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PATHWAYS FOR ENERGY JUSTICE IN LEBANON'S POST-WAR RECONSTRUCTION

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Cover photo: Majdal Silm, South Lebanon, March 2025.

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Table of Contents

List of Acronyms

AFD	Agence Francaise de Développement
CDR	Council for Development and Reconstruction
CEDRE	Conférence Economique pour le Développement, par les Réformes et avec les Entreprises
CNRS-L	National Center for Scientific Research
DRE	Distributed Renewable Energy
DSP	Distribution Service Providers
ECL	Energy Conservation Law
EDL	Électricité Du Liban
EPC	Energy Performance Contracts
ERA	Electricity Regulatory Authority
ICRC	International Committee of the Red Cross
IOF	Israeli Occupation Forces
LCEC	Lebanese Center for Energy Conservation
LEAP	Lebanon Emergency Assistance Project
LRA	Litani River Authority
LSES	Lebanese Solar Energy Society
MoEW	Ministry of Energy and Water
MW	Megawatt
NCC	National Control Center
SCADA	Supervisory Control and Data Acquisition
SDC	Swiss Agency for Development and Cooperation
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
UNIFIL	United Nations Interim Forces in Lebanon
USAID	United States Agency for International Development

1. Introduction

The latest episode of violence between Lebanon and Israel began on 8 October 2023, after Hezbollah launched rockets into the Israeli-occupied Shebaa Farms, in support of the Hamas military operation of October 7. In the months that followed, Israel gradually escalated its military operations in Lebanon over a period of 13 months, 2 weeks, and 5 days. This culminated in a sharp intensification of hostilities on 23 September 2024, marking the start of a 66-day war between Israel and Lebanon. To date, Israeli aggressions have claimed the lives of more than 4,200 people and injured over 16,000 across Lebanon, reflecting a pattern of indiscriminate targeting of civilians (UNDP, 2025). Beyond the human toll, the war left behind widespread destruction of civilian infrastructure and homes, destroying the fabric of entire villages.

Reconstruction is currently estimated to take between three to five years, yet these timelines remain speculative in the absence of any substantial financial commitments or a comprehensive reconstruction plan (El Nahra, 2024; World Bank, 2025a). Since the November 2024 ceasefire, the war's devastating destruction has been compounded by continued Israeli strikes and killings, as well as the ongoing occupation of five "strategic points" along the border (Al Jazeera, 2025). Overall, more than 4,500 Israeli ceasefire violations have been recorded (Arab News, 2025), including airstrikes, artillery fire, civilian shootings, and kidnappings, particularly in border villages, resulting in at least 267 martyrs (Chaaban, 2025a). Indeed, much of the destruction in these villages was carried out after the ceasefire, deliberately violating international humanitarian law and constituting war crimes (Amnesty International, 2025). Over 1.2 million people were displaced during the war, and as of February 2025, nearly 99,000 remain internally displaced (IOM, 2025).

The war's catastrophic toll on Lebanon is estimated to have caused over $14 billion in total losses, with $6.8 billion attributed to damage to physical infrastructure, including severe impacts on the electricity sector (World Bank, 2025a).1 According to the latest World Bank assessment, $11 billion is required for reconstruction and recovery needs. The energy sector sustained losses of up to $207 million, approximately 3% of overall losses, of which $98 million reflects direct physical damage (World Bank, 2025a). This estimate is limited to the impacts on the national grid and the public utility Électricité du Liban (EDL) and excludes the widespread destruction of communal and individual solar installations, as well as informal diesel generator networks (World Bank, 2025a), which together account for a substantial share of electricity provision in Lebanon.2

The patterns of the latest war with Israel differ from those of the July 2006 war.3 In 2006, primary targets included electricity, water, and essential transport infrastructure for the movement of people, food, and goods (World Bank, 2007). The Israeli Occupation Forces (IOF) – via air, sea, and land – attacked the airport, bridges, road networks, and the Jiyyeh power plant along with several substations in the south, as well as major water stations and pipelines, effectively laying a siege on Lebanon. The 2006 war's estimated cost was $2.8 billion in direct damage to infrastructure (World Bank, 2007). In contrast, the 2023-2024 war has been significantly more destructive in terms of scale, duration, and intensity (CNRS-L, 2024). Critical infrastructure in this war has been targeted in the border villages and may have been affected secondarily in other areas. This shift appears to reflect a different Israeli military strategy focused on targeting private housing units,

1 All dollar amounts are in US dollars, unless otherwise stated.

2 In 2019, LCEC (2020) reported that over 93% of households in Lebanon relied on diesel generators, either through ownership or neighborhood subscriptions. With the onset of the financial crisis, however, these generators became increasingly unaffordable for poorer households. By 2023, UNDP (2025) estimated Lebanon's installed solar capacity at 1,253.98MWp, marking a rapid expansion as households and businesses sought alternatives to persistent outages. Together, diesel generators and solar installations remain vital to securing electricity access in Lebanon.

3 The July 2006 war, lasting 34 days, began after Hezbollah captured two Israeli soldiers in a cross-border raid. Israel launched a large-scale military campaign against Lebanon, marked by extensive aerial bombardments and a naval blockade. Over 1,100 people in Lebanon were killed, around a quarter of the population displaced, and large parts of the country's infrastructure severely damaged (Verdeil, 2008; World Bank, 2007).

with housing losses accounting for 67% of total damages amounting to $4.8 million (World Bank, 2025a). These attacks have caused widespread damage across both individual and communal solar installations, alongside severe impacts to the informal diesel generator networks that sustain much of Lebanon's power supply.

Preliminary assessments suggest that between 400,000 and 500,000 solar panels were damaged or destroyed nationwide, resulting in an estimated loss of 150MW to 200MW in installed capacity (Tsagas, 2024). A more detailed study by the CNRS-L found that in the southern suburbs of Beirut alone, 3,989 solar panels were destroyed and 32,160 sustained moderate to severe damage (CNRS-L, 2024). Given that renewable energy infrastructure is more widespread in rural or peri-urban areas, damages are likely to be significantly higher in regions outside major urban centers.

Assessing the impacts of the 2023-2024 war on Lebanon's energy sector is not simply about recording damage; it is a necessary step toward interrogating the kind of reconstruction that is possible, and for whom. In the context of prolonged state failure (Ahmad et al., 2021), Lebanon's energy provision has already become deeply decentralized, with communities increasingly relying on solar installations and informal generator systems. The destruction of this infrastructure and the means of its potential restoration have far-reaching implications on longer-term energy pathways in Lebanon. These challenges are compounded by the combined effects of the financial collapse and the ongoing energy crisis, which have left households, municipalities, and businesses with little capacity to absorb further shocks. This makes the present moment even more precarious and underscores the need for doubled efforts to ensure that the reconstruction and rehabilitation of electricity services do not translate into additional hardship for already strained communities. Previous reconstruction models have been unequal, unsustainable, and shaped by neoliberal frameworks that prioritized privatization and short-term solutions (Verdeil, 2008; Zbeeb, 2021). This study takes the energy sector as a lens through which to examine whether current recovery efforts risk reproducing these dynamics, and the potential for opening space for a more just, inclusive, and sustainable energy future.

1.1. Report Objectives

This study evaluates Lebanon's energy needs for postwar reconstruction through the framework of the energy trilemma – security, sustainability, and affordability – while incorporating a fourth pillar of resilience to reflect the conflict and post-conflict context. It analyses patterns of destruction and damage in the energy sector, examining impacts on the national grid, decentralized communal renewable systems, and household renewable energy. Methodologically, the study draws on stakeholder interviews with municipal actors, energy experts, donors, renewable energy providers, journalists, and civil society organizations to capture both institutional perspectives and local experiences. Site visits were conducted during the month of March 2025 to 10 locations in the south of Lebanon and Bekaa (see section 4) where interviews were conducted with municipal actors, the electricity utility EDL, the private company Mrad Electric tasked with grid repairs, and solar distributors and installers to get preliminary insights on the extent of damage and reconstruction progress and related challenges. Following that, 15 in-depth interviews with energy experts, donors, journalists, and civil society actors provided additional perspectives on the destruction and reconstruction processes, as well as on the potential integration of renewable energy and energy justice into the broader reconstruction framework. Complementary sources of secondary data were also consulted, compiled by the founder of Takom Energy and the LSES, who provided mappings of municipal renewable energy systems for water projects and electricity. The study further assesses secondary data from CNRS-L of satellite imagery analysis to evaluate the overall destruction of solar infrastructure (including household level) across the Bekaa and south Lebanon, offering regional insight into the scale and intensity of damages.

This report also engages in a critical analysis of existing policy and regulatory frameworks to identify structural gaps, implementation barriers, and opportunities for reform. In parallel, it examines donor strategies and international recovery frameworks, with a focus on how financing instruments, conditionalities, and reconstruction priorities are shaping the postwar energy agenda. By integrating these dimensions, the study not only assesses the material impacts of the war on Lebanon's energy sector but also interrogates the

political, financial, and institutional dynamics that will influence reconstruction outcomes and the sector's recovery. Ultimately, it seeks to provide evidence-based, justice-oriented policy recommendations to support a more equitable, resilient, and sustainable energy future.

2. Lebanon's Pre-war Energy Crisis and Policy Landscape

2.1. A Protracted Energy Crisis

The latest war unfolded amid Lebanon's protracted financial and economic crisis, now in its sixth year. Since October 2019, the country's overlapping crises have progressively dismantled the country's already fragile electricity sector. Characterized by high generation costs, poor governance, and chronic inefficiencies, the sector had long been unable to meet national demand or recover its costs (Ayat, 2021). These structural failures culminated in 2021, when prolonged nationwide blackouts became a defining feature of daily life in Lebanon (HRW, 2023).

Since 1992, government transfers to EDL have accounted for approximately 40% of Lebanon's public debt, despite delivering one of the least reliable electricity supplies globally (Ahmad et al., 2020). EDL has operated with a generation deficit of 1,500-2,000MW, covering only 55-64% of demand up to 2018 (World Bank, 2024). These shortfalls were compounded by fixed electricity tariffs – unchanged since 1994 and far below production cost – along with technical losses, widespread electricity theft, nonpayment, and the depreciation of the Lebanese currency, in which tariffs continued to be paid until recently. Collectively, these factors undermined the utility's financial viability and left it unable to modernize or expand service provision (Ayoub et al., 2021).

The financial crisis and increasing shortages of foreign currency further accelerated this breakdown. With dwindling reserves, EDL was unable to secure fuel imports, procure spare parts, or perform routine maintenance (Ayoub et al., 2021). As a result, power production collapsed almost entirely, forcing households and businesses to depend on alternative sources. Diesel generators – initially used as stopgap solutions – evolved into a primary means of electricity provision, sometimes providing over 24 hours of electricity (Abi Ghanem, 2018; Ebla Research Collective, 2024). While these systems had operated alongside the formal grid since the civil war, their use has surged since the crisis, giving rise to a largely unregulated, subscription-based generator economy. In the continued absence of reliable state provision, this informal system expanded rapidly with minimal oversight.4 By 2020, the cost of electricity from private generators had reached approximately $0.60 per kilowatt-hour, placing a severe financial burden on already struggling households (World Bank, 2024).

Additionally, since the collapse, many consumers, businesses, and institutions have turned to decentralized renewable alternatives. The unaffordable generator subscription fee, the removal of fuel subsidies, and intensifying energy insecurity triggered a sharp rise in imports of standalone solar photovoltaic systems and hybrid renewable technologies. By June 2024, installed off-grid solar capacity was projected to reach 1,500MW (Abou AlJoud, 2024). This 'solar boom' unfolded without regulatory oversight or national coordination, leaving a large segment of the population in deep energy poverty. Largely disorganized, market-driven, and exclusionary, this transition was accessible primarily to those with financial means, technical knowledge, and accessible roof space (Choucair Vizoso and El Murr, 2022). Poorer households, especially in urban centers, were often unable to benefit, as many did not own their homes, lacked access to financing, or lived in buildings unsuitable for solar installation.

The convergence of war-related destruction, systemic collapse, and the expansion of informal energy markets underscores the urgency of a reconstruction strategy for the energy sector that is responsive to Lebanon's entrenched structural challenges. Reconstruction must go beyond emergency infrastructure repair to address the deeply unequal energy landscape. This includes rethinking the role of the state in energy provision;

4 The MoEW publishes tariff schedules on the price of a kilowatt hour produced and sold by private generators, yet compliance with these measures, including the installation of meters, is very ad hoc.

strengthening the regulatory environment around carbon-intensive, polluting informal generation; and ensuring that decentralized renewable systems are both accessible to marginalized communities and designed for long-term efficiency. It also requires empowering municipalities, many of which play a central role in maintaining basic services amid state collapse and implementing long-overdue reforms to Lebanon's energy governance framework. Without such multi-scalar interventions, the postwar recovery risks entrenching the very vulnerabilities that made the country's energy system so fragile in the first place.

2.2. Fragmented Energy Policy: Between Reform Stagnation and Emergency Measures

Reforms in Lebanon's electricity sector have long been trapped in cycles of sectarian politics, institutional inertia, and donor-driven agendas. Since the early 1990s, international financial institutions have pushed neoliberal reforms, promoting liberalization, privatization, and the unbundling of utilities (Verdeil, 2018). These agendas were advanced through successive donor conferences – Paris I, II, III, and later CEDRE – where electricity was consistently flagged as a priority for state rehabilitation, yet no results materialized on the ground (Rizk, 2019). Law 462 in 2002 (see Table 1) was intended to corporatize EDL, establish an independent regulator, and open the door for private participation, yet it was never implemented due to entrenched rivalries and elite bargaining (Verdeil, 2019). Within Lebanon's confessional power-sharing system, EDL and the energy sector more broadly became key sites of patronage, where decisions on procurement, oil and gas concessions, and appointments served elite interests rather than coherent planning (Traboulsi, 2014).

By the mid-2010s, efforts to introduce private producers again ran into paralysis, with political figures split between supporting privatization or public–private partnerships (Traboulsi, 2014). One outcome of this was the introduction of DSPs in 2011, which were tasked with rehabilitating the grid, installing smart meters, and improving billing and collection (Abi Haidar, 2024). Yet the DSPs failed to curb rampant power theft, and technical losses are estimated to drain about 40% of EDL's revenues (World Bank, 2025c). Emergency planning measures – such as renting power ships, emergency fuel imports, and unsustainable fuel agreements – further entrenched the status quo. At the same time, the diesel generator economy emerged as a stark symbol of elite capture: what began as a wartime stopgap became a lucrative, sectarian-protected business, where generator owners controlled territorial monopolies and resisted regulation (Chaplain, 2022). More structurally, a diesel import cartel – an oligopoly of politically connected companies – manipulated prices and subsidies to preserve its dominance (Ahmad, 2020). Despite repeated government attempts at oversight, including the Ministry of Environment's push for emissions controls, enforcement remains weak, leaving Lebanon locked in a cycle of dependence and capture.

Struggles for Decentralized Renewable Energy Governance

Renewable energy developments in Lebanon had been stagnant for years. In 2023, however, a number of shifts took place. In May 2023, the MoEW signed contracts for 11 solar farms across the country with a combined capacity of 165MW (Boutros, 2023). By 2024, six of these licenses had been resold to private companies – including CMA CGM, TotalEnergies, and QatarEnergy – but none have reached financial close given Lebanon's fragile political situation (Schellen, 2024). In December 2023, Law 318 was passed to regulate Distributed Renewable Energy (DRE) and facilitate the integration of privately generated electricity into the national grid. The law enables private actors – including households, businesses, and municipalities – to produce up to 10MW of renewable energy, share systems across properties, and engage in net metering, effectively allowing energy exchange with EDL (Abi Haidar, 2024). It also introduces direct purchase agreements without state intermediaries and permits the use of EDL's infrastructure in exchange for a transit fee, while establishing a renewable energy directorate within EDL for the first time.

In principle, Law 318 breaks EDL's production monopoly and offers a more decentralized, locally responsive energy model, particularly by allowing municipalities and private actors to sell power within their territories. However, the law's implementation was conditional on the creation of the long-delayed ERA. Currently, the law has been approved and is

awaiting issuance of the implementation decrees. With the ERA finally established in September 2025, conditions are finally in place for further development.

At present, there is no clear governance framework for decentralized renewable energy. Community-level models remain technically illegal, which has led donors to withdraw from financing them. Funding is now directed only to projects owned by EDL (see section 3.2). With the dissolution of USAID financing, donor support has contracted further, leaving the private sector as the only actor willing to take the risk. From the above, it could be said that decentralization does exist, but the legal framework constrains it rather than encourages it, blocking investment at the community level and narrowing the space for more equitable energy pathways.

Table 1. Most pertinent laws in the energy sector, compiled by the author

Law/Plans/ Developments	Description and Status
Decree 16878/1964	On the establishment of EDL, granting it the entire monopoly over generation, transmission, and distribution in the sector.
Draft Law 462/2002	Draft law on the gradual privatization of EDL; not yet passed.
Decision 318-32/2011	Net metering scheme allowing subscribers to reduce their monthly electricity bills by feeding surplus energy produced by renewables back into the grid.
Law 318/2023	DRE law; passed; awaiting implementation decree
National Energy Efficiency and Renewable Energy Action	Provides low-interest loans through commercial banks for energy efficiency and renewable energy projects. These loans can be repaid over a period of 14 years and can cover full project costs.
Draft Energy Conservation Law (ECL)	Draft law on energy efficiency for renovation. It outlines how building renovations can incorporate energy efficiency measures while benefiting from financial incentives, including exemptions from VAT and customs duties on eligible equipment.

2.3. Lebanon's Previous Post-war Reconstruction Models

Lebanon's post-war reconstruction has been marked by fragmented governance, widening inequalities, and the consolidation of elite interests. The country's long history of violence and wars – including a fifteen-year civil war (1975-1990) and repeated Israeli invasions, occupations, and assaults – has necessitated multiple phases of rebuilding (Traboulsi, 2007). During these periods, the electricity infrastructure has been consistently targeted during Israeli assaults and contested among armed groups during the civil war (Verdeil, 2008).

Following the civil war, Prime Minister Rafik Hariri launched an ambitious reconstruction agenda rooted in a distinctly neoliberal logic. Drawing on technocratic expertise and framed by what Williamson (2004) called the "Washington Consensus", Hariri's vision prioritized macroeconomic stabilization, trade liberalization, and large-scale infrastructure projects, while sidelining the welfare needs of the periphery and

war-affected areas. As Bauman (2012) argues, this form of neoliberalism was not only economic but deeply political: it created opportunities for rent capture by a narrow elite, while presenting itself as a depoliticized path to global competitiveness. In Lebanon, the most emblematic rent-creation mechanism was the redevelopment of Beirut's Central District by Solidere, which appropriated land, displaced residents, and rebranded the area as a luxury enclave aimed at Gulf investors. Public resources absorbed much of the risk, while profits were privatized, transforming the city into an "elite playground" that is largely disconnected from its urban fabric (Swyngedouw et al., 2002).

This logic extended to the electricity sector, where postwar reconstruction poured billions into expanding generation capacity but failed to address systemic dysfunction. While output increased from 700MW in 1990 to over 2,315MW by the early 2000s, EDL never recovered its ability to collect payments or enforce billing, particularly in politically sensitive regions (Traboulsi, 2014). Rentier interests – both political and financial – profited from this dysfunction, as Hariri's attempts to privatize the sector met fierce resistance from rivals like Nabih Berri, who used institutions like EDL to distribute patronage (Bauman, 2012). Crucially, although nearly $2 billion was allocated to the sector in the 1990s, investment was marred by corruption and political interference (Traboulsi, 2014). An estimated $500 million was siphoned through inflated contracts and commissions involving ministers and politically connected contractors. A 2003 scandal tied to generator supply contracts for EDL revealed widespread bribery, yet no prosecutions followed (Traboulsi, 2014). Despite these investments, EDL remained chronically underperforming, with high levels of uncollected bills and entire regions functioning outside formal billing systems. By the early 2000s, the Ministry of Electricity had accumulated more than $5 billion in losses, and EDL operated at a sustained deficit. These failures were not only shaped by the legacy of the civil war, but also by continued Israeli aggression up until the liberation of the south in May 2000.

The 2006 Israeli war on Lebanon ushered in another devastating chapter of destruction and reconstruction, this time concentrated in the south, the Bekaa, and the southern suburbs of Beirut. Despite the scale of destruction, the Lebanese state once again failed to assume a central role in the recovery process (Harb and Fawaz, 2010). Instead of asserting public leadership, the government outsourced reconstruction to an "adoption mechanism", whereby foreign donors – including Qatar, Iran, Kuwait, and Saudi Arabia – selected towns and villages to rebuild, operating outside any national recovery strategy and bypassing state institutions (Saksouk Sasso et al., 2010). Hezbollah's Wa'd program launched within days of the August 2006 ceasefire, distributing cash compensation of over $100 million, and consolidating its political legitimacy in the absence of a state response. While some projects were delivered efficiently, the lack of coordination, public oversight, and equitable standards exposed the deeply politicized nature of the process. As Al-Harithy (2010) notes, this was not simply a case of state weakness; it is instead emblematic of deliberate withdrawal where governance privileges clientelism and short-term visibility over structural recovery. Reconstruction thus became a mechanism to entrench existing power hierarchies rather than redress the injustices that had rendered southern Lebanon disproportionately vulnerable to Israeli aggression in the first place.

Electricity infrastructure was once again a key source of contestation and symbolic neglect. The 2006 war caused an estimated $208 million in losses to the electricity sector, including $128 million in transmission damage and $80 million in power generation losses (Fattouh and Kolb, 2006). Among the most visible infrastructural and environmental consequences was the destruction of five fuel storage tanks at the Jiyyeh power plant, which resulted in an oil spill stretching across 100 kilometers of the Lebanese coast. This constituted the country's worst-ever ecological disaster, compared by some to the 1989 Exxon Valdez spill (Fattouh and Kolb, 2006). The environmental cost alone was projected at $50-100 million, further straining recovery prospects for key sectors (Harvie and Saleh, 2007). Despite these compounded losses, there was no unified state-led strategy to restore or reform the electricity sector. Instead, piecemeal donor-led solutions proliferated, reinforcing pre-existing fragmentation and institutional paralysis. In the aftermath, reconstruction initiatives reproduced spatial inequalities in service delivery, as certain areas – particularly those affected by the war – experienced continued neglect or slower reintegration into the formal grid, revealing how infrastructure recovery had become entangled with political selectivity and sectarian dynamics (Verdeil, 2008). These cycles of reconstruction reveal how infrastructure was

used to consolidate political power rather than address structural deficits or regional disparities, as clearly reflected in the persistent dysfunction and politicization of the electricity sector.

3. The Current Aftermath: Delayed Reconstruction and "Extra" Conditional Financing

Unlike in 2006, responses to the 2023-2024 war have been marked by delays, vague promises, and burdensome conditions. In the aftermath of the 2006 war, Lebanon was able to secure pledges ranging between $3.6 and $7.6 billion at international conferences held in Stockholm and Paris III, with Arab states alone pledging around $1.3 billion within weeks (Reuters, 2007). In contrast, the current pledges are mired in conditions: the first, advanced by international financial institutions, requires Lebanon to implement International Monetary Fund-backed structural reforms, particularly in the banking sector – the same reforms that have been repeatedly stalled by entrenched political elites. The second, promoted by US-aligned actors, demands the disarmament of Hezbollah, a condition so far rejected by the group and its support base. Accordingly, Western and Gulf financing are almost entirely suspended until their conditions are fulfilled.

While minimum stability in the banking sector, effective public institutions, and transparent procurement are all essential for a viable recovery process, communities that have lost almost everything in the war are currently suffering from the ramifications of this approach. Amid the continuing crisis and widespread destruction, these externally imposed prerequisites risk sidelining the urgent material needs of affected communities, making recovery both slow and politically punitive. Beyond infrastructure-related investments, municipal officials interviewed pointed to a significant shortfall in humanitarian aid compared to 2006. NGOs and UN agencies, they noted, provided only minimal support, often favoring municipalities with existing ties to donors or bypassing local authorities altogether. This method, which became common after the 2020 Beirut port explosion, has proven largely ineffective in the absence of institutional capacity, leading to weak coordination, lack of accountability, duplication of efforts, fragmented aid delivery, and unsustainable interventions (Dagher et al., 2022)

In the meantime, a high-level meeting was held on 10 June 2025 to discuss the establishment of a reconstruction fund for Lebanon and the World Bank's Lebanon Emergency Assistance Project (LEAP) (further discussed in the next section). According to the head of the Council for Development and Reconstruction (CDR), the official reconstruction process is now expected to begin only by the end of 2025, with conditional pledges on the horizon, including $250 million loan from the World Bank and $75 million from France (OLJ, 2025b). The World Bank's rapid damage assessment report further outlines the following:

Of the US$11 billion in reconstruction and recovery needs, the report estimates that US$3 to 5 billion will need to be publicly financed, including US$1 billion for the infrastructure sectors (energy; municipal and public services; transport; and water, wastewater and irrigation). While USD 6 to 8 billion will require private financing, mostly in the housing, commerce, industry, and tourism sectors. (World Bank, 2025a)

While the $1 billion in infrastructure funding is examined further below, the remaining billions expected from the private sector raise pressing questions about feasibility, accountability, and who will ultimately step in to deliver.

3.1. Institutional Arrangements

While the newly formed government has formally declared reconstruction a national priority, its implementation is delegated across a patchwork of actors without a unified vision. Initially, responsibility for damage assessment was debated within the cabinet. The Ministry of Defense declined to task the Lebanese Army with the survey, citing operational fatigue. Instead, the task was assigned to the Council of the South, the Higher Relief Commission, and the Union of Southern Suburbs

Municipalities. Their surveys are to be audited by a private firm and submitted to the Ministry of Finance, which will determine compensation parameters (Al-Akhbar, 2025a).

This mechanism is part of a broader three-pillar plan set in motion by the then-Minister of Public Works and Transport Ali Hamieh: first, the disbursement over $100,000 each to the Council of the South and the Union of Southern Suburbs Municipalities, and $56,000 to the Higher Relief Commission for rubble clearance; second, the creation of a transparent aid valuation mechanism in collaboration with the World Bank; and third, the implementation of reconstruction through this standardized methodology, which will be carried forward by the incoming cabinet (OLJ, 2025a). In August, the Ministerial Committee for Reconstruction and Economic Recovery, which includes the ministers of Finance, Energy and Water, Social Affairs, Telecommunications, Public Works and Transportation, and Environment, as well as the presidents of the CDR, the Council of the South, and the Higher Relief Committee, announced a preliminary reconstruction plan (Presidency of the Council of Ministers, 2025). The plan outlined:

- A three-pronged approach focused on: (1) social assistance and shelter for displaced and returnees; (2) urgent infrastructure repairs and livelihood support; and (3) socioeconomic development for war-affected areas.
- Financing mechanisms, including a mix of grants, loans, and the state budget, divided across ministries.
- The following key programs: the Cash for Rent program (launching October 2025) to support housing; the Cash Transfers program (since July 2025) targeting 265,000 displaced people, which will merge into the national Aman program; and the $200 million World Bank Green-Agri Food Transformation for Economic Recovery loan for agriculture, rural infrastructure, and small enterprises.
- Infrastructure projects, including the World Bank's LEAP.

In September 2025, the government announced its budget for 2026, and out of the $5.65 billion expenditure, only $31 million will be allocated to reconstruction through the Council of the South and the Higher Relief Commission, a negligible fraction of what is needed (Al-Akhbar, 2025c). In the meantime, Jihad El Binaa is reported to have already disbursed more than $1.1 billion to restore damaged housing units and provide temporary shelter for displaced families (Al-Akhbar, 2025b). Looking ahead, Hezbollah has announced a three-phase $3.5 billion reconstruction plan (Al-Akhbar, 2025b): the first phase allocates $1 billion for the southern suburbs and other affected areas, excluding border villages; the second and third phases foresee an additional $1 billion each; and approximately $500 million is earmarked for continued shelter assistance.

On the electricity front specifically, EDL has allocated $50 million to repair its extensively damaged distribution network. In the south, DSPs such as Mrad Electric responded rapidly despite severe logistical hurdles. Faced with equipment shortages and delayed shipments, teams adopted an adaptive strategy: reallocating cables, relocating distribution poles, and prioritizing repairs that would restore electricity to the largest number of users. However, this triage approach left some areas without any EDL service, and repairs remain ongoing as Israeli strikes continue. Meanwhile, with the formation of the new government, attention has turned to reducing nontechnical losses, primarily electricity theft. The MoEW, in coordination with EDL, has introduced policy measures that incentivize municipalities to enforce against theft by offering extended power supply in return for improved compliance. Municipalities that are able to reduce theft will be awarded extra hours of electricity, whereas those that are noncompliant are expected to face strict measures. In the informal generator market, generator owners and municipalities took the lead in restoring local networks, though several private generator owners encountered during fieldwork have since ceased operations because of the damage their systems sustained in the war.

After discussing other institutional mechanisms in place, Figure 5 summarizes the interaction of actors linked to the energy sector in the Bekaa and the south of Lebanon.

3.2. A Narrow Reconstruction and Recovery Pipeline: The Conditional Promise of World Bank Loans

The 2025 LEAP

The overarching reconstruction financing and framework currently in place is the LEAP, proposed and partly financed by the World Bank and implemented by the CDR. Overall, it proposes a $1 billion financed project framework focusing, in the short-term, on rubble clearance and recycling and the rapid recovery of critical services and infrastructure. In the longer term, the LEAP focuses on "ready-to-finance" infrastructure projects linked to sustainability (see Figure 1). Currently, the World Bank has pledged an initial financing tranche in the form of a $250 million loan. Activities linked to the energy sector pertain mainly to the second and third pillars, although no formalized activities have been delineated so far.

With the oversight of the World Bank, the CDR was expected to commission an assessment of investment needs in the damaged areas by the end of September 2025, with preliminary outputs anticipated in February 2026. For now, the project remains at the stage of preparatory technical studies, with procurement yet to be launched by the CDR. In coordination with CNRS-L, a set of selection criteria was developed to identify priority areas, as shown in Figure 2, including identifying areas that have:

Figure 1. The LEAP framework(adapted from World Bank, 2025b)

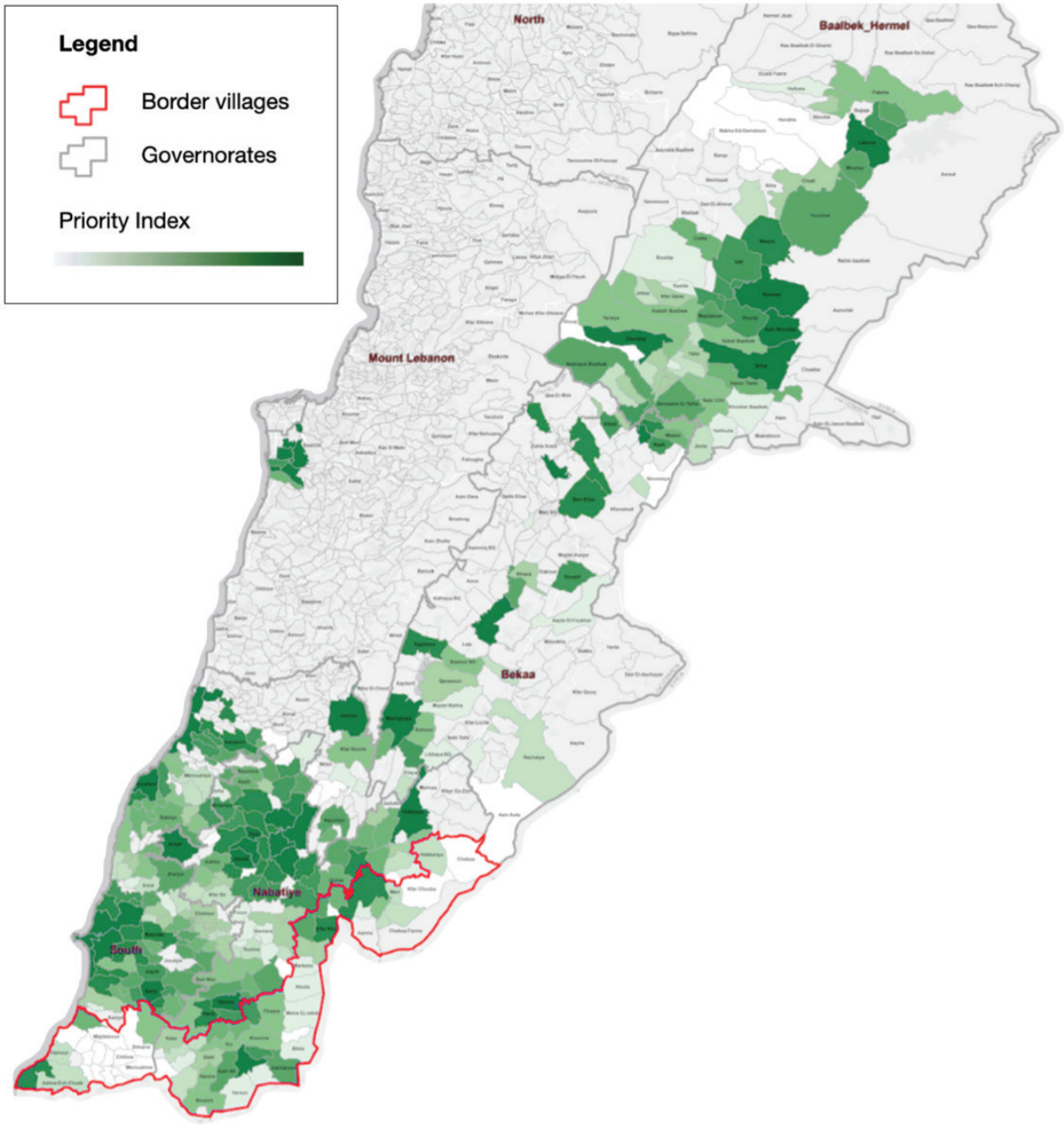
Immediate Response	• Safe rubble clearance, circular economy practices, securing damaged heritage sites, preparing public buildings for reoccupation • $30 Million secured • Total allocation: $60 Million
Rapid Recovery of Lifeline Services and Infrastructure	• Repairs to energy, water, transport, education, and health systems; use of mobile/off-grid solutions (solar + storage); homeowner-driven housing repair targeting vulnerable groups (via DAEM social registry) • $195 Million secured • Total allocation: $645 Million
Sustainable Reconstruction of Critical Infrastructure	• Prepare and implement climate and disaster-related infrastructure projects (transport, wastewater systems, and public buildings). Private sector participation and no financing of civil works • $15 Million secured • Total allocation: $270 Million
Project Management	• Covers all implementation support, including staff for a CDR Project Management Unit, third-party monitoring, citizen engagement, grievance redress, and communication campaigns • $10 Million secured • Total allocation: $25 Million

- The least damage, to enable a quicker recovery and resumption of economic activity;
- The highest winter population, to ensure the greatest number of beneficiaries; and
- The highest preconflict economic activity and potential to contribute to economic

development.

Ultimately, while the LEAP provides a framework for recovery, it falls short of the vast needs on the ground. In its current form, it lacks mechanisms to ensure renewable energy integration. The plan focuses on rebuilding the grid as it is, though its flexibility leaves some room for maneuver. At the same time, its reliance on loans and centralized decision-making raises concerns that reconstruction will unfold in a narrow, top-down manner, with limited space for community participation despite the inclusion of a grievance mechanism in the framework.

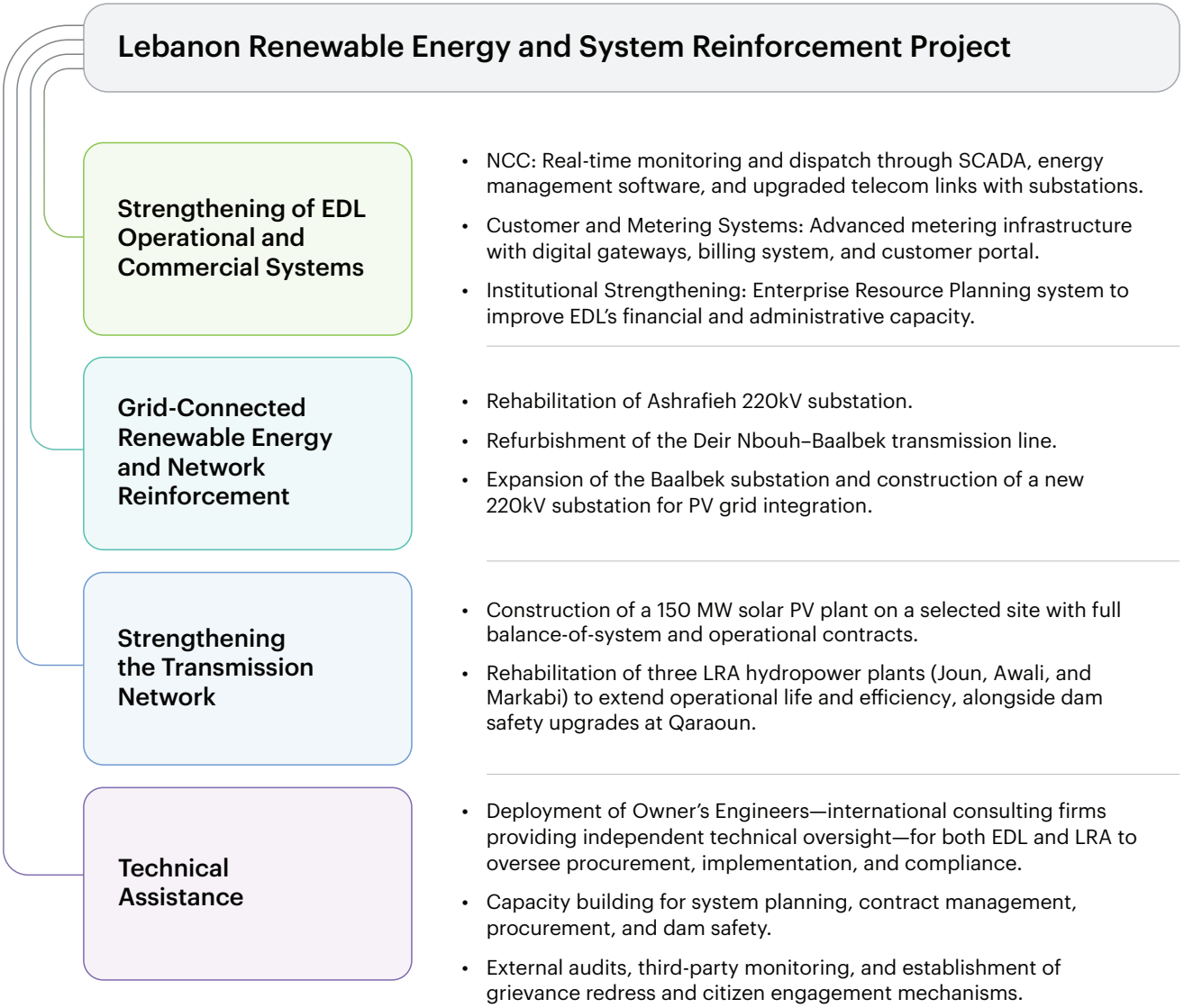
Figure 2. Map of priority areas (adapted from CNRS-L, 2025a)



Lebanon Renewable Energy and System Reinforcement Project

Another World Bank loan, amounting to $250 million and operationalized with EDL and the LRA, has been put forward for the energy sector. Its disbursement hinged on the ERA, only recently established, and at this point, both its timeline and implementation remain unclear. The project is presented as a set of "no regret" investments aimed at restoring system functionality and addressing critical weaknesses in the grid, while at the same time creating the institutional and technical conditions for renewable energy integration (World Bank, 2025c). It is structured around four core components, detailed in Figure 4. It covers several long-awaited developments in the sector, including the establishment of a new NCC equipped with SCADA and energy management systems, alongside an advanced metering infrastructure center designed to improve billing, monitoring, and loss reduction. The loan also earmarks financing for a 150MW solar plant in the Ras Baalbek and Qaa areas (see Figure 4); this is the first step in a wider solar corridor with a potential of up to 800MW, intended to generate economies of scale and attract private sector investment once initial risks are absorbed through this loan. To ensure this capacity can be absorbed, the project also includes targeted transmission reinforcements that will allow the grid to integrate renewable energy more reliably and reduce reliance on ad hoc diesel generation.

Figure 3. Details of the latest World Bank loan for the energy sector (adapted from World Bank, 2025c)



What are the benefits for local communities?

While the project is framed as a national benefit, its value for places like Qaa and Ras Baalbek should be judged by locally felt outcomes. Today, both municipalities receive roughly four hours of EDL supply in two-hour blocks, and many households have shifted to rooftop solar to avoid diesel (EDL, 2024). The key questions are basic: how many households are actually connected to the grid, how many hours of reliable supply will they gain, and how many can afford service under the current tariff and connection fees. An equity lens is needed to ensure low-income and renting households are not left out and that safeguards translate into real access rather than formal promises. More research is required on ability-to-pay, connection costs, and the distributional impact of the tariff, with clear monitoring and use of the grievance mechanism to track whether benefits reach those who need them most.

Figure 4. Potential Sites for grid-connected solar panels (adapted from EDL, 2024)

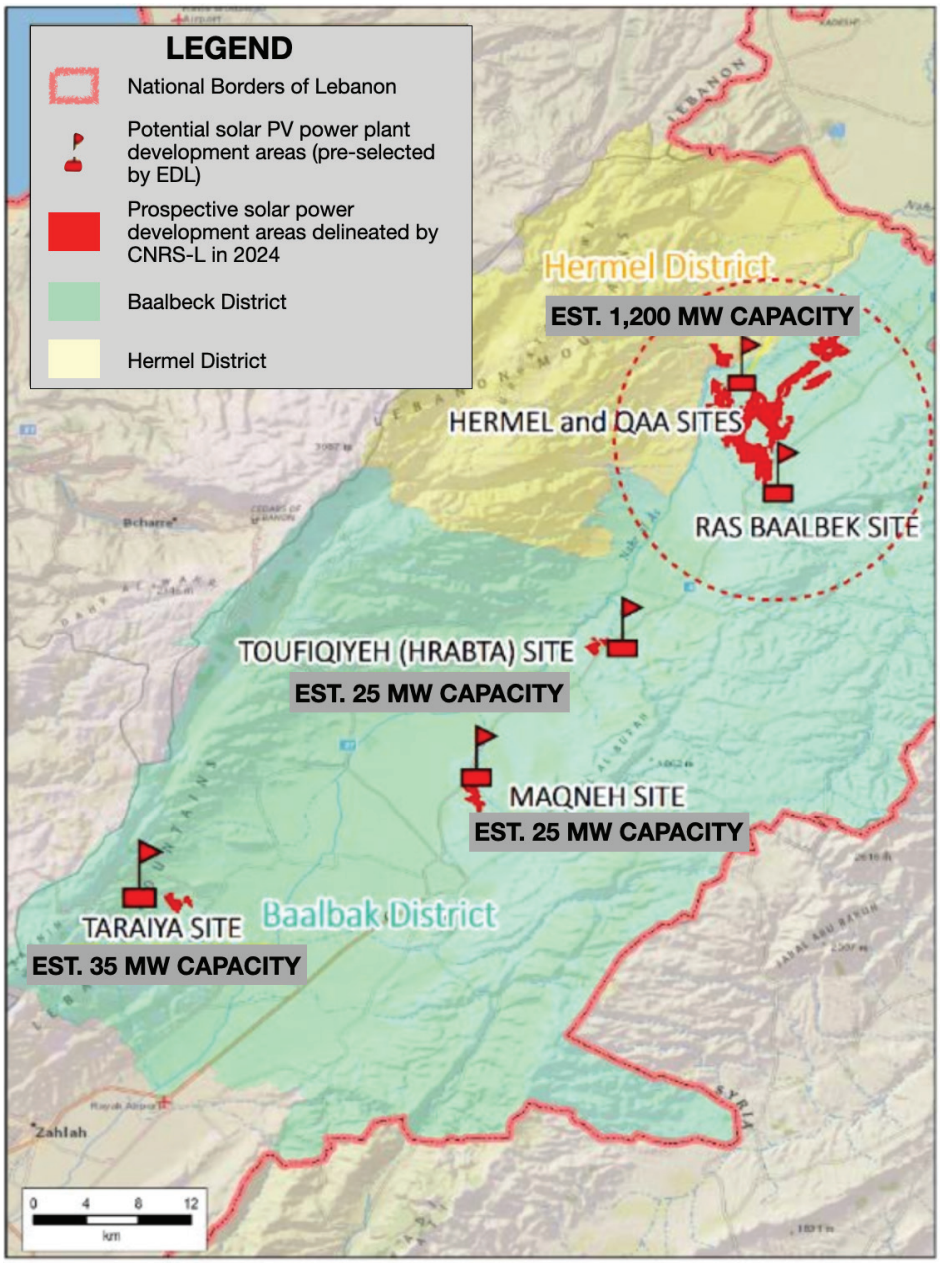
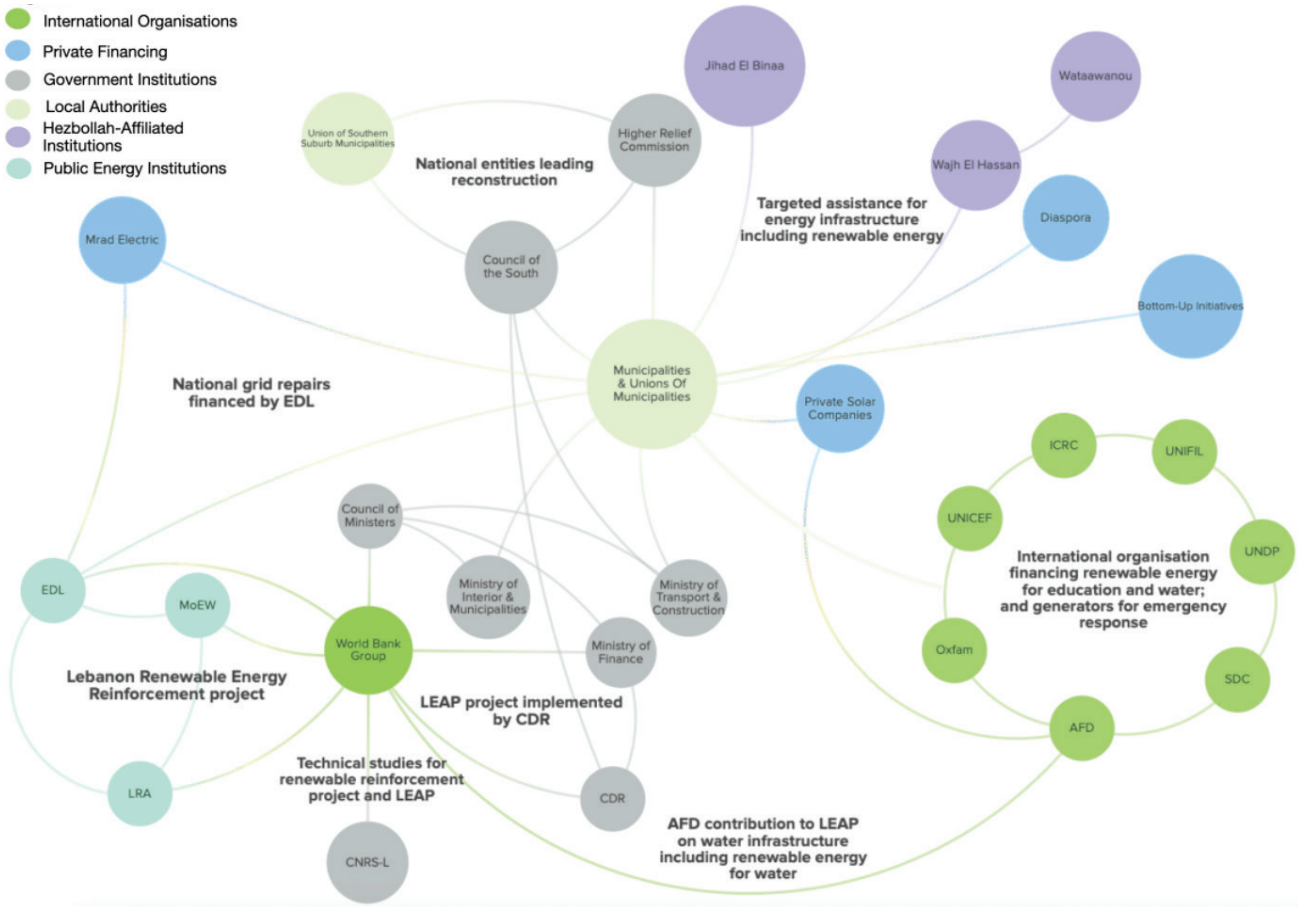


Figure 5. Relationship map of energy sector reconstruction actors in south Lebanon and the Bekaa, compiled by author



4. Field Observations: Renewable Energy in South Lebanon and Baalbeck

In March 2025, field visits were conducted in 10 locations across south Lebanon and the Bekaa. Towns and cities visited include Baalbek, Nabatiyeh, Ghazieh, Sour, Qabrikha, Majdal Silem, Souaneh, Touline, Chaqra, and Sultaniyyeh. During these visits, semi-structured interviews were conducted with municipal officials, solar providers, and residents, alongside site observations of damaged and operational solar installations, generator systems, and the national grid.

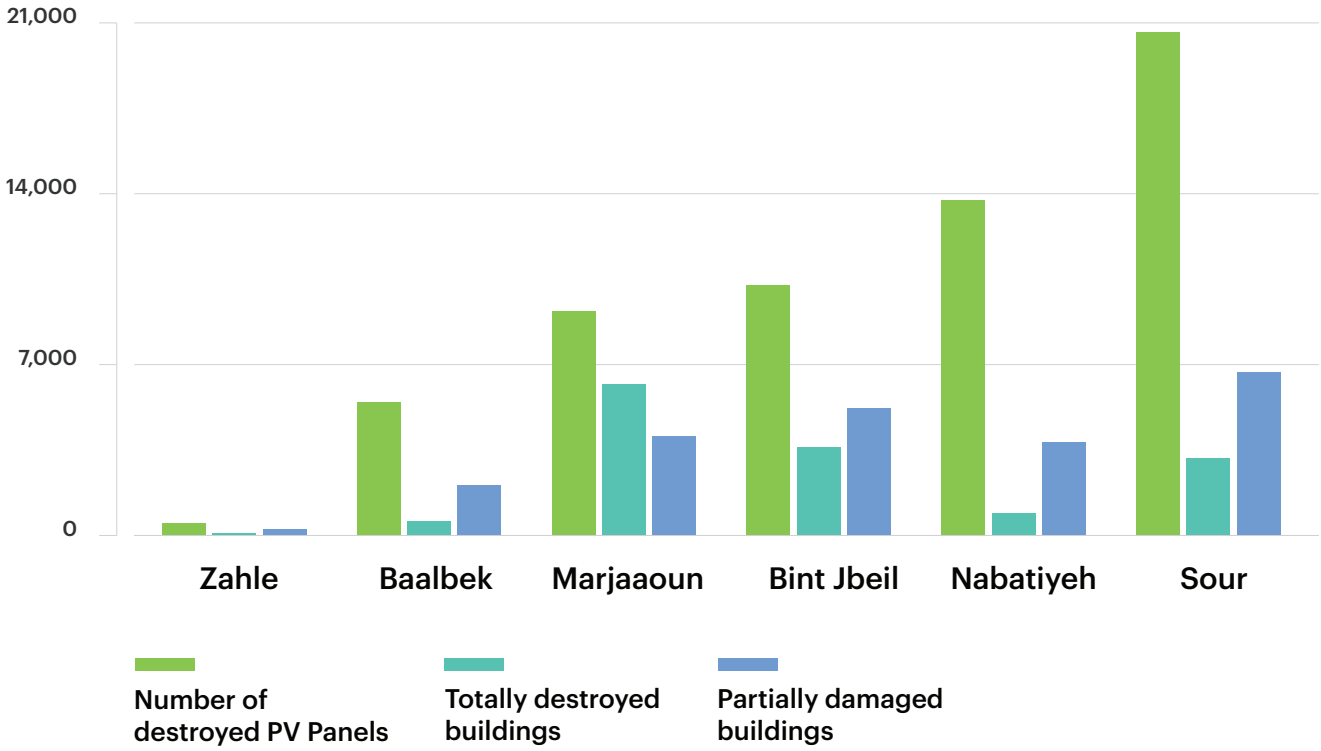
Data access and accuracy proved to be significant limitations, especially concerning solar systems. Municipalities generally had more information on and knowledge of damages to the grid (both national and parallel *ishtirak*) than on solar infrastructure. Assessing solar losses required greater technical expertise, and at the time of the visits, municipalities lacked a full picture of the damage. Household-level data was even less precise: municipal estimates relied on approximating the number of damaged units and multiplying by an assumed number of panels per household, yet no consistent benchmark for panels per unit emerged. As a result, triangulation and validation of these figures were not possible. For this reason, the author opted to rely on satellite data provided by CNRS-L. As shown in Figure 6, the war caused extensive destruction across both solar infrastructure and buildings, with notable variation between districts. In total, 59,735 photovoltaic (PV) panels were destroyed. Sour recorded the highest number of PV panel losses (20,652), followed

by Nabatiyeh (13,706), Bint Jbeil (10,258), and Marjaayoun (9,169), while Baalbek (5,432) and Zahle (517) reported comparatively fewer.

When set against building damage, a more complex picture emerges. Marjaayoun, for example, had fewer PV panel losses than Sour but registered the highest level of building destruction, with 6,161 structures totally destroyed and 4,035 partially damaged. Sour, in contrast, combined the highest PV panel losses with 3,153 destroyed structures and 6,661 partially damaged, reflecting the area's dense solar adoption and the presence of agricultural plots and orchards equipped with panels. Nabatiyeh stands out for its high PV panel losses (13,706) despite recording fewer affected buildings (926 destroyed, 3,858 damaged), suggesting that solar infrastructure there was more widespread or more directly exposed to bombardment than building destruction figures alone would indicate.

These patterns highlight several dynamics. First, the intensity of bombardment in southern border districts explains both the concentration of building destruction and the scale of PV panel losses there. Second, prewar solar adoption, shaped by factors such as diaspora support, remittance flows, and overall socioeconomic conditions, likely meant that in some areas, solar infrastructure was more widespread and thus more exposed to destruction. Finally, the discrepancy between building and solar damage across districts suggests that panels were deployed not only on residential rooftops but also in agricultural and community settings, amplifying the impact of their destruction on both households and the local economies.

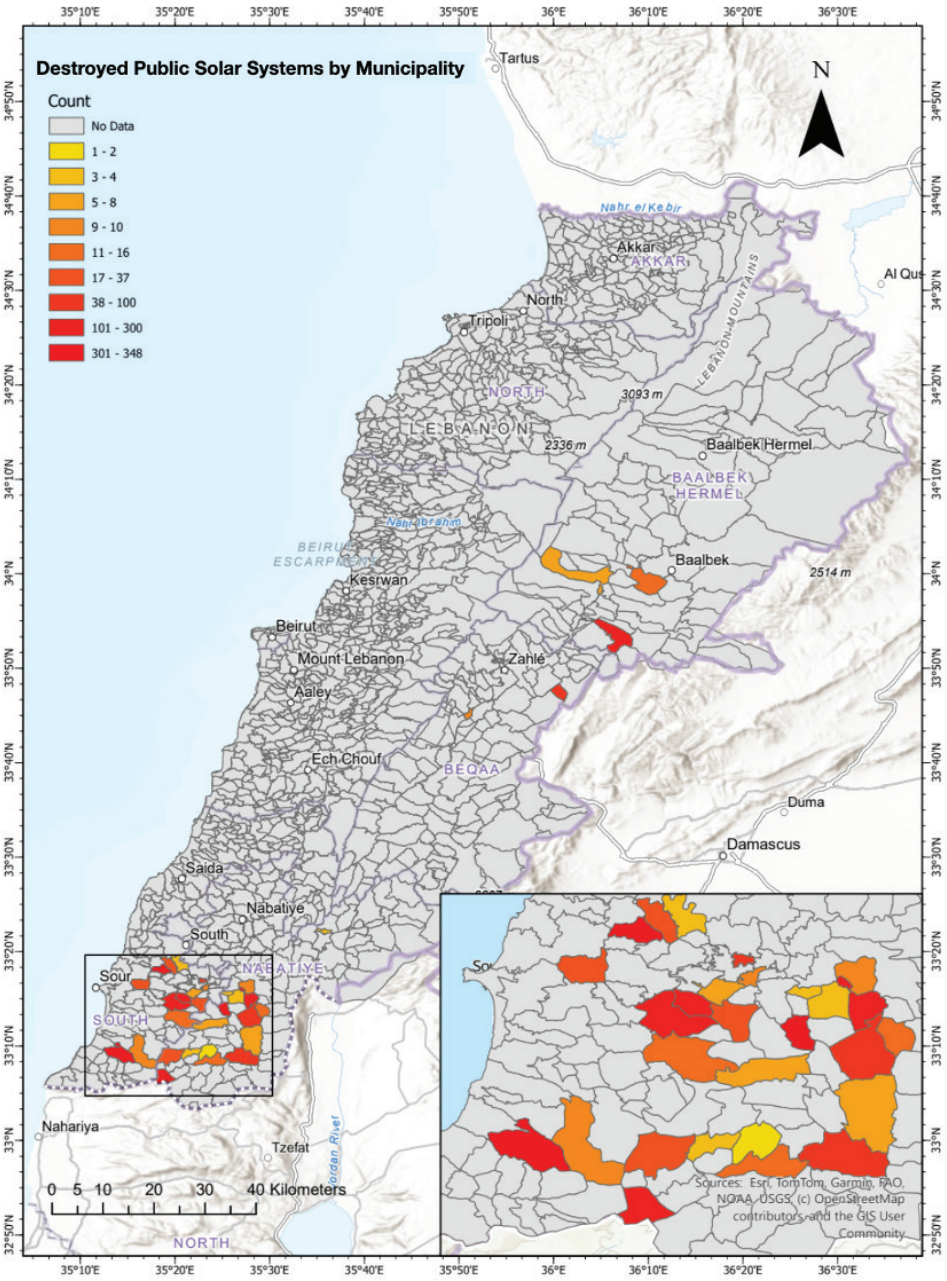
Figure 6. Damage to PV panels and buildings by district across the Bekaa and South Lebanon as of December 2024 (adapted from CNRS-L 2025b; 2025c)



A total of 66 municipal solar systems were reported destroyed across 38 municipalities, amounting to at least 2,553 damaged panels (see Figure 7). Secondary data provided by Takom Energy was utilized for the analysis of these systems, and it is important to note that in some sites, the total number of damaged panels could not be recorded, meaning that actual losses are likely to be higher. Damages were especially severe in Kherbet Silem (348 panels), Majdal Zoun (335 panels), Deir Qanoun El Nahr (301 panels), Ramyeh (300 panels), and Debaal (300 panels). Data from several frontline border villages could not be collected due to the political and security situation; this area will be discussed further

in section 4.3, where more information is provided. What makes the reported damages particularly significant is the function of many of these systems: 31 installations, nearly half of the total, were dedicated to water pumping and distribution across 25 municipalities. Their destruction, therefore, disrupted not only renewable energy adoption at the local level but also access to essential services such as water provision, which had become heavily reliant on municipal solar systems in the absence of state support. In most cases, damage extended beyond panels to include batteries and inverters, leaving entire systems inoperable. The loss of these installations represents a major setback for municipalities that had emerged as key providers of decentralized services, further weakening community resilience and complicating prospects for equitable reconstruction.

Figure 7. Destroyed municipal solar systems by municipality (data provided by Takom Energy)



4.1. Vulnerability and Resilience of Solar Systems

After the ceasefire, residents returning to their villages and towns were met with a complete blackout. Public service provision, including water, electricity, and telecom, was nonexistent, and even the ishtirak grid had sustained severe damage, with multiple municipalities reporting damage of over 90%. Many households found their rooftop solar systems damaged even when their homes remained intact, while in rarer cases, the opposite occurred, with destroyed homes leaving solar installations relatively unscathed. Discussions with renewable energy providers revealed that lead batteries, which are more widely used than lithium batteries because they are cheaper, were either partially or completely damaged in the majority of systems. As mentioned, housing destruction accounted for 67% of total damage (approximately $4.8 billion), and because most residential units hosted rooftop solar units, household-level renewable energy infrastructure absorbed a large share of the losses. Similarly, municipal renewable energy systems sustained damage, as previously mentioned.

Figure 8. Damaged solar system in Nabatiyeh due to a nearby strike (source: author)

For the first two months, both the national grid and parallel generator networks were undergoing repairs, which meant that no electricity services were available for residents. Overall, 34% of electricity facilities were damaged across the country, including the direct targeting of the Marjeyoun power station. As EDL and Mrad Electric undertook repairs, solar systems became the primary source of electricity during the first two months following the ceasefire, and communities were accordingly able to maintain some electricity access during this period. In cities where roof space is more limited,

the situation was more difficult. As one interviewee from Sour explained, having the privilege of solar power meant his house was the only one lit in the entire neighborhood. In the absence of alternatives, many households used their compensation from Jihad El Binaa to either fix solar systems or buy new ones, which became their main source of electricity.

On the other hand, municipalities worked on restoring basic services to encourage residents to return to their towns. In Chaqra, for example, the mayor explained that in the first months, the municipal generator was distributed from house to house to help pump trucked water, after IOF bulldozers destroyed the electric room that powered the village well pumps, cutting supply to over 2,000 households. Municipal spending focused on lighting main streets and communal buildings, including the municipal offices, religious establishments like the Husseiniyeh, and the town squares. Surveyed municipalities said repairs to the ishtirak grid were financed either by diaspora and wealthier residents or by institutions linked to Jihad El Binaa.

In terms of financing for solar repairs, the burden initially fell on residents themselves, many of whom used their compensation payments to fix or purchase new systems. For municipal solar projects, in some cases, such as Nabi Sheet, donors like the Swiss Development Cooperation, which had financed the original installations, also covered the repair costs. In other cases, international actors, while primarily engaged in education, water, and street lighting, also extended limited support to renewable energy. These included UNIFIL, UNICEF, UNDP, and Oxfam (see Figure 5). More recently, AFD announced a €100,000 seed fund to identify and restore renewable energy projects for water provision that required minimal funding to resume operations as part of its broader $75 million contribution to the LEAP. Alongside these efforts, grassroots initiatives emerged, such as the "USD 1 Campaign", which sought to bring people back to border villages and invested in residential solar panels in the absence of alternative infrastructure. Similarly, charity organizations linked to Hezbollah, such as Wajh el Hassan and Wata'awanu, cofinanced the restoration of municipal establishments in Majdal Silem and Ramyah as one example, incorporating solar panels into local infrastructure as a way to encourage communal living and support the return of displaced residents.

Changes to the Generator Economy

All municipalities reported either direct or indirect targeting of generators during the war (see Figure 9). In the immediate aftermath of the ceasefire, they relied on these systems to restore basic services as a form of emergency response. New generators were supplied by donors such as the ICRC, by wealthy residents, or by generator owners themselves. The extent of recovery depended heavily on local socioeconomic and geographic conditions. In larger cities such as Sour and Nabatiyeh, where generator owners were already numerous and relatively resilient, municipalities were able to work with them to bring services back online. In wealthier towns with donor connections, including Chaqra, Majdal Silem, and Qabrikha, access to financing for generators was facilitated. Elsewhere, generator services had already declined with the solar boom, and even in cities like Baalbeck, they were largely restricted to those operated directly by municipalities. In smaller villages such as Touline and Souaneh, municipal services were further disrupted after the war: although repairs were made to the ishtirak network, residents could no longer afford subscriptions, and municipalities lacked the funds to cover unpaid bills owed to generator owners.

In Sour, for example, the municipality moved quickly after the war to reorganize the electricity sector at the local level. Meetings were held with generator owners across the city and suburbs to address the damage sustained to cables and equipment, and to coordinate power provision during and after the hostilities. A subcommittee was established between generator owners and the municipal Electricity Committee to regulate the sector, develop cost criteria, and consult technical experts. One of the central outcomes was an agreement to remove, maintain, and reorganize the network of generator cables in cooperation with Mrad Electric. Generator owners also committed to street lighting in coordination with the municipality, with some even covering costs at their own expense. Alongside these efforts, the municipality has emphasized the need for cooperation with generator owners on pricing, environmental standards, and fair distribution of supply. Regular pricing schedules have been published, reflecting coordination with owners across Sour and its neighborhoods. Importantly, discussions have also included the gradual incorporation of solar energy as an alternative, building on projects already completed with international partners such as the Korean

UNIFIL battalion, which funded and installed solar-powered street lighting along the city's southern beach road. Together, these initiatives point to a willingness by the municipality and generator owners to regulate a chaotic sector, while also opening space for solar solutions as part of postwar recovery.

Figure 9. Generators in Nabatiyeh damaged in a targeted strike (source: author)

4.2. Direct Targeting of Water Infrastructure

Unlike electricity, water infrastructure appears to have been more deliberately targeted, particularly south of the Litani River. Damage to 34 public facilities in the Sour, Bint Jbeil, and Marjaayoun districts disrupted access to water for more than 400,000 residents (UNDP, 2025). Strikes hit major pumping stations in Taybeh, Sour, Wazzani, and Nabatieh El Tasse, as well as the Yarin and Maaroub storage tanks. The most severe attack was in Sour, where the mokhtars (local elected officials) of Sour and Borj El Chemali were killed at the pumping station, despite being there only in their capacity as workers of the south Lebanon Water Establishment (see Figure 10).

With no government funding available for repairs, and with the utility already weakened by unpaid bills, the sector has been left to self-finance where possible and otherwise depend on external aid. As in the energy sector, donor financing has become the only lifeline: the ICRC is rehabilitating the Wazzani station, while UNDP is restoring facilities in Taybeh. The crisis has further deepened water insecurity. In 70% of surveyed municipalities, damaged solar systems had been powering well pumps that served as the sole source of potable water. The bombing of the main canal carrying water from the Litani to the Qasmieh irrigation scheme halted flows of 260,000 cubic meters per day, cutting irrigation to 6,000 hectares of banana, citrus, and vegetable crops.

As a result, 82% of farmers in south Lebanon now face acute shortages for irrigation and livestock (Al-Akhbar, 2025d).

4.3. From Scorched-Earth Policy to Planned Buffer Zone

During this research, access to border villages was not possible due to continuing Israeli targeting of these areas. Instead, insights in this section are drawn from an interview with a journalist from Legal Agenda and from their investigations (Chaaban 2025a, 2025b, 2025c). Unlike elsewhere in Lebanon, Israel has pursued what can only be described as a scorched-earth policy in the border villages. This refers to the systematic destruction of everything that sustains life: homes, wells, pumps, crops, electricity, and telecom infrastructure. It was not collateral damage but a deliberate strategy to make these areas uninhabitable and to prevent residents from returning.

Electricity and renewable energy infrastructure were among the facilities most affected. In Tayr Harfa, an airstrike destroyed a 200-panel solar farm valued at $130,000, collectively financed by residents to operate the village's water pump that served 4,000 people (see Figure 11). In Chamaa, bulldozers uprooted solar systems and electricity poles, while in Maroun El Ras, streetlights were torn down. In Naqoura, excavation works carried out after the war deliberately destroyed sewage, telecom, and electricity networks. These examples illustrate a systematic pattern: in every village entered by Israeli forces, electricity and renewable energy systems were dismantled.

The outcome is a border area stripped of its basic infrastructure, where residents cannot return and where even reconstruction efforts are being undermined. Prefabricated homes, communal buildings, and lighting projects have also been deliberately targeted, further obstructing resettlement. Limited donations have supported the reinstallation of solar lighting in some villages, but these interventions are marginal when set against the scale of destruction.

As Chaaban (2025b; 2025c) observes, these patterns are not random but part of a broader strategy to transform the south into a buffer zone. Trump himself floated the idea of recasting it as an "economic zone". But on the ground, the policy has operated through three intertwined methods of erasure: large-scale military destruction, systematic targeting of civilian and energy infrastructure, and the prevention of reconstruction. Together, these methods amount to a planned process of depopulation, designed to permanently prevent the return of residents and recast the border zone as a securitized frontier.

4.4. Community-Led Survival and Solidarity

In the absence of coordinated recovery efforts, communities turned to bottom-up strategies to secure energy and water access. Some of these involved the revival of older practices, such as the use of small ponds and mezrab systems for water collection, or wood-fired water heaters. As one interviewee explained, returning to the villages was conditional not on the availability of electricity but on restored water access: "At night you can light a candle, but without water you cannot come back."

Where renewable energy systems were only partially damaged, households improvised with what remained. Components such as inverters and panels were salvaged from destroyed systems, repaired, or redistributed locally. Damaged PV panels were repurposed to power solar water heaters when government electricity wasn't there or, in some cases, as shading and shields (see Figure 10). These practices reflect the resourcefulness of communities but also highlight the precarity of decentralized renewable energy when it is not supported by institutions. Solar panels in particular carry environmental risks: once broken, they release toxic dust and hazardous chemicals, yet no recycling or safe disposal mechanisms exist.

These dynamics illustrate two interlinked processes. On the one hand, sociopolitical dynamics have produced a form of resilience through household-level coping strategies: repairing, redistributing, and reusing energy systems in highly constrained conditions. On the other hand, the absence of structured institutional support means that these efforts remain contingent and precarious, subject to the same vulnerabilities that have long shaped Lebanon's energy sector. What emerges is a fragmented landscape of resilience, where survival depends on improvisation rather than reliable systems of service provision.

Yet these accounts also point to forms of solidarity that extend well beyond individual households. Municipalities often acted as first responders: repairing networks, lighting communal spaces, and ensuring water access despite scarce resources. Generator providers coordinated service restoration with the support of diaspora funding that became a vital lifeline for many towns. Hezbollah and its affiliated NGOs, many of which were themselves directly targeted as they attempted to work on the ground, nonetheless continued to compensate families, restore housing, and reinstall solar systems in municipal and communal facilities. These bottom-up efforts, emblematic of what has been described as a "resistance society", show that recovery was sustained not only through household ingenuity but also through the collective commitment of local communities, diaspora networks, and political organizations stepping into roles the state abandoned. Taken together, they underscore both the creativity and solidarity that make survival possible in the aftermath of war, but that also urgently call for a coordinated framework – with much-needed government support – that can transform these energies into sustainable, safe, and equitable recovery.

Figure 10. Solar panels reused as sun shields in the village of Souaneh (source: author)

5. Policy Recommendations for Energy Justice Pathways

Field observations and in-depth interviews focused on potential pathways for integrating renewable energy into the reconstruction process. Throughout this process, experts highlighted reforms that are largely structural and technical in nature, which have been on the table for decades and are still necessary. My contribution here is to frame these reforms through an energy justice lens, since questions of distribution, access, and exclusion are central to any transition.

Interviewees identified a set of baseline conditions that must be put in place to unlock change in the governance and performance of the sector. The first was the urgency of establishing the ERA, without which real progress could not be achieved. At the time of the interviews, this had not yet been achieved. Its recent formation marks a positive development. However, given the trajectory of past reforms in the sector – which have consistently been blocked – this development should be approached with cautious optimism. Beyond regulation of the electricity market, the ERA will also need to play a central role in the reconstruction phase, setting out a clear plan for how it should intervene to guide investment, prioritize equity, and ensure that rebuilding does not replicate the failures of the past.

Beyond this, experts pointed to the importance of implementing the measures already agreed to under the World Bank loans, which include upgrading transmission lines, operationalizing the national control center, expanding smart metering, and connecting renewable energy to the grid. While some questioned the transparency of the loan process, there was broad agreement that it remains the only concrete step forward to date. One interviewee noted that these measures largely repackage recommendations from the Ministry of Energy's 2010 policy paper, underscoring that little substantive reform has taken place.

The most significant disagreement among interviewed experts related to the role of decentralized renewable systems. Some argued that the current focus on household and community-scale installations diverts attention away from the central grid and from the EDL itself. There was, however, a broad consensus that such systems must, at a minimum, be legalized and better regulated to enable transferability, access to financing, and consumer protection. Without this, they remain unsustainable and highly costly solutions. From an equity perspective, these models exacerbate burdens on communities rather than alleviating them. For this reason, policy interventions should prioritize maximizing benefits while reducing costs for communities. Positive discrimination measures that channel targeted support and investment into marginalized regions could make them more attractive for development and prevent the deepening of inequalities.

Finally, experts stressed that reforms cannot be implemented in isolation. The grid is largely intact, although rehabilitation is needed in several areas. For the DRE law to work in practice, let alone to scale, the grid itself must be reliable and fully electrified. For net metering to function, widespread deployment of smart meters is required, alongside the technical capacity to read and manage them. At present, only around 5,000 smart meters have been installed since 2016, according to one expert, which is far from sufficient. Similarly, for on-grid renewable energy to be viable, EDL staff must be able to manage intermittent power supply. As one interviewee noted, the institution currently lacks this capacity and would require significant training and support. What is needed is a package of reforms that moves beyond piecemeal fixes: the full disbursement of the World Bank loan now that the ERA has been established (transmission, control center, smart meters, and grid-connected renewables), as well as targeted measures to address inequities in access and financing. Additionally, reforms should include securing sustainable agreements for fossil fuel imports (e.g., via long-term contracts or regional supply partnerships) and building new natural gas power plants (such as planned proposals for Deir Ammar II) to reduce reliance on imported heavy fuel oil and improve efficiency in generation. Crucially, the recycling and safe disposal of damaged solar systems should be made an essential component of the LEAP, given that broken panels release toxic dust and chemicals.

Taken together, these reforms would enable a just transition by ensuring fair regulation, transparent pricing, and reliable access while avoiding the

exclusionary and fragmented pathways that have long characterized Lebanon's energy landscape.

5.1. Investing in the Flexibility and Interconnection of Existing Decentralized Systems

Building on the Case of Qabrikha

One of the main "no regret" investments is connecting existing decentralized systems to the grid. Many of these projects were built by donors or through diaspora and local contributions; they power basic municipal services like water pumping or are integrated into the local diesel generator network. But because they operate in isolation, their value remains limited. If connected to EDL, municipalities could reduce their electricity bills and ease the financial pressure of service provision. This is not only a technical upgrade but also a justice issue, as it would free up scarce municipal resources currently spent on costly private generation and redirect them toward other essential services.

Building on the case of Qabrikha illustrates this potential (see Figures 11 and 12). Qabrikha piloted a virtual net metering scheme that is different from solar systems tied only to the parallel ishtirak grid. When EDL supply was available, households accessed it directly; when it was cut, they relied on local solar production. Surplus generation was exported to the grid. For the municipality, the scheme created the prospect of lowering its electricity bill by offsetting consumption with local production. Although EDL's financial insolvency has so far prevented residents from seeing tangible benefits, the experience in Qabrikha points to what could be possible once the utility's financial position improves. For such interconnection to succeed, the grid must be reliable and electrified, smart meters must be deployed and read, and EDL staff must be trained to manage intermittent supply. Without these capacities, net metering cannot function, and municipalities will remain unable to realize the savings that make such systems viable. Several municipal systems – such as those in Debaal, Majdal Zoun, Kherbet Silem, Deir Qanoun El Nahr, Arzoun, Nabi Sheet, and Nabatiyeh are already large enough to be feasibly connected to the grid, making them priority cases for future investment.

Figure 11. Diagram depicting the concept of the microgrid 'virtual net-metering'

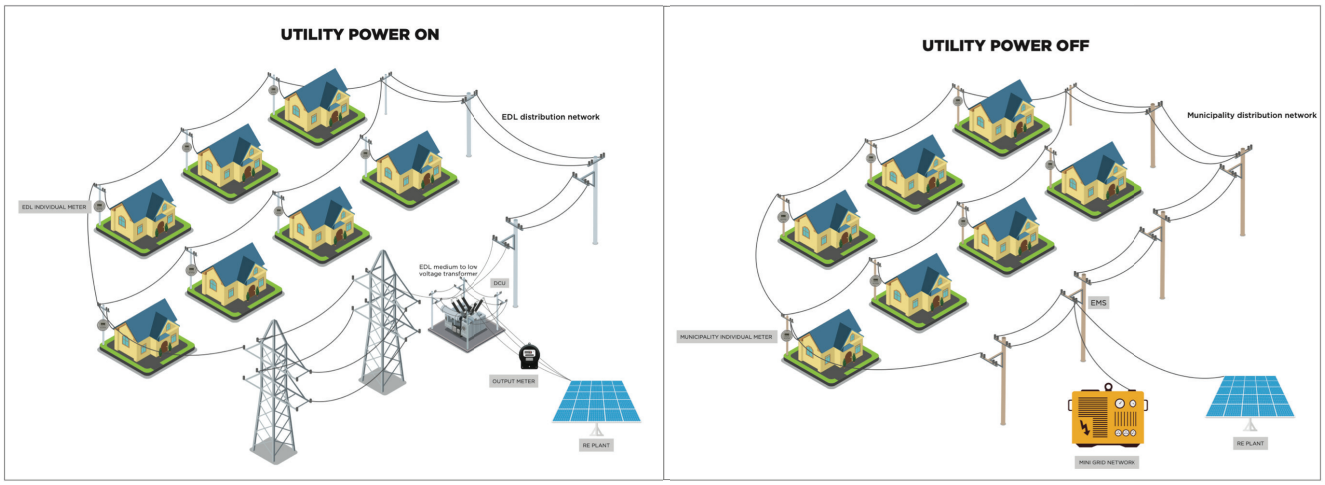


Figure 12. Field visit photo of solar installations in Qabrikha. Left: funded by UNDP, partially damaged. Right: installed to power the village well (source: author)

Collective Self-Consumption

A promising pathway for energy recovery is collective self-consumption, especially in coastal areas such as Sour and Adloun, where large agricultural fields or orchards already host sizable solar installations. These systems often produce more electricity than they can use at certain times. For instance, irrigation pumps run only during the watering season, leaving solar panels idle for long periods, while industrial operations fluctuate depending on shifts in demand. Today, this surplus energy is effectively wasted. Collective self-consumption offers a way to pool production so that excess electricity can be shared locally rather than lost. The principle brings producers to neighboring households and services in a collective scheme where generation and consumption are balanced within a defined perimeter. Surplus energy can either be redistributed locally or, when EDL supply is available, exported into the grid through net metering. This turns isolated, privately financed systems into community resources, maximizing efficiency while extending benefits to a wider group of users.

International benchmarks highlight the regulatory and institutional conditions required for effective collective energy arrangements. In France, collective self-consumption is legally recognized, allowing producers and consumers to form local energy groups where flows are measured and costs and benefits are shared transparently (Frieden et al., 2019). Similarly, the concept of agro-energy cooperatives has been explored in countries such as Spain, Turkey, and India, where farmers pool solar generation for irrigation and consider surplus sharing within cooperative structures or selling it back to the grid (Rubio-Aliaga et al., 2016; Bhatt and Kalamar, 2016). Both cases stress the importance of a clear regulatory framework, reliable metering, and a coordinating body to manage distribution. For Lebanon, this would mean a stronger role for the ERA in establishing legal provisions for collective schemes alongside municipalities acting as coordinators. The benefits would be direct: lower energy bills, reduced reliance on diesel, and fuller use of renewable capacity that would otherwise stand idle.

5.2. Transparency and Access to Information

Fiscal incentives have already been introduced to reduce the upfront costs of renewable energy in Lebanon. Law No. 10 (the 2022 Budget Law) exempts solar equipment from VAT and customs duties; Decision No. 640/1 (2023) extends these exemptions to a wider range of renewable components; and Decree No. 167 (2017) applies tax reductions to environmentally friendly products. These exemptions are now at risk of being removed when they should instead be strengthened through greater transparency and accountability. Without clear mechanisms, benefits are likely to be captured by importers and distributors rather than reaching households and municipalities that face the heaviest energy burdens. To align fiscal incentives with energy justice principles of transparency, affordability, and inclusion, reconstruction planning should ensure that exemptions are not only maintained but also

translated into lower consumer prices. This requires the establishment of a clear regulatory framework under the ERA that would:

- Introduce mandatory price disclosure: Solar providers and distributors should be required to publish itemized costs for equipment, installation, and after-sales services, clearly indicating how exemptions are factored into end-user prices. This could follow the model of fuel price bulletins currently issued by the MoEW.
- Create a consumer-accessible registry: A publicly available online platform, managed by the ERA, should track approved solar providers, equipment standards, and average market prices. This would enable households, municipalities, and cooperatives to make informed comparisons and avoid exploitation.
- Link exemptions to equity measures: Fiscal incentives should be tied to subsidy schemes that prioritize households and institutions most affected by energy poverty, including renters, rural communities, and residents of informal settlements. Vulnerable consumers can be identified using existing targeting mechanisms such as the DAEM social registry and the Aman cash transfer program, complemented by geographic indicators (e.g., border or conflict-affected areas) and socioeconomic criteria such as tenancy status and high energy burdens (e.g., farmers).

5.3. In the Absence of Microcredit Finance: Energy Performance Contracts

Access to finance remains one of the biggest barriers for households and municipalities wishing to install solar energy or implement energy efficiency measures. At one point, LCEC examined the possibility of promoting EPCs as an alternative financing model. EPCs create a private contractual arrangement between a consumer and a company, whereby the company finances and installs renewable energy or efficiency measures, and the consumer pays back the investment through regular installments tied to savings.

For solar, this often takes the form of leasing rooftops: the company covers the installation costs, and the household pays only for the electricity consumed, without upfront investment. For energy efficiency improvements, the model is even clearer: a company installs improved insulation or more efficient cooling systems, for example, and the household or municipality pays the company a monthly fee equal to the difference in its reduced electricity bill until the full investment is recovered. At the end of the contract, the consumer retains the asset and benefits from permanently lower energy costs. In the current legal vacuum, such contracts are permitted under the principle that contracts are the law between parties, but they lack regulation and consumer protection. The forthcoming ECL offers a chance to embed EPCs within Lebanon's governance framework. Doing so would:

- Provide access to finance for households and municipalities otherwise excluded from renewable energy and efficiency adoption;
- Ensure consumer protection by introducing standardized EPC models, disclosure requirements, and minimum performance guarantees;
- Promote sustainable construction by integrating efficiency measures at the design stage rather than through costly retrofits; and
- Leverage private investment into reconstruction, while ensuring that benefits are fairly distributed to consumers.

EPCs should be formally recognized and regulated under the ECL, with the LCEC mandated to develop standardized contract templates and guidelines and the ERA tasked with oversight and consumer protection. In the context of reconstruction and recovery, this model would allow households and municipalities that lost infrastructure in the war to rapidly adopt solar and efficiency measures without prohibitive upfront costs, turning energy savings into a tool for rebuilding livelihoods and easing financial strain.

5.4. An Independent Reconstruction Fund

Several interviewees stressed the importance of establishing a reconstruction fund dedicated to war-affected areas, arguing that conventional state-led financing or donor loans are currently inefficient. One interviewee explained that such a fund should

prioritize renewable energy projects, both because of their immediate relevance to households and municipalities, and because they create durable assets that can generate long-term savings. Haidar (2025) suggests that the model could be structured around reconstruction bonds, backed by the state but marketed to the diaspora as a secure investment with returns tied to concrete projects. These could include solar farms, water pumping systems, or municipal microgrids modeled around the Qabrikha system. Unlike charitable giving, this mechanism would give the diaspora a direct stake in the region's recovery while ensuring that capital flows into productive infrastructure rather than short-term consumption.

However, such a fund would need a clear set of priorities to be effective. The first is housing: without habitable homes, the return of residents remains impossible, regardless of other infrastructure. Importantly, the financing secured by the World Bank and other international organizations so far excludes housing. Alongside this, renewable energy and water projects should be treated as core priorities, since they are essential for both day-to-day survival and longer-term resilience. Energy for critical infrastructure – including healthcare centers, telecommunication, schools, and water pumping stations – must also be guaranteed to ensure that communities can function beyond the household scale. A reconstruction fund could therefore act as a vehicle for directing resources toward durable, equitable, and community-serving projects rather than quick or politically driven fixes.

Conclusion

Lebanon's energy recovery is currently unfolding through fragmented and uncoordinated efforts. Government plans, World Bank loans, and local or partisan initiatives by groups such as Hezbollah and its affiliated organizations are all moving separately rather than within a unified framework. The result is a patchwork response that risks reproducing the same unequal and politicized patterns that have defined Lebanon's past reconstruction efforts.

The destruction of more than 60,000 solar panels and municipal systems has pushed the burden back onto households and municipalities that had already financed their own resilience. Border villages, where destruction was most severe, remain absent from official planning and risk being left behind altogether. Current grid repairs have focused narrowly on service restoration, without aligning reconstruction to longer-term energy needs. Rebuilding cannot mean restoring what was lost to its previous form or relying yet again on debt-financed projects and piecemeal fixes.

A holistic and just reconstruction framework should be built on principles of transparency, accountability, dignity, participation, and the right of return. At its core, this requires placing housing at the center of recovery and enabling displaced residents to return. Yet the primary official reconstruction framework, the World Bank's LEAP, excludes any financing for housing, leaving a fundamental gap unaddressed.

Reconstruction must also encompass energy and water as core pillars, both of which are essential for dignified living and the viability of return. Embedding energy justice within this framework means treating electricity as a right rather than a privilege. This could be achieved in several cost-effective ways, including connecting decentralized systems to the grid, enabling collective use of surplus generation, ensuring that fiscal exemptions benefit end users, and creating financing tools that reduce the burden on households and municipalities. A reconstruction fund that brings together public, donor, and diaspora resources could further anchor these priorities, provided it directs investment into durable and community-serving projects rather than quick fixes. Finally, the safe recycling and disposal of thousands of destroyed solar panels and batteries must be treated as an essential component of recovery to prevent today's destruction from creating more environmental hazards.

With the risk of Israel intensifying the war again, reconstruction requires urgency and actual prioritization, not slogans. Yet the government has allocated only $31 million so far – a token amount against the scale of destruction. Depoliticizing reconstruction is crucial if there is to be any genuine commitment to not abandoning the south, the Bekaa, and the southern suburbs. The question now is whether Lebanon's reconstruction can finally change the status quo of politicization and empty promises, or whether, like so many times before, it will remain deferred, fragmented, or perhaps never happen at all.

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