the energy demands of rural communities, it is crucial to collect data on their specific requirements and willingness and ability to pay.

Ensuring that the developed renewable energy technology business model is accessible and financially viable for the rural community needs to be done by assessing their ability to pay. This leads to the design of tailored renewable energy solutions that empower local communities by gaining a deep understanding of consumer needs and conditions.

b. Securing capital and operational financing

In general, the greatest expenditure in small-scale renewable energy technologies is the initial capital costs and, to a lesser extent, operational costs. The capital expenditures comprise the costs of procurement, design, transport, storage, supply

and installation. Operating costs represent a lower margin and include maintenance and operations, Internet (for remote monitoring, for example), systems' expansion and growth prospects, and replacement costs when needed. Operating costs should also account for variation orders, changing circumstances and thus increasing overhead.

In rural areas, capital expenditures can be provided through grants or private investments. The largest share of capital financing for renewable energy technologies in rural areas has so far derived from grants from Governments, local and international organizations, development and aid agencies, among others.⁴³ Such has also been the case for REGEND, which has been designed to provide equipment and services targeting vulnerable populations with low purchasing power in rural areas. REGEND has therefore relied on grants to secure implementation and long-term economic sustainability.

In this regard, redirecting donor energy grants towards rural productive activities is a strategic move that can yield significant benefits. Furthermore, it is essential for corporate social responsibility initiatives to extend their reach to rural areas and actively pursue economic benefits. This can be achieved by promoting the adoption of small-scale renewable energy solutions which would not only contribute to protecting the environment but also empower local communities by creating jobs and stimulating economic growth in these marginalized areas.⁴⁴



In general, the greatest expenditure in small-scale renewable energy technologies is the initial capital costs and, to a lesser extent, operational costs.

Private investments, however, are typical project financing mechanisms, through equity, credits or loans. Additionally, innovative financing mechanisms have been emerging to reduce the burden of the upfront capital costs. Renewable energy technology developers have been setting up business models that recoup capital and operational costs – and generate profits – while constituting an affordable option, particularly for rural communities. Such models operate in various ways: on a lease basis, peer-to-peer, through long-term power purchase agreements, pay-as-you-go models and instalment mechanisms.

c. Blended finance

In economically disadvantaged areas, it may be necessary to guarantee the capital and operating costs of renewable energy technologies by leveraging a combination of resources. This could involve a strategic mix of public funds, subsidies and customer fees tailored to the unique circumstances of the project at both national and local levels.⁴⁵

The use of public funds can be foundational for financing renewable energy technologies in rural areas. Governments can allocate resources to support these projects, recognizing their long-term benefits such as reducing greenhouse gas emissions and enhancing energy security. Public funding can help bridge any financial gaps that hinder private sector involvement and attract



In economically disadvantaged areas, it may be necessary to guarantee the capital and operating costs of renewable energy technologies by leveraging a combination of resources.

additional investment. This funding would also help to de-risk small-scale renewable energy technologies in rural areas.

Furthermore, incorporating customer fees into blended finance models ensures sustainability while aligning with local economic conditions. Tailoring these fees based on the unique circumstances of each project helps distribute costs fairly among end users while providing predictable revenue streams necessary for covering operational expenses over time.

Blending and aggregating these various funding resources into a common structure leverages those funds effectively while minimizing reliance on any single financing mechanism.

Box 14. Solar Securitization Pilot for Rwanda

The Solar Securitization Pilot for Rwanda aims to revolutionize the solar industry by aggregating loans from various solar developers. This concept involves creating an asset-backed security that can be traded, unlocking capital and fuelling the expansion of the solar home system market. Although still in its pilot development phase, this proposed issuance has been sized at an impressive \$9 million, with the potential to provide clean and affordable energy solutions to 175,000 households. The concept aims at redefining access to sustainable power on a massive scale.

In Rwanda alone, this scheme has the potential to reach \$100 million. Its main target is to provide access to 2 million households, thus making a significant impact on energy accessibility. Moreover, the scheme has a scale-up potential to expand into other countries that share similar economic and institutional conditions.

d. Fiscal and financing incentives

The provision of fiscal and tax incentives to rural MSMEs for the implementation of small-scale renewable energy technologies would further support their market development.

Introducing small-scale renewable energy technologies as a means of subsidizing home-based and new businesses comes with multiple benefits. Not only does it incentivize other businesses to invest in renewable energy systems, but it also plays a crucial role in supporting these businesses during their initial production stages. This support fosters sustainable growth and encourages households and enterprises to integrate renewable energy solutions within their premises and lines of operations.

This could also work through the implementation of low taxation measures for rural businesses following their adoption of small-scale renewable energy technologies to stimulate investments in these areas. This will not only boost the economic performance of rural regions but also replicate the success in urban centres.⁴⁶

Additionally, the redirection of fossil fuel subsidies into public financing for small-scale renewable energy technologies also plays a significant role by reducing the upfront costs associated with renewable energy technology deployment. These incentives encourage both individuals and businesses to adopt clean energy solutions by making them more affordable. Finally, international organizations and donors should also aim to establish a guarantee fund to ensure and compensate for any material risk in the components of a solar PV system installation.⁴⁷

e. Targeted low-interest loans

Financing mechanisms, such as soft loans, should be developed with local and international finance institutions to alleviate the barriers for renewable energy technologies in rural areas and women's economic inclusion. These

mechanisms should be established through dedicated vehicles in partnership with local financial institutions to offer low-interest loans in specific sectors such as agriculture, agrifood and other industries, specifically designed for renewable energy integration in rural areas. To establish such mechanisms, a specialized de-risking fund is needed to lower interest rates and allow collateral-free debt for small businesses.⁴⁸ These loans should also account for the unstable and uncertain cash flow of small rural businesses. These vehicles for soft loans could additionally provide financing instruments to private companies that lease renewable energy projects to rural MSMEs.⁴⁹

f. Microfinance and revenue-based financing

Microfinance institutions step in where commercial banks are not the most suitable vehicles, as there is a need to account for the nature of small rural businesses that have a low borrowing capacity and whose revenues are generated from low-income populations facing several risks.⁵⁰

Thus, microfinance institutions that do not increase the debt's interest rates and require high collaterals to mitigate the risks of uncertainties are vital for the deployment of small-scale renewable energy technologies, particularly for MSMEs.



International organizations and donors should also aim to establish a guarantee fund to ensure and compensate for any material risk in the components of a solar PV system installation.

Microfinance institutions aim to extend small loans to businesses such as MSMEs that may not necessarily meet the conditions for lending from commercial banks. As such, microloans are tailored to be of low value and offer flexible repayment options. They are particularly suitable for businesses operating in rural areas and within the informal sector. These businesses often turn to informal credit and microfinance solutions to secure capital for their ventures. In addition to these traditional options, impact investors and technology-driven platforms like peer-to-peer lending are emerging as viable alternatives for microfinance.⁵¹ As well as providing financial assistance, microfinance institutions offer other

services such as financial literacy, which is crucial for MSMEs, especially those that are women-led businesses in rural areas.

Another mechanism that should be more widespread for rural businesses seeking funding is revenue-based financing. This financing scheme allows businesses to secure funds based on their projected future revenue. This would allow the financing of small-scale renewable energy technologies through the significant savings incurred from energy bills following system implementation. Under this scheme, the lending institution receives a percentage of the business revenue for a specific period and until the full amount is recouped.

Box 15. Solar Sister

Solar Sister is making a difference in Africa by empowering women entrepreneurs to become agents of change in their communities. This social enterprise operates across multiple African countries, enabling rural women to sell solar products. Solar Sister achieves this by providing these women with microloans that allow them to purchase essential equipment such as solar lanterns, solar home systems and other solar-powered solutions.

The availability of these microloans enables women to start and run income-generating activities. Thus, these microloans by Solar Sister are creating a positive ripple effect for the community.

Box 16. Savings and credit cooperative organizations

To address the issue of high transaction costs associated with potential repayment risks in financing MSMEs, savings and credit cooperative organizations are a mechanism that was established to offer essential financial services and support to these MSMEs through low costs.

In 2021, savings and credit cooperative organizations had 2,541 registered customers in the United Republic of Tanzania, offering them share capital, loans and grants in addition to targeted grant funding supported by either the public sector or various donors. The Tanzania Association of Micro finance Institutions (TAMFI) is a non-profit umbrella association for microfinance institutions in the United Republic of Tanzania.

TAMFI engages with local community leaders, government agencies and non-profit organizations to gain acceptance within rural communities. It additionally collaborates with its member microfinance institutions to provide clients, especially those in rural areas, with financial products that are tailored to specific needs. TAMFI also encourages its members to establish branches in rural areas and conducts needs assessments to understand the needs of the people in the areas in which it is operating. In addition to promoting technology and the use of digital financial services and mobile banking, especially in remote areas, TAMFI conducts financial education campaigns and capacity-building to empower rural residents with the knowledge needed to make sound financial decisions.

Box 17. Pay-as-you-go

Emerging end-user financing mechanisms, such as the pay-as-you-go system, allow renewable energy technologies to be accessible to a wide market segment. The pay-as-you-go model reduces the cost of setting up the solar system while charging very low upfront costs.

Kenya is one of the countries where pay-as-you-go models are predominant, and among these models is M-KOPA Solar. M-KOPA offers solar home systems with capacities ranging from 5 to 20 watts that power basic appliances such as LEDs and mobile phone chargers on a pay-as-you-go basis. Customers can assume full ownership of their solar home system after a certain period of time through an arrangement known as “rent to own”. The company currently operates in Kenya, Uganda, Nigeria and Ghana and has reached 3 million customers. The system costs a little over \$200 and end users are required to pay a small portion of the product’s cost upfront equalling around \$35. After that, end users make daily payments to the company equalling around \$0.5 per day, which covers the remaining cost of the product and a small service fee. Once all payments are completed, M-KOPA ceases its daily collection plan, and the customer takes full ownership of the product. Customers are also offered additional accessories and upgrades.

2. Technical

Integrating renewable energy solutions into rural areas requires significant planning and design strategies to ensure long-term success and sustainability. Below are key best practices across different aspects of implementing small-scale renewable energy systems, from licensing and design to operation, maintenance and future expansion.

a. Designing for durability and sustainability

An assessment must be conducted to ensure that structures can withstand the additional loads from the system components such as solar PV panels and mounting structures. These components must be corrosion-resistant and ammonia-resistant, especially in farm settings where ammonia emissions are high. This ensures the longevity and durability of the installations in various environmental conditions. In the absence of shop drawings and data, building the load profile and schematics for the electrical systems will be necessary for the optimal system design.

b. Adapting to local infrastructure conditions

The engineering work should align with the rural nature of the projects. In locations lacking a reliable grid or suffering extensive power supply shortages,

the renewable energy systems must include battery energy systems, and must be capable of operating in hybrid modes: on-grid and off-grid, with an additional existing power source such as diesel generators. The technical team must carefully consider the cost implications, as the need for sophisticated systems and expensive batteries can significantly increase overall project costs.

c. Initiating approval and licensing processes early

The approval or licensing process must be initiated from the project’s inception stage, to mitigate any risks of delays. Engaging with partners as per the “partnership and engagement” pillar is critical in this as well. The early start to approval-seeking is crucial for smooth project progression and to address any regulatory requirements upfront. The stringent regulations for obtaining licences in Tunisia for the commissioning, inspection and grid connection of the solar PV systems required effective coordination by REGEND with official authorities from the early design stage.

d. Ensuring connectivity and remote monitoring

Remote monitoring systems enable real-time tracking of system performance and can alert to issues, facilitating prompt response and minimizing system downtime. Yet, considering

the potential for unreliable Internet service in rural areas, it is essential to account for Internet data bundles over extended periods at the design tendering stage. This strategy was exemplified by REGEND, which included a two-year data bundle purchase in the contracting company's scope of work. Plans should also consider longer purchasing periods and an extended data storage capacity within the data logger, safeguarding data integrity even if the purchased Internet service fails.

e. Establishing robust operation and maintenance frameworks

It is critical to establish comprehensive operation and maintenance frameworks from the project's inception phase to ensure the sustainability of the renewable energy systems. Recognizing that local communities may not have the necessary skills or capacity to manage these systems, implementing agencies must develop that capacity, as described below, and put in place detailed operation and maintenance protocols. This includes adequate handovers and clear guidelines on the responsibilities of each stakeholder involved.

f. Training for local technicians

Enhancing the technical capacity of local communities or technicians for basic maintenance and troubleshooting is crucial and ensures the system's sustainability. In addition to accounting for extended operation and maintenance contracts, as listed below, building the technical capacity of the beneficiaries is critical for the sustainability of the system and technology transfer. This includes developing operation and maintenance manuals by the contracting company as part of the project's scope of work and building the local capacity.

Extensive training sessions for the beneficiaries' representatives, local technicians and young students from the villages' technical schools were carried out by the REGEND team and the contracting firm. This also introduces young students to new potential jobs in the future.

g. Securing long-term maintenance contracts

As exemplified by REGEND, a two-year maintenance contract with the contracting company is essential for the ongoing performance and sustainability of the systems. However, extending these maintenance contracts beyond the initial period is advisable. This approach safeguards the investment and ensures that systems remain functional and efficient over time.

h. Provisioning for spare parts and replacements

The project's scope should include purchasing additional solar PV panels to be kept on-site for quick replacement if needed. For example, the REGEND scope of work included the equivalent of 5 per cent of the total capacity. In remote areas, where the risk of damage is greater, procuring a higher percentage of spare units is advisable to mitigate downtime and ensure resilience against unforeseen damages.

i. Drafting post-maintenance agreements

It is vital to formalize agreements with the beneficiaries that detail the operation and maintenance procedures, roles and responsibilities of each party, after the contracted maintenance period. These agreements ensure that the framework for system care and maintenance continues seamlessly, fostering a sense of ownership and responsibility among the beneficiaries.

j. Preparing for troubleshooting and unforeseen events

Despite best practices in design, implementation and maintenance, unforeseen events such as natural disasters or technical faults (e.g. lightning strikes damaging communication lines) can disrupt system operation. A predefined framework to address troubleshooting and force majeure situations is essential. This plan should outline steps for rapid response, repair and restoration to minimize downtime and maintain system reliability.

k. Anticipating future capacity needs

It is important to incorporate a margin for capacity overhead at the design stage, recognizing that the initial solar PV system design might not fully meet the expanding needs of beneficiaries' productive activities over time. This allows for some degree of expansion without requiring a complete overhaul of the system, therefore sustainably managing future demands.

l. Establishing a framework for follow-up and expansion

It is crucial to also develop a structured framework for follow-up and potential significant system expansion to address the inevitable changes in demand. This framework should be developed in collaboration with the beneficiaries to ensure it aligns with their evolving needs and capacities.

Part of this framework should focus on capacity-building, particularly in financial management related to the savings generated from reduced energy bills. Building the beneficiaries' capacity in reinvesting a portion of these savings into their business and the renewable energy systems can foster sustainable growth and system scalability.

m. Implementing a reporting and assessment protocol

A critical component of the follow-up framework is the establishment of a robust reporting mechanism between the implementing agency and the beneficiaries. An annual reporting template or a similar tool can facilitate regular updates on system performance, financial savings and any challenges faced. This reporting helps in the projects' impact assessment and capturing valuable lessons learned that can inform future initiatives.

G. Capacity and knowledge building

A major contributor to the high-impact factor of the REGEND initiative is the focus on building local capacity from the early stages till the phase-out and follow-up. Building the capacity of the rural community has therefore been showcased as a key pillar of building an ecosystem and ensuring the optimal productive usage of small-scale renewable energy systems.

These activities should be carried out from the initial stages of the project. Recruiting the trainers from the early stages to accompany the beneficiaries throughout the journey may also increase the benefits and productivity of the rural businesses, especially those that are women-led.

The challenges identified within the needs assessment in terms of the necessary skills to start and manage a business render the elimination of barriers to women's entrepreneurship as a key priority in developing an integrated framework.⁵²

REGEND developed and implemented capacity-building programmes and training manuals which aimed to improve the knowledge and enhance the skills of rural women. The focus was to improve their income-generating activities for their own benefit and for the benefit of the entire community where, in some instances, they have become trainers themselves, spreading the knowledge and skills acquired in a cascading manner and ensuring a lasting impact. Thanks to a simplified scientific and water-energy-food nexus approach integrating lectures, exercises and practical training in the field, the workshops enabled the trained rural women to build their scientific and technical capacities. These workshops were developed as a curriculum with regional relevance and made available to a wide audience.

REGEND was selected in 2021 as an [SDG Good Practice](#) for its capacity-building initiatives and productive equipment on good practices related to agriculture, food processing and marketing,

small-scale renewable energy technologies, water-energy-food nexus applications, marketing and entrepreneurship, packaging, labelling and marketing of food products, municipal planning, management and finance, among other areas.

The beneficiaries have expressed that these workshops have had a lasting impact on their capacity development and inclusion. Equally important, it is worth noting that thanks to these workshops, it was possible to ease some of the social norms prevalent in rural areas where experts who were men were able to mentor women participants and demonstrate that men are also capable of working in the kitchen on food manufacturing such as producing jams and cheese. In the early stages of the capacity-building workshops, women were often accompanied by their husbands or children. Yet, as the project ensured the safety and adherence to cultural norms in the delivery of the workshops, an increasing number of women started attending on their own. REGEND also accounted for transportation to training venues in order to make the workshops more accessible to rural women who often lack the transportation means and costs.

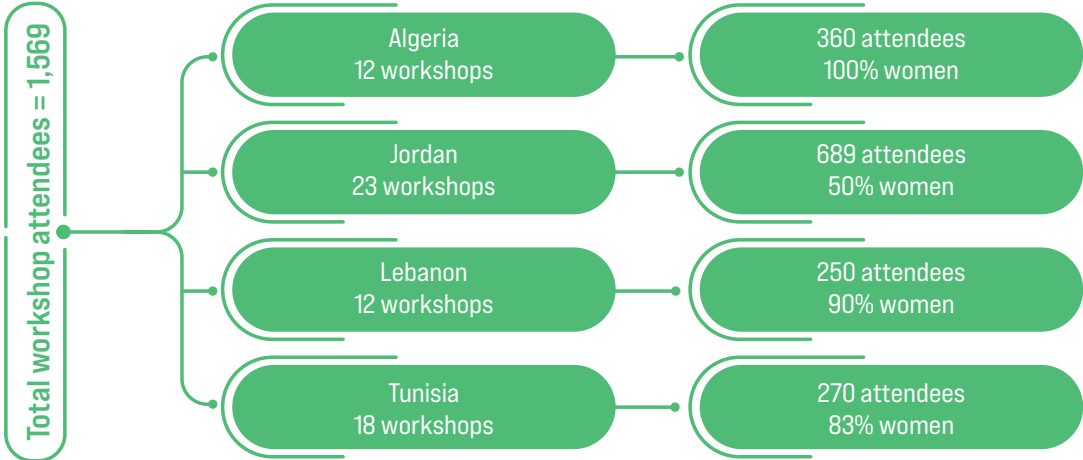
The skills acquired by the beneficiaries enabled them to expand their income-generating activities, and often become trainers of other rural women in neighbouring areas. Training also included awareness-raising workshops on renewable energy and energy efficiency and their applications and benefits to the rural communities.

Training cycles and training manuals were delivered by REGEND across Algeria, Jordan, Lebanon and Tunisia, and were attended by a total of 1,569 participants, 70 per cent of whom were women. In Algeria, 12 workshops were delivered in partnership with the Arab Organization for Agricultural Development and were attended by 360 participants, with 100 per cent female participation. In Jordan, 23 workshops were delivered and attended by 689 individuals, 50 per cent of whom were women. In Lebanon, 12 capacity-building workshops were delivered and attended by 250 beneficiaries, 90 per cent of whom were women. In Tunisia, 18 workshops were delivered to 270 attendees, 83 per cent of whom were women.

The training manuals for the renewable energy technology applications, agriculture practices and the water-energy-food nexus were based on a multitude of available ESCWA knowledge products as references, and have been made publicly available via an online platform that was established and maintained as part of REGEND: <https://www.unescwa.org/regend>. The training materials include the following:

- ▶ [Renewable energy operational toolkit.](#)
- ▶ [Good practices guide for agriculture, post-harvest processing, manufacturing, packaging and labelling within the framework of training on the sustainable use of energy.](#)

Figure 12. Gender data for workshop attendees per country



H. Sustainability and scalability

The “sustainability and scalability” pillar is fundamental to the long-term success and expansion of small-scale renewable energy projects that promote gender mainstreaming and rural growth. This pillar emphasizes the importance of establishing practices and models

that adapt and grow to meet evolving needs.

The following table showcases the suggested measures for the cross-cutting issues to ensure the long-term sustainability of the project after it ends.

Sustainability aspects	Measures to enhance sustainability and ownership of the project outcomes
<p>Political/Institutional sustainability</p>	<ul style="list-style-type: none"> • Institutional sustainability is strengthened in the project with: – Objectives linked to existing national policies and programmes – Government strategies geared towards poverty reduction and supportive of participatory design – Activities mainstreamed into existing agencies. • Functional institutions will be self-sustaining after the project ends through the training of trainers programme and would have access to the project knowledge product. • The implementing partners and national institutions selected within the framework of this regional initiative are active in the development of rural areas and work in line with national government priorities. • The technical advisory services that member States could benefit from through “regional knowledge”.
<p>Social sustainability</p>	<ul style="list-style-type: none"> • Gradual and participatory process of community-led project design. The project at inception already enabled a gradual and participatory process and will continue to engage with local targeted communities. • Social mobilization and capacity-building for community organizations would support the acceptance of the project and use of its outputs beyond the project’s timeframe. • Gender equality is an integral part of the project activities and outputs and as a cross-cutting priority along the various phases of its implementation: through the steering committee and each local facilitating team, the gender-based advisory network, pilot projects, involvement of women’s associations as an implementing partner, mentors and agents of change, gender mainstreaming strategy and plan. • The gender-based advisory network on energy and entrepreneurial skills in rural development, which builds on international experience and involves partners and non-governmental organizations (NGOs) that help support the sustainability of the project. • Equal participation of women at the various national and regional capacity-buildings activities, including the training of trainers, to constitute a “live knowledge”.
<p>Ownership</p>	<ul style="list-style-type: none"> • Promoting a sense of community ownership by using a bottom-up and multi-stakeholder participatory approach as an effective method for rural development initiatives. • Fostering a sense of community ownership and facilitating a process of capacity-building appropriate to the local context to ensure that rural communities, local governments, and households accept and own the outcomes of the project in ways that are sustainable. • Strong involvement of the local facilitating teams, the gender network and the rural practitioners’ network at the national level. • Contribution of women’s associations as an implementing partner, mentors and agents of change. • Multi-stakeholder forum to bridge the communication gap between the various stakeholders, build effective and sustainable partnerships for coordination, wide dissemination of project results and lessons learned. • Social mobilization and capacity-building efforts by emphasizing support for traditional institutions. The involvement of the private sector and financial institutions support building on the project outputs for enhancing its results. • Communication plan to ensure stakeholder engagement and provide accurate access to relevant information and ownership.

Technical sustainability

- Technical standards employed in service delivery and infrastructure development thoroughly reviewed to determine whether the entrepreneurs (in charge of the field project) can operate and sustain project interventions with the financial, social and human capital available to them once the project ends.
- The partnership agreement signed with the implementing entity and each contractor of the renewable energy field projects, including procurement, clearly specifies the contingency plan for any malfunctioning, quality control, maintenance, loss or damage.
- Technical training for the trainers who would ensure the maintenance and reparation of the equipment after the project completion. In addition, the operation and maintenance contract should consider potential damage repairs.

An effective communication strategy is central to achieving this sustainability and scalability, which ensures that project achievements, lessons learned and best practices are disseminated to partners and the broader community. This strategy facilitates ongoing engagement, fosters transparency, and supports the scalability and replication of similar business models.

REGEND has therefore focused on developing a solid communication strategy and knowledge products to promote and support the development of integrated approaches for the productive use of small-scale renewable energy technologies for sustainable rural development.

REGEND was featured in the United Nations High-level Dialogue on Energy 2021 Theme Report on Enabling SDGs Through Inclusive, Just Energy Transitions by highlighting its contribution towards energy for prosperity – renewable energy, gender equality and education. REGEND was also praised in the 12th session of the ESCWA Committee on Energy in 2019 as an effective initiative in supporting the interlinkages between energy, water and food. During the 13th Session of the Committee on Energy in 2021, the importance of promoting the REGEND business model among ESCWA member States and adopting the regulatory and institutional tools and frameworks emanating from the initiative and directed at policymakers, with attention to rural women and young people, was emphasized. Finally, REGEND was featured on Tunisian national television during a report covering its women’s empowerment activities and impacts in Chorbane, Mahdia, as well as on the ESCWA YouTube channel covering the project’s initiatives in Akkar, Lebanon.



An effective communication strategy is central to achieving this sustainability and scalability.

The communication strategy revolved around the following outlets:

1. Communication meetings through focus groups and local facilitating team meetings for communication with stakeholders; on-site visits and meetings with beneficiaries.
2. Knowledge products to support policymakers, international and local organizations, public entities and finance institutions.
3. Dissemination of knowledge products through workshops, webinars and forums.
4. Using ESCWA media platforms, including through videos, interviews and so on.

A key factor in amplifying the impact of the project is the elimination of the need to develop and rediscover knowledge, and the dissemination of challenges and best practices. This enables organizations implementing similar projects to redirect valuable time and resources towards other activities, while benefiting from the lessons learned. The knowledge products that have been developed are publicly accessible via the REGEND online platform, accessible at: <https://www.unescwa.org/regend>. They cover the following topics:

General	Small-scale renewable energy technological solutions in the Arab region: Operational toolkit (2020)
	Good practices guide for agriculture, post-harvest processing, manufacturing, packaging and labelling within the framework of training on the sustainable use of energy (2021)
	Social, economic and environmental impact assessment report of REGEND (2022)
	REGEND Factsheet (2022)
	REGEND Business models toolkit (2022)
	REGEND Policy Toolkit (2022)
	The REGEND online course
Jordan	Study on gender mainstreaming, social inclusion, human rights processes and outcomes of access to energy in targeted local communities in Jordan (2020)
	Assessment Report of Prevailing Situations in Rural Areas in Jordan (2021)
	Case study on policy regulatory reforms and financial and legal frameworks to promote small-scale renewable energy technologies and applications in rural areas in Jordan (2021)
Lebanon	Assessment report of prevailing situations in rural areas in Lebanon (2020)
	Study on gender mainstreaming, social inclusion, human rights processes and outcomes of access to energy in targeted local communities in Lebanon (2020)
	Case study on policy regulatory reforms and financial and legal frameworks to promote small-scale renewable energy technologies and applications in rural areas in Lebanon (2021)
Tunisia	Assessment report of prevailing situations in rural areas in Tunisia (2020)
	Study on gender mainstreaming, social inclusion, human rights processes and outcomes of access to energy in targeted local communities in Tunisia (2021)
	Etude de cas : « Cadres institutionnels, réglementaires, incitatifs et financiers nécessaires pour promouvoir les technologies et applications des énergies renouvelables à petite échelle pour le développement rural en Tunisie » (2021)

The scalability of the project is showcased in its replicability across other countries, starting with Algeria and Mauritania, following the demonstrated positive impact in the three initial targeted countries: Jordan, Lebanon and Tunisia. This expansion of the REGEND initiative's activities, listed previously in table 6, underscores

the flexibility and effectiveness of the field projects in enhancing rural economic growth and sustainability. The ability to scale across borders also highlights the vast potential of REGEND as a transformative, integrated model for the sustainable development of rural areas and gender mainstreaming across Arab countries.

A person is working in a field, with their legs and feet visible in the lower portion of the image. The scene is partially obscured by a large, semi-transparent green and orange geometric overlay that dominates the foreground. The background shows a field with rows of plants and a bright sky.

05

Conclusion



This toolkit explored best practices for the deployment of small-scale renewable energy systems for the promotion of economic growth, social inclusion and environmental sustainability in rural areas, with a strong focus on gender mainstreaming. These best practices align with the Sustainable Development Goals (SDGs), particularly SDG 1 (no poverty), SDG 5 (gender equality), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 10 (reduced inequalities) and SDG 13 (climate action), through an integrated, demand-driven and flexible approach.

The integrated business models, strategic partnerships, and comprehensive governance frameworks developed by REGEND and discussed in this toolkit not only cover energy needs but also catalyse broader socioeconomic development and gender mainstreaming.

Scaling up this initiative across the Arab region and in other developing countries presents an unmissable opportunity to transform rural development. This expansion requires a collaborative effort among Governments, international organizations, the private sector and communities to share knowledge, mobilize resources and replicate the integrated business models. The path forward involves enhancing regional cooperation through leveraging REGEND platforms for knowledge exchange and capacity-building to share best practices and lessons learned across countries. It also includes mobilizing financing and attracting capital through supportive regulatory and policy frameworks and financial mechanisms. At the core of all this lies building capacity by emphasizing knowledge transfer and training programmes that improve local capacities in renewable energy technologies, entrepreneurship and other soft skills that are deemed necessary by the local community. Finally, ensuring the sustainability of these models ensures an enduring positive impact.

Endnotes

- 1 ESCWA, 2019, p. 22.
- 2 ESCWA, 2024.
- 3 Ibid.
- 4 ESCWA-IsDB, 2023, p. 6.
- 5 Ibid.
- 6 ESCWA, 2023, p. 2.
- 7 ESCWA, 2024.
- 8 ESCWA, 2023, p. 8.
- 9 ESCWA, 2024.
- 10 Ibid.
- 11 ESCWA, 2020c, p. 66.
- 12 ESCWA, 2020c.
- 13 ESCWA, 2021c, p. 13.
- 14 FAO, 2011, p. 42.
- 15 European Union Energy Initiative Partnership Dialogue Facility, 2015, p. 3.
- 16 ESCWA, 2021.
- 17 ESCWA, 2022b, p. 9.
- 18 ESCWA, 2020a, p. 6.
- 19 Ibid., p. 58.
- 20 ESCWA, 2021c, p. 39.
- 21 ESCWA, 2021a, p. 40.
- 22 Ibid., p. 29.
- 23 ESCWA, 2020d.
- 24 ESCWA, 2021b, p. 39.
- 25 ESCWA, 2021a, p. 42.
- 26 ESCWA, 2022a, p. 35.
- 27 ESCWA, 2021b, p. 18.
- 28 ESCWA, 2020d, p. 43.
- 29 ESCWA, 2020e, p. 21.
- 30 World Resources Institute, 2017, p. 48.
- 31 UNDP, 2022, p. 18.
- 32 ESCWA, 2022a, p. 45.
- 33 ESCWA, 2022a, p. 32.
- 34 ESCWA, 2020a, p. 24.
- 35 ESCWA, 2022c, p. 41.
- 36 ESCWA, 2020b, p. 27.
- 37 ESCWA, 2022a, p. 45.
- 38 ESCWA, 2022c, p. 27.
- 39 ESCWA, 2022d, p. 60.
- 40 ESCWA, 2021a, p. 40.
- 41 UNEP-DTU, 2015.
- 42 ESCWA, 2022a.
- 43 RES4Africa, 2019.

- 44 ESCWA, 2021b, p. 7.
- 45 ESCWA, 2022a, p. 20.
- 46 ESCWA, 2021a, p. 62.
- 47 ESCWA, 2021c, p. 83.
- 48 GIZ, 2020, p. 34.
- 49 ESCWA, 2021c, p. 83.
- 50 UNDP-Climate Bonds Initiative, 2022, p. 18.
- 51 Ibid.
- 52 ESCWA, 2020b, p. 55.

Bibliography

EnDev (2020). Available at https://endev.info/wp-content/uploads/2021/03/EnDev_Learning_Innovation_PUE.pdf.

ESCWA (2019). Tracking SDG 7: Energy Progress Report 2019 Arab Region. E/ESCWA/SDPD/2019/3. Available at https://www.unescwa.org/sites/default/files/pubs/pdf/energy-progress-report-arab-region-english_1.pdf.

_____ (2020a). REGEND Assessment Report of Prevailing Situations in Rural Areas in Lebanon. E/ESCWA/CL1.CCS/2020/TP.1. Available at <https://www.unescwa.org/publications/report-baseline-study-lebanon>.

_____ (2020b). REGEND Assessment Report of Prevailing Situations in Rural Areas in Tunisia. E/ESCWA/CL1.CCS/2020/TP.2. Available at <https://www.unescwa.org/publications/assessment-report-prevailing-situations-rural-areas-tunisia>.

_____ (2020c). REGEND Assessment Report of Prevailing Situations in Rural Areas in Jordan. E/ESCWA/CL1.CCS/2020/TP.5. Available at <https://www.unescwa.org/publications/assessment-report-prevailing-situations-rural-areas-jordan>.

_____ (2020d). Study on gender mainstreaming, social inclusion, human rights processes and outcomes of access to energy in targeted local communities in Lebanon. E/ESCWA/CL1.CCS/2020/TP.3. Available at <https://www.unescwa.org/publications/gender-mainstreaming-social-inclusion-lebanon>.

_____ (2020e). Study on gender Mainstreaming, Social Inclusion, Human Rights Processes and Outcomes of Access to Energy in Targeted Local Communities in Jordan. E/ESCWA/CL1.CCS/2020/TP.4. Available at <https://www.unescwa.org/publications/gender-mainstreaming-social-inclusion-jordan>.

_____ (2021a). Study on gender mainstreaming, social inclusion, human rights processes and outcomes of access to energy in targeted local communities in Jordan. E/ESCWA/CL1.CCS/2021/TP.12. Available at <https://www.unescwa.org/publications/regional-initiative-promoting-small-scale-renewable-energy-applications-rural-areas-arab-region>.

_____ (2021b). Case study on policy regulatory reforms and financial and legal frameworks to promote small-scale renewable energy technologies and applications in rural areas in Lebanon. E/ESCWA/CL1.CCS/2021/TP.5. Available at <https://www.unescwa.org/publications/regional-initiative-small-scale-renewable-energy-rural-areas-arab-region>.

_____ (2021c). Etude de cas: Cadres institutionnels, réglementaires, incitatifs et financiers nécessaires pour promouvoir les technologies et applications des énergies renouvelables à petite échelle pour le développement rural en Tunisie. E/ESCWA/CL1.CCS/2021/MANUAL.2. Available at <https://www.unescwa.org/publications/r%C3%A9glementaires-financiers-technologies-%C3%A9nergies-d%C3%A9veloppement-tunisie>.

- _____ (2022a). REGEND Business Models Toolkit. E/ESCWA/CL1.CCS/2021/TOOLKIT.2. Available at <https://www.unescwa.org/publications/regional-initiative-business-model-toolkit>.
- _____ (2022b). REGEND Factsheet. E/ESCWA/CL1.CCS/2022/FACTSHEET.1. Available at <https://www.unescwa.org/publications/small-scale-renewable-energy-technologies-rural-areas-arab-region-factsheet>.
- _____ (2022c). REGEND Policy Toolkit. E/ESCWA/CL1.CCS/2021/TOOLKIT.1. Available at <https://www.unescwa.org/publications/regional-initiative-small-scale-renewable-energy-applications-rural-areas-arab-region-policy-toolkit>.
- _____ (2022d). REGEND Social, Economic, and Environmental Impact Assessment Report. E/ESCWA/CL1.CCS/2022/TP.10. Available at <https://www.unescwa.org/publications/regional-initiative-promote-small-scale-renewable-energy-applications-rural-areas-arab>.
- _____ (2024). Arab SDG Monitor. Accessed on May 2024. Available at <https://arabsdgmonitor.unescwa.org/>.
- European Union Energy Initiative Partnership Dialogue Facility (2015). The Productive Use of Renewable Energy in Africa. Available at https://energypedia.info/images/a/a3/The_Productive_Use_of_Renewable_Energy_in_Africa.pdf.
- Food and Agriculture Organization of the United Nations (FAO) (2011). The State of Food and Agriculture. Available at <https://openknowledge.fao.org/server/api/core/bitstreams/3547e4eb-e763-44d1-88f6-8f573a361854/content>.
- RES4Africa Foundation (2019). RE-thinking Access to Energy Business Models: Ways to Walk the Water-Energy-Food Nexus Talk in Sub-Saharan Africa. Available at <https://www.engreensolutions.com/wp-content/uploads/2019/12/RES4AFRICA-RE-thinking-Access-to-Energy-Business-Models-1.pdf>.
- United Nations Development Programme and Climate Bonds Initiative (2022). Linking Global Finance to Small-Scale Clean Energy; Financial Aggregation for Distributed Renewable Energy in Developing Countries. Available at <https://www.undp.org/publications/linking-global-finance-small-scale-clean-energy>.
- United Nations Economic and Social Commission for Western Asia (ESCWA) and Islamic Development Bank (IsDB) (2023). Arab Forum for Sustainable Development: Solutions and Actions – SDG 7 Background Note. E/ESCWA/RFSD/2023/INF.3. Not Available.
- United Nations Environment Programme and Technical University of Denmark Partnership (UNEP-DTU) (2015). Enhancing Access to Electricity for Clean and Efficient Energy Services in Africa. Available at https://backend.orbit.dtu.dk/ws/portalfiles/portal/116687221/Enhancing_Access_to_Electricity.pdf.
- World Resources Institute (2017). Accelerating Mini-Grid Deployment in Sub-Saharan Africa. ISBN 978-1-56973-923-5. Available at <https://www.wri.org/research/accelerating-mini-grid-deployment-sub-saharan-africa-lessons-tanzania>.



While the Arab region boasts a high rate of access to electricity, the largest share of the population without reliable electricity is found in rural areas. Access to financing, employment, high-level education and training, and clean cooking fuels constitute some of the other challenges that rural communities face. Small-scale renewable energy systems are transformative for rural development, as they enhance livelihoods and economic conditions, support productive activities and contribute to energy, water and food security. They also aid in poverty reduction and help lower unemployment. However, they cannot be the solution to every challenge in rural communities, which underscores the importance of an integrated and multi-sectoral approach that uses renewable energy systems, capacity-building, productive equipment for income-generating activities, and policy guidelines. The Regional Initiative to Promote Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region (REGEND) best practices toolkit sheds light on a diverse range of best practices and lessons learned. It also disseminates and showcases knowledge and information generated from REGEND at the policy and technical levels to support initiatives that stimulate private sector investment, entrepreneurial development, poverty reduction, and women and youth empowerment. By focusing on job creation and developing robust value chains, REGEND promotes just and inclusive energy transitions that leave no one behind.

