Tessa
Energy Transition, Sustainable Inclusive Economic Growth in Lebanon

GUIDELINES FOR ADVANCING ENERGY COMMUNITIES IN LEBANON:

TECHNICAL, REGULATORY, & SOCIO-ECONOMIC PATHWAYS

Prepared By :
ALMEE

Reviewed by:
ICU

www.tessaproject.com

AGENZIA ITALIANA PER LA COOPERAZIONE ALLO SVILUPPO

Ambasciata d'Italia
Beirut

ICU

ALMEE 2025

CREDITS

COORDINATION AND REVISION

Mario Goraeib
Harout Hamparsoumian

AUTHORS

Lead Author
Sabine Saad

Policy and Regulatory
Adel Mourtada
Anissia Beainy
Julien Bou Gebrael

Industrial Sector, SMEs, & Job Creation
Adnan Jouni
Nadine Yehya
Clara-Rita Issa

Table of Contents

EMPOWERING LOCAL COMMUNITIES FOR A CLEAN AND RELIABLE ENERGY FUTURE

These guidelines are designed as a transitional framework to help municipalities, cooperatives, and local actors establish small-scale energy communities and micro-grids until the national grid is fully rehabilitated. During this period, these systems will primarily operate in island mode, providing reliable electricity locally. Once grid stability is restored, they can be integrated into the national network under the supervision of the Electricity Regulatory Authority (ERA).

GLOSSARY

Key Terms for Energy Communities

Energy Community

A group of people, municipalities, or organizations that produce, share, and manage renewable energy together — often through solar or micro-grid systems. Members benefit from cheaper, cleaner, and more reliable electricity.

Micro-Grid

A small, local electricity network that can operate independently from the national grid. It combines renewable sources (like solar PV), batteries, and sometimes diesel backup to ensure 24-hour power.

RE - Renewable Energy

Energy produced from natural sources that are continuously replenished, such as the sun, wind, or water. In Lebanon, most community projects use solar energy.

PV - Photovoltaic System

A system that converts sunlight directly into electricity using solar panels.

Distributed Generation

Electricity that is produced close to where it is used (for example, on a municipal rooftop) rather than at a large central power plant.

Virtual Sharing

A digital system that allows community members to share renewable electricity using smart meters, without being physically connected to the same line.

MoEW – Ministry of Energy and Water

The government ministry responsible for energy policy, planning, and coordination of renewable energy projects in Lebanon.

ERA – Electricity Regulatory Authority

The national public body that oversees and regulates electricity generation, distribution, and licensing in Lebanon.

BESS - Battery Energy Storage System

A set of batteries used to store electricity during the day and release it when needed (at night or during power cuts).

Collective Self-Consumption

A system where several users (for example, households or public buildings) share the electricity produced by a common renewable installation.

Net Metering

A billing system that credits users for the electricity they feed into the grid and offsets it against their consumption.

Combined Grants & Concessional Loans

A mix of grants and concessional loans used to make renewable energy projects more affordable and financially viable.

O&M - Operation & Maintenance

The ongoing technical management of the system after installation, including repairs, cleaning, and performance monitoring.

Grid Instability

Frequent voltage fluctuations or power interruptions in the national grid that make it unreliable for continuous use.

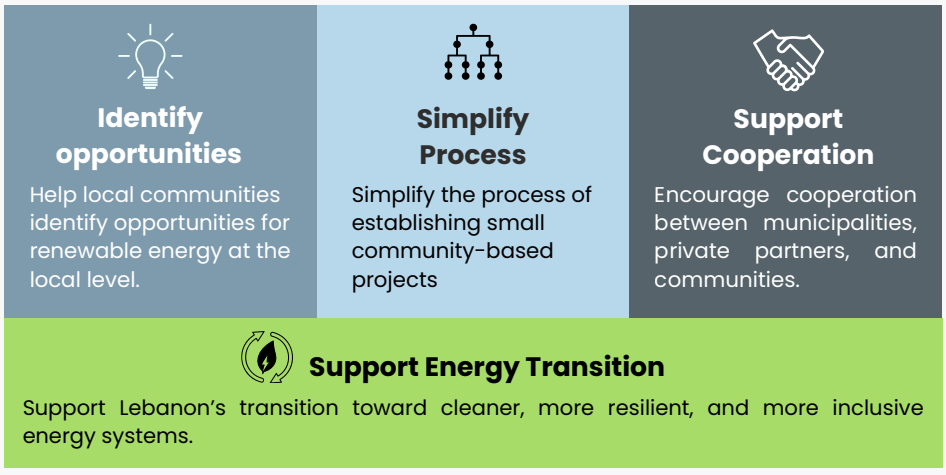
PPP - Public/Private Partnership

A cooperative arrangement between public authorities and private entities to finance, develop, and manage projects of public interest—such as renewable energy and community infrastructure—through shared investment and responsibility.

SECTION 1 - INTRODUCTION AND PURPOSE

Lebanon's ongoing energy crisis has created a strong need for local and practical solutions to improve access to clean and reliable electricity.
The concept of "energy communities" offers a way for municipalities, cooperatives, and citizens to collectively produce and share renewable energy to serve local needs.
These guidelines provide a simplified roadmap to help municipalities and local actors understand how to plan, organize, and implement small-scale renewable energy projects under the national framework of Law 318/2023 on Distributed Renewable Energy.
The Electricity Regulatory Authority (ERA) oversees the implementation of this law and is responsible for regulating and approving renewable energy activities in Lebanon.

Purpose of These Guidelines



These guidelines are written in clear and simple language to serve as a practical field tool for decision-makers, engineers, and development partners working to promote local renewable energy in Lebanon.

SECTION 2 - UNDERSTANDING ENERGY COMMUNITIES

An energy community is a group of people, institutions, or organizations who come together to produce, share, and use renewable energy for their collective benefit. This concept allows local actors to play an active role in improving energy security, reducing dependence on expensive diesel generators, and supporting environmental protection. Energy communities can take different forms depending on local conditions:

Municipal-Led Model	A single municipality that installs solar panels to power public buildings and streetlights.
Cooperative Model	A cooperative of households that invests jointly in a small solar or hybrid system.
Public Private Partnership	A partnership between a municipality and a private company that develops a shared renewable project.

These initiatives are particularly relevant in rural areas and small municipalities where EDL grid supply remains unreliable. They can help reduce electricity costs, create local jobs, and demonstrate the benefits of renewable energy in practice.

Legal Framework & Guidance

Under Law 318/2023, municipalities and cooperatives are encouraged to develop renewable systems for local self-consumption. Although the current implementation of the law does not yet fully enable energy communities, these guidelines propose a simple and practical approach that can be applied immediately while preparing for future legal amendments.

Broader Impact

Energy communities should be viewed as a practical tool to strengthen local governance, promote citizen participation, and support Lebanon's gradual transition toward a more sustainable and decentralized energy model.

SECTION 3 - HOW TO ESTABLISH AN ENERGY COMMUNITY

ESTABLISHING AN ENERGY COMMUNITY REQUIRES ORGANIZATION, TRANSPARENCY, AND LOCAL PARTICIPATION. THE FOLLOWING STEPS PROVIDE A SIMPLE ROADMAP THAT ANY MUNICIPALITY OR LOCAL GROUP CAN FOLLOW.

1 IDENTIFY LOCAL ENERGY NEEDS

Begin with a short assessment of the community's energy situation:

- Which public or community facilities lack reliable electricity?
- How much energy is currently consumed and at what cost?
- What renewable resources (sun, wind, water) are available locally?

2 ORGANIZE COMMUNITY PARTICIPATION

- Call a meeting with citizens, local associations, and small businesses to discuss the idea.
- Participation builds trust and ensures that the project serves real community priorities.

3 FORM A WORKING GROUP OR COOPERATIVE

- The municipality can lead or support the creation of a small committee or cooperative.
- This body manages the project's planning, communication, and basic decision-making.

4 SELECT A SITE AND SYSTEM SIZE

- Identify a municipal rooftop, school, or public land suitable for RE installation.
- Define the size of the system according to needs (for example, 50–200 kWp for small municipalities).

5 PREPARE A SIMPLE FEASIBILITY NOTE

The note should describe the site, estimated capacity, expected production, number of beneficiaries, estimated cost, and possible funding sources. This is the base document for approaching donors or partners.

6 CHOOSE A FINANCING MODEL

Select one of the available options (grant, cooperative investment, PPP, or Combined grants and concessional loans) depending on the project's scale and local resources.

7 IMPLEMENT AND MONITOR THE PROJECT

- Work with a qualified installer under a simple contract. Once the system is operational.
- Keep monthly records of energy production, savings, and maintenance needs.

FOLLOWING THESE STEPS HELPS MUNICIPALITIES BUILD REALISTIC AND TRANSPARENT PROJECTS THAT CAN ATTRACT FUNDING AND DELIVER VISIBLE BENEFITS TO LOCAL COMMUNITIES.

SECTION 4 - ROLES AND RESPONSIBILITIES

ENERGY COMMUNITIES DEPEND ON COLLABORATION BETWEEN LOCAL AUTHORITIES, CITIZENS, AND NATIONAL INSTITUTIONS. EACH ACTOR HAS A SPECIFIC ROLE TO ENSURE TRANSPARENCY, SUSTAINABILITY, AND LONG-TERM SUCCESS.

Municipalities

- Lead and coordinate the energy community initiative.
- Identify suitable sites for renewable installations (schools, public buildings, or unused land).
- Facilitate public participation and promote awareness campaigns.
- Oversee contracts, maintenance, and transparent reporting of results.

Community Members & Cooperatives

- Participate in project design and contribute through membership fees or small investments.
- Support awareness and local acceptance of renewable energy.
- Monitor the operation and communicate regularly with the municipality.

Private Sector & Technical Partners

- Provide technical design, installation, and maintenance services.
- Offer expertise in project management and safety compliance.
- Support training for local technicians and staff.

ERA

The Electricity Regulatory Authority (ERA) is responsible for overseeing and approving renewable energy activities in Lebanon. Its role includes:

- Establishing simplified procedures for small renewable projects.
- Approving technical standards for local generation and self-consumption.
- Providing regulatory guidance to municipalities and cooperatives developing energy communities.

MoEW

- Define national priorities for renewable energy and decentralized generation.
- Coordinate with ERA on the licensing framework and connection procedures.
- Support pilot projects and ensure consistency with national strategies.

BY WORKING TOGETHER, THESE ACTORS CAN DEVELOP SUCCESSFUL LOCAL ENERGY INITIATIVES THAT IMPROVE ACCESS TO CLEAN ENERGY AND BUILD TRUST BETWEEN CITIZENS AND PUBLIC INSTITUTIONS.

SECTION 5 - FINANCING MODELS AND SUPPORT OPTIONS

Energy communities can begin with small and realistic projects. The key is to select a financing model that fits the municipality's capacity and available support. Below are four practical options that can be applied in Lebanon.

Grant-Funded Projects

Best for small municipalities and rural areas.

- Apply to donor-funded programs that support renewable energy, such as those financed by the EU, AFD, GIZ, UNDP, or the World Bank.
- Start with small projects (50–200 kWp) for municipal buildings, schools, or water pumps.

Public-Private Partnerships (PPP)

Recommended for medium-sized towns or groups of municipalities.

- A private operator designs, finances, and operates the renewable system.
- The municipality purchases part of the produced energy (e.g., for public lighting or pumping).
- Ownership may transfer to the municipality after a defined period.

Community & Cooperative Investment

Suitable for communities with strong participation or diaspora links.

- Citizens, small businesses, or diaspora members invest collectively in exchange for energy credits or reduced bills.
- The municipality provides land or rooftops, while a cooperative manages the project and shares benefits fairly.

Combined Grants, Concessional Loans & Green Loans

For larger or advanced projects.

- Combine grants from international donors with concessional loans from local or international banks.
- Green finance programs (such as those supported by EIB or AFD) may provide interest subsidies or guarantees.

KEY PRINCIPLES FOR ALL MODELS:
- START WITH ONE PILOT PROJECT BEFORE SCALING UP.
- ENSURE TRANSPARENT FINANCIAL MANAGEMENT AND CLEAR CONTRACTS.
- KEEP A SMALL MAINTENANCE RESERVE FUND.
- PARTNER EARLY WITH TECHNICAL AND FINANCIAL INSTITUTIONS FOR SUPPORT.

SECTION 6 - REGULATORY & POLICY RECOMMENDATIONS

01 Clarify the Scope of Law 318/2023

- Clearly define "energy communities" as collective self-consumption groups involving municipalities, citizens, and local entities.
- Simplify licensing and administrative steps for projects below a defined capacity (e.g., <500 kWp).

02 Simplify Licensing & Connection Procedures

- The Electricity Regulatory Authority (ERA) should issue clear and simple licensing procedures for small renewable systems.
- Standardize the process for grid connection and define timelines for approval to ensure predictability.

03 Enable Collective & Virtual Self-Consumption

- Allow community members located within the same municipality to share electricity virtually through digital metering and billing systems.
- Encourage pilot projects to demonstrate this model's benefits before large-scale rollout.

04 Introduce Transitional Arrangements

- Recognize that these schemes are designed primarily for small and rural municipalities until the national grid achieves full reliability (24/24 service).
- During this transitional phase, allow local self-consumption without requiring injection into the national grid.

05 Promote Training & Capacity Building

- Develop capacity-building programs for municipalities and cooperatives on project management, finance, and maintenance.
- Encourage partnerships with universities and training centers for renewable energy skills development.

06 Ensure Long-Term Integration

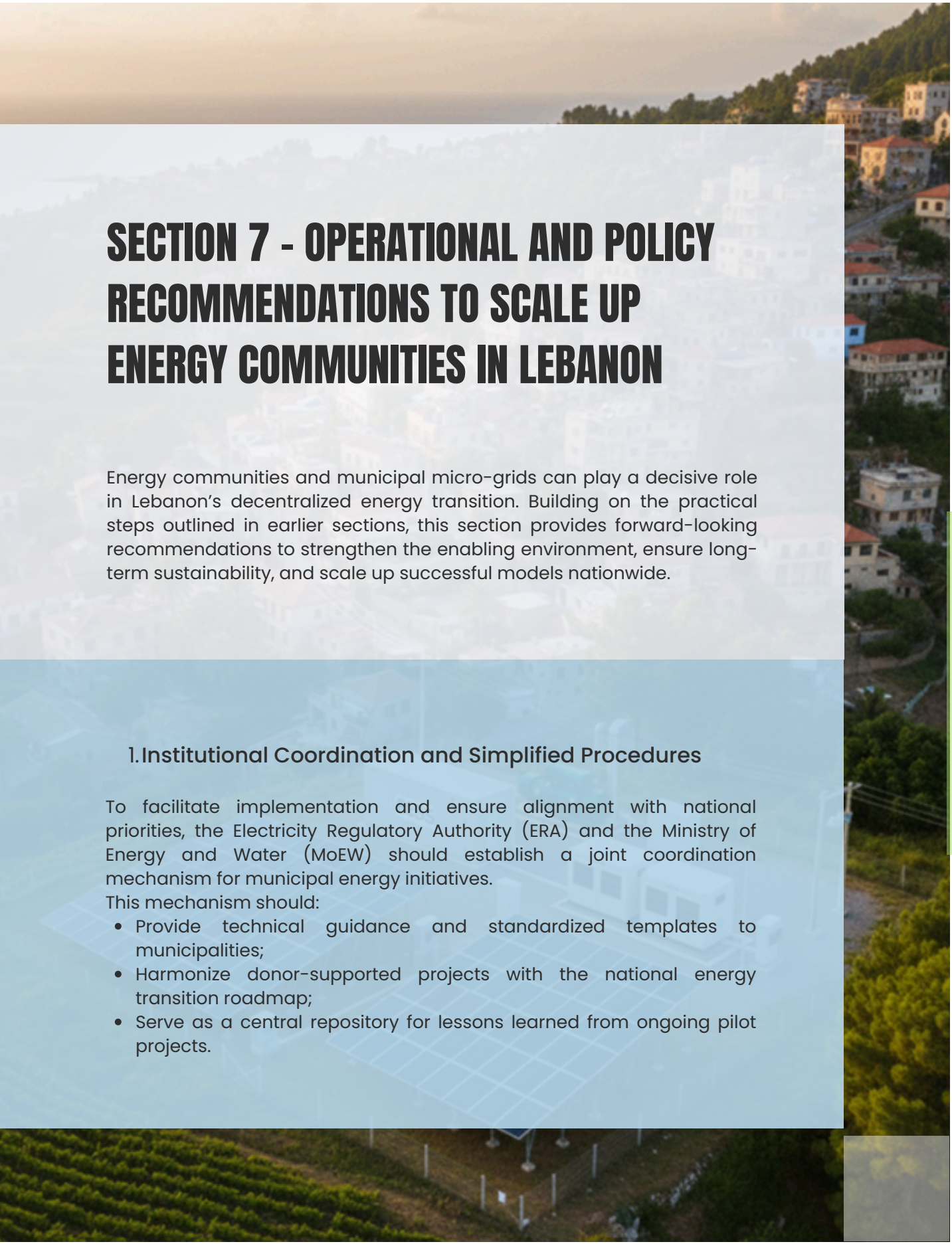
- When the national grid becomes reliable, establish rules for energy communities to inject surplus power safely and fairly.
- ERA and the Ministry of Energy and Water should jointly define tariffs, safety standards, and metering systems for this integration.

07 Consumer and Environmental Protection

To ensure fairness and sustainability, municipalities and project operators must adhere to basic consumer and environmental safeguards.

- Tariffs and billing procedures should be transparent, with clear communication to residents.
- Operators must prevent excessive pricing or private monopolization of community energy services.
- All battery and PV components should comply with environmental standards for safe installation, maintenance, and end-of-life disposal.

ERA SHOULD ISSUE SIMPLIFIED COMPLIANCE GUIDELINES TO ASSIST MUNICIPALITIES AND PRIVATE PARTNERS IN MEETING THESE REQUIREMENTS.



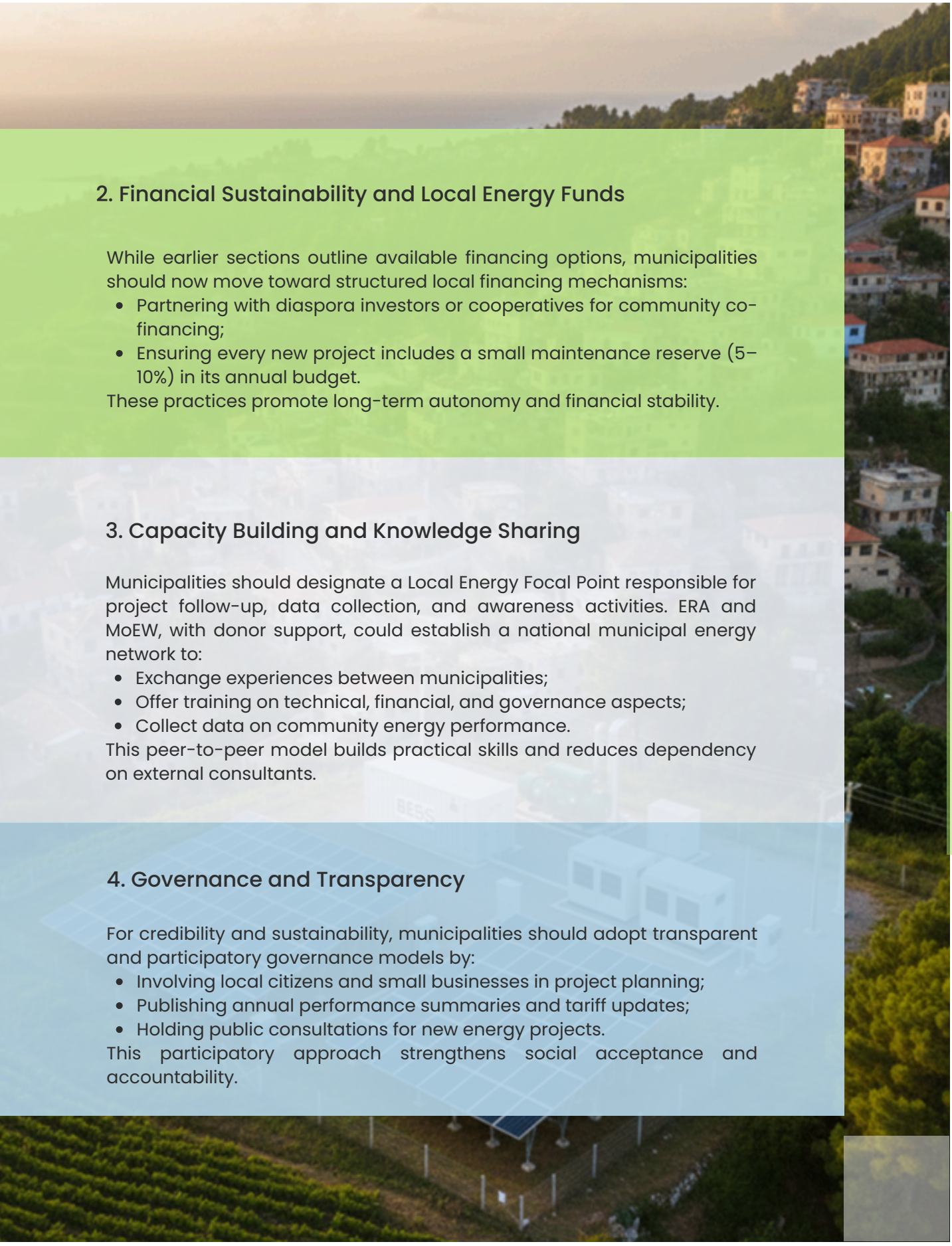
SECTION 7 - OPERATIONAL AND POLICY RECOMMENDATIONS TO SCALE UP ENERGY COMMUNITIES IN LEBANON

Energy communities and municipal micro-grids can play a decisive role in Lebanon's decentralized energy transition. Building on the practical steps outlined in earlier sections, this section provides forward-looking recommendations to strengthen the enabling environment, ensure long-term sustainability, and scale up successful models nationwide.

1. Institutional Coordination and Simplified Procedures

To facilitate implementation and ensure alignment with national priorities, the Electricity Regulatory Authority (ERA) and the Ministry of Energy and Water (MoEW) should establish a joint coordination mechanism for municipal energy initiatives.
This mechanism should:

- Provide technical guidance and standardized templates to municipalities;
- Harmonize donor-supported projects with the national energy transition roadmap;
- Serve as a central repository for lessons learned from ongoing pilot projects.



2. Financial Sustainability and Local Energy Funds

While earlier sections outline available financing options, municipalities should now move toward structured local financing mechanisms:

- Partnering with diaspora investors or cooperatives for community co-financing;
- Ensuring every new project includes a small maintenance reserve (5–10%) in its annual budget.

These practices promote long-term autonomy and financial stability.

3. Capacity Building and Knowledge Sharing

Municipalities should designate a Local Energy Focal Point responsible for project follow-up, data collection, and awareness activities. ERA and MoEW, with donor support, could establish a national municipal energy network to:

- Exchange experiences between municipalities;
- Offer training on technical, financial, and governance aspects;
- Collect data on community energy performance.

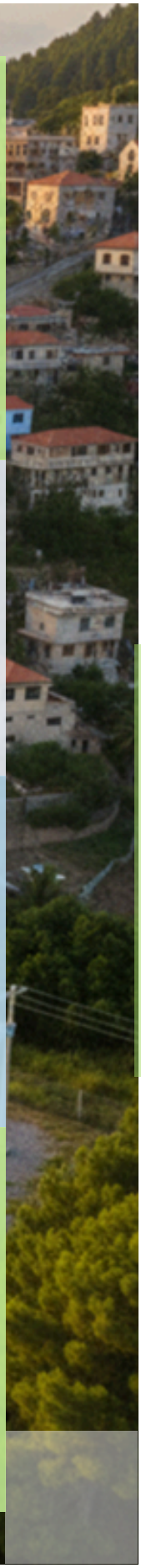
This peer-to-peer model builds practical skills and reduces dependency on external consultants.

4. Governance and Transparency

For credibility and sustainability, municipalities should adopt transparent and participatory governance models by:

- Involving local citizens and small businesses in project planning;
- Publishing annual performance summaries and tariff updates;
- Holding public consultations for new energy projects.

This participatory approach strengthens social acceptance and accountability.



5. Pilot and Demonstration Projects

Municipalities with adequate technical and institutional capacity—such as Baabdat, Baskinta, or Jezzine—should be prioritized for pilot micro-grids under ERA or donor supervision.
Each pilot should:

- Test different business models (private-led, community-led, PPP);
- Include a clear monitoring plan;
- Serve as a replicable model for other municipalities in similar contexts.

6. Integration with National Grid and Long-Term Transition

As the national grid remains unstable, local systems should continue operating in isolated or semi-autonomous mode. However, micro-grids must be technically prepared for future integration with the rehabilitated EDL grid once reliability improves.
This transitional design ensures that current investments remain compatible with Lebanon's long-term national energy vision.

7. Social and Economic Impact

Energy communities should aim not only to provide electricity but also to support local development, such as:

- Powering water pumping, healthcare centers, schools, and small industries;
- Reducing reliance on diesel and energy poverty;
- Creating local jobs in maintenance and installation.

This broader development perspective turns local energy into a driver of resilience and inclusion.

8. Roadmap for Institutional Scaling-Up

To institutionalize and replicate successful models:

- Ministry of Interior and Municipalities, MOIM, MoEW, and ERA should prepare a National Framework for Energy Communities, defining clear procedures, tariffs, and licensing categories.
- Donor programs should prioritize funding for municipal demonstration clusters.
- Municipalities should integrate energy projects into their Local Development Plans to ensure coherence with land use, environment, and community needs.

CONCLUSION

Energy communities provide a practical, inclusive, and forward-looking response to Lebanon's ongoing energy challenges.
By mobilizing municipalities, citizens, and local partners around small-scale renewable projects, they offer an immediate way to improve electricity access, reduce dependency on diesel generators, and strengthen local resilience.
At this stage, energy communities represent a transitional solution to ensure local electricity supply until the national grid is fully rehabilitated. Once stability is restored, these community-based systems can evolve into integrated contributors to the national grid, promoting both social equity and environmental sustainability.
The development of energy communities will also help rebuild trust between citizens and institutions, create new local jobs, and foster a culture of shared responsibility for energy management.
Through continued coordination among municipalities, the Electricity Regulatory Authority (ERA), and the Ministry of Energy and Water (MoEW), Lebanon can transform today's energy crisis into an opportunity for decentralized, cleaner, and more participatory growth.

Job Creation and Local Economic Empowerment

Energy communities are not only a solution to Lebanon's electricity challenges but also a driver of local job creation and economic empowerment. The establishment, operation, and maintenance of decentralized renewable systems generate employment opportunities across multiple sectors — from engineering, installation, and technical maintenance to data monitoring, community management, and awareness campaigns. These initiatives create sustainable, long-term jobs, particularly for youth and skilled technicians, while also opening new avenues for women's participation in energy-related activities. As municipalities develop their local energy ecosystems, new small businesses can emerge to provide equipment, services, and training, further reinforcing local economies and reducing migration from rural areas.

Mini Case Study – Fieldwood Village Microgrid, Baabdat

The Fieldwood Village microgrid, implemented in 2022 by Bureau d'Études Georgio Labaki, represents the first operational microgrid project in Lebanon.
Located in the mountainous town of Baabdat, it serves a private residential compound composed of 50 apartments and villas.
This pioneering initiative demonstrates how advanced energy management and hybrid generation systems can provide continuous and reliable electricity in a context of severe national grid instability.

Technical Configuration:

The system integrates several energy sources to ensure uninterrupted supply:

- 300 kWp of photovoltaic (PV) solar panels
- 200 kVA / 516 kWh Battery Energy Storage System (BESS)
- 400 kVA diesel generators for backup generation
- A 1 MW connection to the Électricité du Liban (EDL) grid

All sources are coordinated through an advanced Energy Management System (EMS), which continuously monitors and optimizes the operation of each component. The EMS ensures smooth switching between power sources, maintaining voltage stability and minimizing fuel consumption.

Total investment cost : 1M€.

Operational Approach:

The microgrid operates as a hybrid system, prioritizing renewable energy and battery storage while using diesel generation only during peak demand or when solar input is low.
When EDL power is available, the system synchronizes automatically, reducing dependence on diesel and improving efficiency.
During outages, the microgrid functions autonomously (island mode), ensuring residents receive uninterrupted electricity.

Key Outcomes:

- 24/7 reliable power supply, independent of national grid fluctuations.
- Optimized fuel consumption, reducing generator use by nearly 60%.
- Lower electricity costs for residents compared to standalone diesel generation.
- Enhanced comfort and stability, proving the technical and economic feasibility of smart microgrids in Lebanon.

In the Fieldwood Village microgrid (Baabdat) case study, the electricity tariff applied to residents is reported in the source document as being:

- 10 to 15% lower than the official tariff of Électricité du Liban (EDL);
- which means it is approximately 40% cheaper than the cost of electricity from private diesel generators.

This tariff structure was designed to ensure both affordability for residents and financial sustainability for the microgrid operator, allowing operation and maintenance costs to be covered while maintaining a reasonable payback period on the initial investment

Lessons for Municipalities:

The Fieldwood Village project illustrates that microgrids combining solar PV, batteries, and diesel backup can provide a viable local energy solution in Lebanon's current transition phase.
While this specific initiative was privately financed, its model can inspire municipal or community-driven microgrids in rural areas—particularly when supported by donor grants and simplified regulations.
It also underscores the need to amend Law 318/2023 to enable legal recognition of such decentralized systems and allow future integration with the national grid once it is rehabilitated.

Source : *strategic roadmap to enhance renewable energy and energy efficiency in lebanon's industrial sector, UNDP & Free Energy, september 2024.*

Mini Case Study – Bchaaleh Microgrid

Project Overview
The Bchaaleh Microgrid Project was implemented in the village of Bchaaleh (Batroun district, North Lebanon) as part of the PK_ME (Power Kinetics Microgrid Experience) initiative. It was developed to address the chronic electricity shortage affecting the community and to demonstrate a decentralized, renewable-based microgrid solution for rural municipalities.

Implementing Entity
The project was executed by ME Green, with the support and participation of the Municipality of Bchaaleh and local stakeholders, as a pilot model for community-level energy independence.

Technical Specifications

- Installed PV Capacity: 125 kWp
- Battery Energy Storage System (BESS): 240 kWh lithium-ion storage
- Diesel Generator Backup: 200 kVA
- Energy Management System (EMS): Controls the hybrid system to optimize energy dispatch and balance supply from PV, storage, and diesel backup.
- Operational Mode: The system operates in islanded mode most of the time due to the instability of the national grid.

System Architecture and Operation
The Bchaaleh microgrid supplies power to around 50 residential units and community facilities. The EMS ensures that solar energy is prioritized, followed by battery discharge and, when needed, diesel generation. The system maintains energy autonomy for the village, offering reliable electricity even during national grid outages.

Financial and Economic Aspects
The total investment of the project is approximately USD 310,000, financed through the PK_ME program with support from local partners. The operational model is based on a prepaid system, ensuring transparent cost recovery and financial sustainability. The average electricity cost for consumers is 15% lower than EDL tariffs and significantly cheaper than diesel generator subscriptions.

Key Results and Benefits

- 24-hour reliable power supply for the entire village
- Reduction in diesel fuel consumption and greenhouse gas emissions
- Local employment opportunities through system operation and maintenance
- Improved quality of life for residents and local businesses

Lessons Learned
The Bchaaleh experience shows that microgrids can effectively meet local energy needs when national supply is unreliable. Its hybrid configuration combining PV, storage, and diesel ensures both flexibility and resilience. The project also highlights the importance of municipal engagement and local management capacity to ensure sustainability.

Source : *MICROGRID NET-ZERO MORE ENERGY FOR ALL, TESSA/ALMEE/ICU, Multi-Stakeholder Roundtable on Energy Communities, 16 July 2025 – Beirut, Lebanon*

Case Study – EDZ Mini-grid (Electricité de Zahlé)

Project Overview

The Electricité de Zahlé (EDZ) Minigrid serves approximately 250,000 residents in the Zahlé area and has operated a 24/7 hybrid power supply model since 2015. It represents a pioneering example of decentralized energy resilience in Lebanon, combining local diesel generation, solar production, and smart grid technologies to provide continuous electricity despite national grid outages.

Technical Information

- Total Generation Capacity: 68 MW
  - Diesel Generation: 60 MW
  - Solar Generation: 8 MW (operational)
  - New Solar Project (under development): 63 MW to progressively replace diesel generation
- System Control: Hybrid SCADA (Supervisory Control and Data Acquisition) integrating diesel and solar power sources
- Smart Metering: 100% smart meters installed, with technical losses below 5% (compared to ~40% for EDL)
- Service Quality: Fast outage recovery with SAIDI < 40 minutes/month

Financial Information

- Tariffs: Cost-reflective range of 18 – 25 US cents/kWh, designed to ensure operational sustainability without subsidies
- Collection Rate: Over 95%, confirming strong local payment discipline and trust
- Financing and Future Investment: Ongoing development of the 63 MW solar expansion to further reduce reliance on diesel fuel

Key Achievements

- Continuous 24/7 electricity supply in an otherwise constrained national context
- Substantial reduction in fuel consumption through gradual solar integration
- Robust financial model with high collection rates and no public subsidies
- Demonstrated resilience through advanced SCADA monitoring and smart metering

Relevance for Municipal Guidelines

The EDZ model shows that financially viable microgrids can sustain high service quality when tariffs are cost-reflective, governance is transparent, and local engagement is strong. It provides a benchmark for future municipal or community-scale microgrids, especially in legally reformed contexts that may authorize local energy operators.

Source : *EDZ Case Study, A Model for Decentralized Energy Resilience in Lebanon, TESSA/ALMEE/ICU, Multi-Stakeholder Roundtable on Energy Communities, Julien Bou Gebrael, ALMEE, 16 July 2025 – Beirut, Lebanon*

Mini Case Study – Overview of Microgrid Projects in Lebanon (2016–2020)

Project Presentation

Between 2016 and 2020, nine (9) microgrid pilot projects were implemented across Lebanon by municipalities and private actors. These initiatives were driven by the need to secure reliable electricity amidst the chronic instability of the national grid (Électricité du Liban – EDL).

The projects combine solar photovoltaic (PV) systems, battery storage, and diesel backup, forming hybrid mini-grids that ensure partial or full autonomy from the EDL network. While seven projects were municipally owned and grant-funded, two were privately financed, operating under subscription-based business models.

These projects demonstrate the technical feasibility and social acceptance of decentralized renewable systems in both rural and peri-urban contexts, providing a practical foundation for future energy community schemes under a reformed legal framework.

Synthesis and Key Insights

The collective installed capacity of these microgrids exceeds 1.7 MWp of solar PV and includes a range of battery storage technologies from small-scale (4.8 kWh) to medium-scale (552 kWh). Despite differences in ownership models, several key lessons emerge:

- Energy Autonomy: Most systems operate in islanded mode, confirming the technical capability to sustain decentralized power generation independently from EDL.
- Ownership Diversity: The municipal model ensures social ownership and local trust, while private investment models (e.g., Bchaaleh, Jabbouleh, Bqaatouta) prove financial sustainability through transparent subscription mechanisms.
- Technology Mix: The combination of PV + BESS + Diesel remains the most viable option for reliability under Lebanon's current grid conditions.
- Financing Structure: Grant dependency remains high (≈ 78% of projects), indicating the need for structured financial incentives and credit mechanisms for replication.
- Institutional Learning: Several municipalities established Energy Committees to manage operations and collect payments, an approach that could evolve into formal energy communities under the amended Law 318/2023.

Overall, these microgrid experiences confirm that community-based hybrid systems are both technically feasible and socially acceptable in Lebanon, representing the cornerstone for future renewable energy community models once the legal and regulatory framework is fully adapted.

Source : *Lebanon's existing microgrids and the potential of RE, Marc Ayoub, TESSA/ALMEE/ICU, Multi-Stakeholder Roundtable on Energy Communities, Julien Bou Gebrael, ALMEE, 16 July 2025 – Beirut, Lebanon*

Summary of Microgrid Projects in Lebanon

Location / Year	Ownership / Operator	PV Capacity (kWp)	Battery Type / Capacity (kWh)	Diesel Backup	Financing	Mode of Operation	Special Features / Notes
Kabrikha (2016)	Municipality / EDL	250	Not specified	Yes	Grant	Islanded	Active energy committee, community participation
Kfarmishki (2019)	Municipality / EDL	55	Lead-acid / 552	Yes	Grant	Hybrid	Local management, community-led operation
Baaloul (2018)	Municipality / EDL	80	Not specified	Yes	Grant	Islanded	Early green village concept
Ramlieh (2019)	Municipality / EDL	60	Lithium-ion / 552	Yes	Grant	Hybrid	Strong resilience, moderate maintenance costs
Jabbouleh (2019)	Private (E24, Matrix, Kenergy)	800	Lithium-ion / 552	Yes	Private	Hybrid	Subscription-based business model
Menjez (2019)	Municipality	70	Lead-acid / 441	Yes	Grant	Islanded	Eco-village initiative, school participation
Bechmezzine (2017)	Municipality / EDL	75	VRLA Lead-acid / 4.8	Yes	Grant	Hybrid	Early northern Lebanon pilot
Bqaatouta (2020)	Private	300	Lead-acid / 500	Yes	Private	Islanded	Fully independent microgrid for ~250 homes
Bchaaleh (2018)	Private (Matrix Energy, E24, Kenergy)	300	Lithium-ion / 500	Yes	Private	Islanded	Successful operational model, reference project

Source : *Lebanon's existing microgrids and the potential of RE, Marc Ayoub, TESSA/ALMEE/ICU, Multi-Stakeholder Roundtable on Energy Communities, Julien Bou Gebrael, ALMEE, 16 July 2025 – Beirut, Lebanon*

Municipal Feasibility Note for Energy Community Project

It can serve as a standard document for submission to AFD, EU, or World Bank programmes.

1. General Information

Field	**Details to be Completed**
Municipality Name:	
Governorate / Caza:	
Project Title:	
Contact Person:	Name / Position / Phone / Email
Date of Submission:	
Project Status:	□ Concept □ Under Study □ Implementation

2. Project Overview

Brief description (max. 5 lines):

Explain the purpose of the project, its expected impact on electricity supply, and its benefits for the community.

3. Technical Information

Aspect	**Details**
Type of system:	□ Solar PV □ PV + BESS □ PV + Diesel Hybrid □ Other (specify)
Proposed capacity (kWp):	
Expected annual production (kWh):	
Main uses:	□ Public lighting □ Water pumping □ Administrative buildings □ Schools □ Health centers □ Residential supply
Proposed site / land:	Describe the selected location (ownership, accessibility, surface area).
Grid connection:	□ Isolated micro-grid □ Connected (future option)
Backup source:	□ Diesel generator □ None □ Other

4. Economic and Financial Information

Item	**Estimated Amount (USD or LBP)**
Estimated CAPEX (equipment, installation):	
OPEX (annual maintenance, operation):	
Expected annual savings / revenues:	
Funding requested (grant / loan):	
Co-financing (municipality, private, community):	

Remarks:

Explain any available support (donor programs, partnerships, community contributions).

5. Stakeholders and Partners

List the main entities involved in the project and their roles.

Entity	**Role / Contribution**
Municipality	Coordinator / Owner
ERA (Electricity Regulatory Authority)	Licensing / Technical guidance
MoEW (Ministry of Energy and Water)	National coordination
Local or International Partner	Technical / Financial support
Private Operator / Cooperative	Operation / Maintenance
Local Community	Participation / Awareness

6. Expected Impacts

- Reduction of diesel generator use: ____ %
- Expected reduction in electricity cost for beneficiaries: ____ %
- Estimated number of beneficiaries (households / institutions): ____
- Contribution to CO_2 reduction: ____ tons/year (if available)

7. Sustainability and Next Steps

Describe briefly:

- Maintenance plan (who will operate and maintain the system).
- Community engagement and awareness strategy.
- Expected timeline for implementation.

8. Signature and Endorsement

Name	**Position**	**Signature / Seal**	**Date**
Mayor / Municipal President			
Municipal Council Representative			