

POLICY PAPER

**POWER TO THE PEOPLE:
IT'S TIME FOR RENEWABLE
ENERGY TO TRANSFORM ELECTRICITY IN LEBANON**

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EXECUTIVE SUMMARY

The tragic irony that the offices of Lebanon's state electricity utility – Électricité du Liban (EDL) – were one of the primary infrastructure casualties of the Beirut blast of 4 August 2020 did not escape most Lebanese. Authorities' persistent failure to meet the energy needs of the population have for decades been a central symbol of the same state corruption and mismanagement that caused the blast.

The national grid suffers from both technical and regulatory deficiencies and relies overwhelmingly on expensive and highly polluting imported fuel-oil. Since the civil war, EDL has burned through public funds to secure barely enough fuel to keep the network operational – a financial burden that has become untenable during Lebanon's ongoing financial crisis. Even during a global pandemic, Lebanon made global headlines with the nation's parlous electricity network forcing closures of essential services including water pumps and hospital life-support systems.

Regulatory hurdles and political manipulation have prevented much-needed technical reforms, which would make electricity production more reliable and less expensive. Lebanon's sectarian leaders have repeatedly frustrated the establishment of an independent electricity regulatory authority (ERA) capable of bringing Lebanese power production sector into the 21st century.¹

Instead, the government has tolerated only the stop-gap solution of private diesel generators to supplement EDL's poor coverage—which supplies only around 1600 MW from an average total demand of 3000 MW. Lebanese households then pay additional,

inflated power bills for the heavily polluting and inequitable diesel generators. The country's elites have permitted this informal concession to politically connected generator owners, while largely precluding municipalities and community groups from producing their own electricity more sustainably.

Many technical reports have set out Lebanon's best pathway out of this quagmire: renewable energy. Lebanon enjoys considerable potential to develop renewable energy sources such as solar, wind, and hydro power – now competitively placed to provide electricity for communities, households and industry – and the legislative and financial reforms required to open the way for rapid renewable energy expansion are well known.

Yet, in 2018, renewable energy output accounted for less than 3% of total electricity generation.² Over 4,700 MW of additional renewable energy capacity is needed in the next 10 years to meet the Government's target of 30% of renewable energy generation by 2030.^{3,4} Least-cost modelling has identified a target of 40% of renewable energy as a feasible goal to be achieved within a decade. This would replace nearly all diesel generators with renewable energy.⁵

While Lebanon requires nothing short of a comprehensive overhaul of EDL's national grid, there are options for immediate action.⁶ With government support, communities can begin supplementing their energy needs with renewable energy through 'micro-grids' that already exist outside EDL's system.⁷ This approach would allow communities to receive myriad benefits, such as better air quality, more reliable coverage, cost savings, and enhanced community ownership of key infrastructure and intra-communal trust.



“Electricity systems provide a near-perfect reflection of the societies they power.”⁸

SYSTEM OF A DOWN: LEBANON’S BROKEN ELECTRICITY SECTOR

Lebanon’s ongoing fuel crisis has drawn renewed international attention to the country’s thoroughly dysfunctional electricity system. The country’s two main sources of power – state electricity provider Électricité du Liban (EDL) and privately owned generators – both rely entirely on imported liquid fuels (diesel and oil). With fuel becoming unaffordable, persistent blackouts have ensued across the country, with neither the national grid nor private generators able to operate consistently. At its lowest ebb, the fuel crisis forced the closure of hospitals and other essential services, accentuating the rapid decline in average living standards. The shoddy public-private electricity sector bears other costs for the Lebanese people, including increased living costs, widespread environmental damage, and impaired physical health. Blackouts resulting from patchy electricity service pose an additional strain on the Lebanese economy – in 2016 alone, electricity outages were estimated to have cost individuals and businesses US\$3.9 billion.⁹

EDL: PUBLIC ENEMY #1

For decades, EDL has been the lead culprit in Lebanon’s electricity woes. The state-owned operator is the sole operator of the national electricity grid, which provides inadequate coverage and imposes an enormous financial burden on Lebanon. Since 1993, the government has been forced to subsidise EDL’s budget shortfalls at a cost up to US\$2 billion per year – mak-

ing the energy sector responsible for 43% of Lebanon’s public debt.¹⁰ EDL has primarily incurred these losses by importing fuel-oil purchased in US dollars. Accordingly, EDL’s financial difficulties have drastically worsened amidst Lebanon’s ongoing currency devaluation. Even before the current economic crisis, fuel prices and the cost of electricity generation had increased significantly since the 1990s, when EDL tariffs were set at US\$0.095 per kilowatt hour (KWh). These tariff rates still apply, even though the true cost of providing electricity in Lebanon has risen to between US\$0.16 to \$0.23 US cents per KWh.¹¹ On top of this loss-making business model, internal mismanagement has driven up EDL’s debts. In 2019, tariff collection rates stood at just 57% of amounts owed. In the same year, theft and inefficient infrastructure caused EDL to lose around 35% of total energy generated.¹²

PRIVATE GENERATOR OPERATORS: PUBLIC ENEMY #2

Many Lebanese households, frustrated by EDL’s poor coverage levels, have long resorted to backup diesel generators as a supplementary power source. Private generator operators have constructed their own micro-grids for electricity across the country, capable of supplying electricity at times when the national supply cuts out. Use of backup generators has grown rapidly since the mid-2000s, from 22% to more than 50% of demand being covered by generators in 2020.¹³ This stop-gap solution has cost the Lebanese public dearly, which pays nearly \$2 billion annually to private generator operators to cover EDL’s shortcomings.¹⁴ These additional expenses have also amplified wealth disparities, with only the relatively wealthy able to afford to pay multiple electricity bills.



The current fuel and energy crisis has demonstrated that generators fail to address any of Lebanon's fundamental energy problems. Using generators to produce electricity exacts enormous financial and environmental tolls, while falling into the same chronic dependence on imported fuel-oil that plagues EDL's national public network.¹⁵ In this way, private generators worsen Lebanon's energy insecurity, rather than harnessing the potential of alternatives to fossil fuels. In the meantime, generators have contributed to Lebanon – with its relatively small population – suffering from air pollution and cancer rates on par with large, heavily industrialised cities.¹⁶ Lebanon has very high cancer rates, particularly in areas close to industrial and power production sites.¹⁷ Air pollution in Lebanon is estimated to have caused the deaths of more than 1,800 people in 2013 and a loss to society of around \$2.6 billion.¹⁸

The rapid proliferation of private generators since the 1990s – now estimated at over 32,000¹⁹ – saw the government attempt flimsy price regulations in 2011, when the Council of Ministers (COM) issued a decree to permit the Ministry of Energy and Water (MoEW) and Ministry of Economy and Trade (MoET) to regulate the sector. De-facto regulation of generator operators through price-setting (no matter how poorly implemented) provided tacit legal consent for generators to sell energy publicly when EDL is unable to provide electricity – a privilege renewable energy providers have been so far denied.

Generator owners have thrived off massive profits and opaque and poorly regulated monthly tariffs based on the number of cut-off hours or “per kilowatt hour” consumption²⁰ with rates as high as US\$0.45 per kilowatt hour.²¹ Their business model – reliant on a stable exchange rate and profitable fuel importation – is however being challenged in the current financial crisis. The unaffordability of US dollar-reliant fuel, depreciation of the Lira, and the impoverishment of most of the population has meant few can afford to pay generator fees in 2021 – and made renewables a far more competitive offering.

INTERNAL INERTIA

“Policy makers and researchers in this industry are just tired. What more do we have to say? It is a dismal situation where the broken politics is the only solution to the problems.”

– Renewable energy expert interviewed by Triangle.

While Lebanon's energy production sector urgently needs effective decision-making, domestic politics remain mired in self-interest and idleness. Past reform proposals have stumbled at myriad political obstacles. These include sectarian squabbling over the location of new power plants; misappropriated procurement and contracting processes;²² opaque decision-making in flagrant contradiction of international expert advice; and unrealistic, rushed plans.



“While Lebanon's energy production sector urgently needs effective decision-making, domestic politics remain mired in self-interest and idleness.”





The intractable landscape of Lebanon's energy politics has undermined numerous studies and energy sector reform plans – most of which have included recommendations for expanding renewable energy development.²³

Useful reforms for Lebanon's electricity sector have especially struggled in the absence of an effective industry regulator. Law 462 of 2002 specifically mandates that the Lebanese government should create an independent electricity regulatory authority (ERA), which would guide the country's energy policies and reforms in the national interest. The same legislation created the required legal and institutional frameworks for the ERA's operation, but has never been fully implemented.^{24,25,26}

Key decision-making power in the energy sector currently lies with the MoEW, MoET, and Ministry of Finance and the factional interests in control of each ministry. The MoEW has submitted amendments to law 462 to update it, including amendments that sought to take away the autonomy and independence of the regulatory authority. Expert sources interviewed for this paper stated this is one main reason the law has not been implemented fully.²⁷

Tellingly a former Minister of Energy and Water remarked privately as to what interest he had in handing over power of electricity generation to a six-member board representing the country's major religious sects – reflecting Lebanon's political context, where nearly every process is held up by sectarian squabbling. This is currently the case with the Board of Directors of EDL, as well as the ongoing tender process for the infrastructure needed to run existing power plants on more efficient and cleaner natural gas.²⁸

"The MoEW has submitted amendments to law 462 to update it, including amendments that sought to take away the autonomy and independence of the regulatory authority."

Without an ERA, a series of temporary laws allow MoEW to submit individual power project proposals to the Council of Ministers. This process has achieved isolated successes, including the approval of a major, 226 MW wind power project in Akkar. Concerningly, the temporary laws expire in July 2022, with no current plan for how decision-making will operate afterwards.

RENEWABLE, THE RIGHT CHOICE

Renewable energy offers the most pragmatic solution to Lebanon's electricity woes – no matter how much politicians resist that reality. Given the stricken and outdated national electricity grid, the country requires reforms that provide more decentralised power production and rely less heavily on imported fuel-oil and diesel. Renewable energy – primarily from wind, solar, and hydropower – meets these needs, while also bearing the added benefits of increased job creation, cheaper electricity, and lower carbon emissions. Indirect social and economic benefits will also accrue in the health and environment sectors.

Encouragingly, Lebanon can immediately start making this transition over the coming decade. Detailed



technical studies and modelling exercises indicate that Lebanon can feasibly achieve 30% of national energy production from renewable sources by 2030. This revamped energy mix would comprise 3,500 MW of solar and wind energy constructed over the coming decade, supported by 4,000 MW of natural gas power production. Under this new direction, Lebanon could realistically phase out the use of liquid fuels (diesel and oil) by 2025.²⁹

Even during the transition period, Lebanon would start realising various economic benefits from relying more heavily on renewable energy. The proposed energy mix would lead to net savings of US\$2.1 billion, mostly in reduced fuel and EDL subsidy expenditure. The construction and maintenance required for the new system would also create around 1,900 jobs – more than half of which would be based in typically marginalised rural areas. What is more, Lebanon would save around \$US5.4 billion in healthcare costs due to improved air quality and reduced strain on medical services³⁰. Such benefits would require an incremental yearly capital cost of just US\$175 million, representing an excellent return on investment³¹. And, if Lebanon could exceed the target of 30% reliance on

renewables, some calculations indicate that Lebanon would save US\$200,000 per year for each extra megawatt of solar power generated.³²

Indeed, far from imposing a burden on Lebanon's finances, renewable energy can help drive the country's economic recovery. Owing to their labour-intensive nature, renewables create long-term, sustainable employment. Studies show that the various tasks required for renewable energy production – in manufacturing, construction, installation, operation, and maintenance – create two to 20 times more jobs per kilowatt than oil and gas production does.³³ Renewable energy also offers clear promise for reviving Lebanon's productive and industrial sectors. The industrial sector, for instance, has peak energy demand during the day; accordingly, factories tend to prefer the greater reliability of solar power during the daytime, which adds to long-term cost savings compared with oil and gas. Already, productive sectors are leading figures in Lebanon's green transition – at present, around 20% of all existing rooftop solar systems are installed within the commercial sector and 13% in the agricultural sector.³⁴

And, perhaps most importantly, renewable energy production can help insulate Lebanon against a repeat of this summer's fuel crisis. Global competition over the region's hydrocarbons means that oil and gas will always remain insecure energy sources for Lebanon. For this reason, Lebanon can drastically improve the country's baseline energy security by meeting the achievable target of 30-40% reliance on renewable energy production by 2030. Under this structure, Lebanon could begin relying on locally produced electricity if the supply of hydrocarbons is disrupted due to supply and / or cost reasons.

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“With EDL’s approval, renewable energy producers could receive discounts on their EDL electricity bills for contributions made to the national grid.”

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HOW DO WE GET THERE?

Renewables can further build Lebanon’s energy security by reinforcing EDL’s existing capacity for energy production. At present, the public relies on the unsustainable and expensive solution of diesel-powered generators to supplement EDL’s shaky coverage. Over time, renewables could assume this support role, by feeding electricity into the national network from micro-grids around the country. It would be possible to incentivise renewable energy producers to make such contributions through a legal and administrative concept known as net-metering. With EDL’s approval, renewable energy producers could receive discounts on their EDL electricity bills for contributions made to the national grid. Such a scheme would incentivise users to invest more funds in renewable energy infrastructure, offering a way to offset the upfront capital expenditure required for adopting renewables.

Any plan for reforming Lebanon’s electricity sector must account for unavoidable technical and political obstacles. The national grid will require an extensive overhaul over a long period of time, which precludes its readiness for a complete switch to renewable energy before 2030. National decision-making on energy issues remains mired in division and inaction, meaning that municipalities and local communities stand out as the most likely option for facilitating immediate action. Thankfully, options exist for reducing the degree to which both EDL and private generator micro-grids rely on oil and gas production.

NATIONAL GRID

For the coming decade, natural gas stands out as a better alternative to fuel-oil as the majority power source for EDL’s national grid. At present, the obsolete national electricity infrastructure cannot receive renewable energy at times when the EDL grid is not running – a depressingly regular occurrence. Some of EDL’s production plants, however, can rely on cleaner-burning and cheaper natural gas instead of fuel-oil. Yet they have rarely done so, due to supply fluctuations and damage to essential pipelines passing through war-torn Syria. While an imperfect solution, using natural gas would help to bolster electricity supply to Lebanese households in the immediate future, while beginning the country’s transition away from fossil fuel dependence. At the time of writing, Lebanon is finalising an agreement with Egypt, Jordan, and Syria to import natural gas from Egypt, which would provide an additional 450MW capacity to the beleaguered EDL.

Of course, increasing natural gas usage is no substitute for a long-term, large-scale overhaul of EDL’s infrastructure. As soon as possible, the central government must implement utility-grade solar and wind energy production plants, capable of supplying EDL directly. Since 2019, another major obstacle to these reforms has emerged: the worsening financial crisis. Renewable energy projects require long-term financing; yet Lebanon now fails to meet the most basic lending requirements, with mounting state debts and a trashed national credit rating.³⁵



The same unavailability of credit prevents private sector initiatives from attracting investment for non-governmental projects, even at the grassroots level.^{36,37} Even previously approved projects have fallen prey to the economic crisis. For instance, a 2018 plan to build three wind farms in Akkar lost financial support from several international finance institutions, following Lebanon's default on state debt in March 2020. Moreover, international donors have balked at providing funding due to regulatory obstacles, most notably the absence of an independent ERA for the national energy sector.

MUNICIPAL MICRO-GRIDS

At the decentralised level, Lebanon can immediately begin transitioning to renewable energy by harnessing the country's many existing generator-powered micro-grids. These localised networks – mostly owned by the generator operators and/or municipalities – operate separately from EDL's national grid. This means that – from a technical standpoint – it would be relatively straightforward to replace diesel-powered generators with renewable power sources. Working through municipalities and local communities has, to a certain extent, the added advantage of circumventing sclerotic decision-making processes at the national level. Municipalities can be an effective partner for improving renewable energy production for several reasons: they enjoy local administrative powers, often control tracts of available land, and are increasingly keen to establish and expand localised micro-grids. Everyday citizens can directly participate in grassroots solutions to electricity shortages too. Indeed, the International Renewable Energy Agency (IRENA) found that up to 34% of Beirut's electricity demand could be covered by rooftop solar energy production alone.³⁸

Any plan to channel renewable energy through micro-grids will need to successfully involve private generator operators, who own most of the localised networks around the country. For many years, private generator owners have made considerable profits from providing supplementary electricity based on diesel. As seen in Zahle in 2014/15, generator owners are often closely connected with entrenched political interests and heavily resistant to change in their business model. On the other hand, Lebanon's economic crisis has fundamentally changed certain, long-held assumptions about the generator industry's profitability. The country's recent fuel shortages demonstrated that most Lebanese people can no longer afford to pay multiple electricity bills; at the same time, generator operators will need to meet rising costs of fuel, which the government no longer subsidises. Accordingly, generator owners could stand to benefit from transitioning to renewable energy production, which has much higher consumer demand and long-term potential.

BOX 1: An independent power reality?

Électricité du Zahle (EDZ), one of Lebanon's two independent electricity concessions, has shown the capacity for local communities to advocate for and maintain decentralised power production. Limited to only distributing EDL electricity, rather than being allowed to generate its own, in late 2014, EDZ sought to address residents' long-standing issues with inconsistent electricity supply, and the demands of paying bills to both EDZ and generator owners. EDZ's plan – of dubious legal status as it went beyond its distribution-only role – involved leasing and operating its own fleet of generators to cover power outages at rates that undercut private generator owners by an average of 50%.³⁹



The owners of private generators responded aggressively, conducting violent protests and acts of sabotage against EDZ infrastructure. By early 2015, these actions had slashed EDZ's power production capacity to just 12 hours per day. Tellingly, the violent reaction provoked no official reprisals, perhaps owing to connections between private generator owners and local authority figures.⁴⁰ Community mobilisation however drove EDZ to continue with its scheme for replacing privately owned generators. The tensions were also eased by accommodating agreements to provide EDZ jobs for former generator employees.

The community's ongoing support has ensured that EDZ continues to provide a reliable and professional service providing 24-hour electricity prior to the current crisis⁴¹. Now acting as an independent electricity generator and distributor, EDZ has also been able to operate a net-metering scheme that encourages the adoption of renewable energy among subscribers. As of June 2020, EDZ had eight megawatts of solar capacity (around 10% of the total capacity) connected to its grid. In one of the larger industrial sites with a net-metering arrangement with EDZ, around 50-60% of solar energy produced is sent back to the grid. It should be noted, however, that EDZ's core capacity and business model still relies on purchasing heavily subsidised fuel from EDL.⁴²

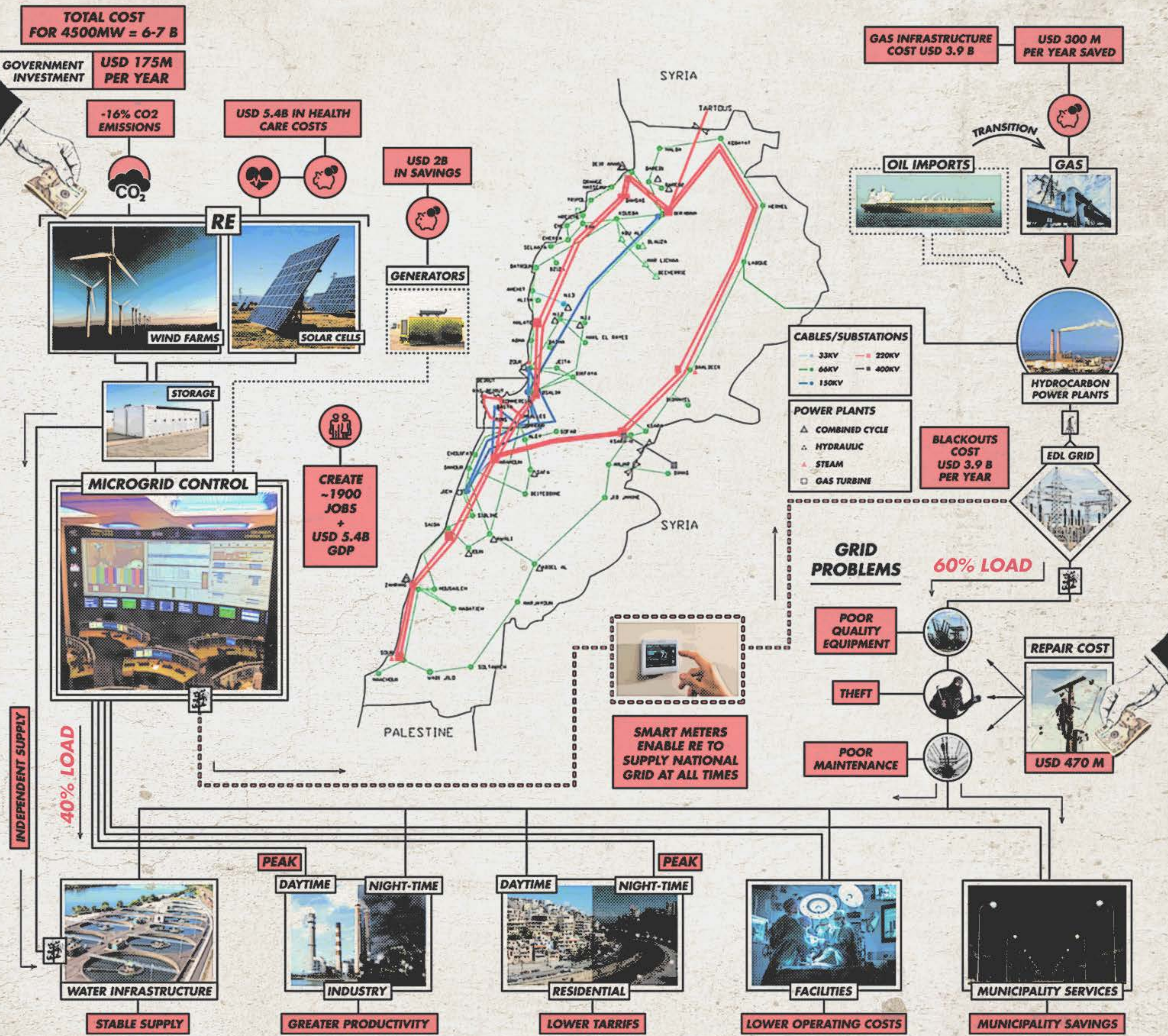
metering (for individual enterprises or households), but not community net-metering. The latter would allow local groups – from apartment building co-tenants to municipalities – to receive reductions on their total electricity bill for their renewable energy contributions to the national grid. A group-based structure would thus help Lebanese citizens to share the upfront capital investment required to install renewable infrastructure, such as rooftop solar panels, and incentivise larger-scale investments. Relatedly, if the EDL grid were upgraded to operate 'smart meters', renewable energy sources could contribute to the national grid even when EDL's service is not operating.

At present, it remains unclear whether the government and EDL will allow community net-metering. The scheme is reviewed annually by the MoEW and EDL's board and has reportedly been delayed by uncertainty over whether EDL's board can contradict the original ministerial decree establishing EDL's monopoly over electricity production, which dates to the early 1970s. Triangle understands that a draft Distributed Renewable Energy Law establishing the frameworks permitting net metering in all forms has been submitted to EDL for comment by a consortium of technical experts and development banks.

A further challenge for the micro-grid option is that municipalities have limited options for attracting investment. Micro-grids of sufficient scale can cost hundreds of thousands of dollars, depending on the number of households covered and installed storage capacity. Unlike the central government, municipalities are not allowed to take out loans to fund renewable energy initiatives. These funding restrictions make municipalities reliant on external contributions to

At present, EDL's regulations and technical capacities limit the full potential of distributing renewable energy through micro-grids. Currently micro-grids can feed renewable energy into EDL's national grid only at times when it is operational. Under current regulations however, EDL permits only single net-

RENEWABLE ENERGY MICRO-GRIDS FOR LEBANON





finance micro-grid projects. For example, the Bchaale and Kabrikha solar micro-grid initiatives would not have been possible without funding from both UNDP and private investors (See Box II).

The micro-grid approach illustrates the very real potential of delivering electricity through infrastructure that directly serves Lebanese communities. Moving forward, Lebanese citizens should be able to assume control over power production, wresting it from the grasp of the country's self-interested ruling elites. The democratisation of energy production can decrease decision-making bottlenecks, build intra-community trust, and eventually usher in a reliable, more affordable, and sustainable system for generating electricity.⁴³

BOX II: Community net-metering in action

The experiences of the Bchaale and Kabrikha villages – two of the earliest pilot sites for solar micro-grids – demonstrate the importance of cooperation between the state, municipalities, development agencies, and the private sector. Private investors and UNDP respectively funded the projects. In Bchaale, an investment of \$650,000 enabled 250 families to replace their back-up generators with solar panels, while 100 households in Kabrikha established their own solar micro-grid for a total cost of \$300,000.⁴⁴

Crucially, EDL granted permission for Kabrikha's micro-grid to trial community net-metering, based on the single net-metering model. Under the scheme, EDL reduced the community's electricity bill proportionally to the amount of renewable energy provided to the national grid. EDL did not, however, provide direct payments if the micro-grid provided electricity worth more than the total of EDL's bill. This regulation

limits the cost-benefit potential and incentives for communities to invest in larger-scale production facilities, which could attract sources of income in exchange for power production.

The Kabrikha community formed a community energy committee to constitute the legal entity in agreement with EDL. Other aspects of the project supported EDL in data collection, creating management software, and preparing the required regulatory reforms. The pilot project succeeded in delivering energy bill savings for residents and still feeds into the EDL grid, but EDL has ceased operating the net-metering discount. EDL requires major upgrades – both in terms of infrastructure and human resources – to conduct similar schemes on a nationwide scale.

HOW CAN A PHASED TRANSITION WORK FOR LEBANON? (RECOMMENDATIONS)

Nearly 100% of Lebanese surveyed are interested in attaining electricity from renewable sources, and more than two thirds were aware this would fundamentally affect community life in Lebanon at all levels.⁴⁵

Development actors, the private sector and technical experts are all ready to begin work on expanding this transformational infrastructure, which could realistically reach the 30% of production target by 2030 if the right legislative and regulatory environment was established.⁴⁶ A dual-track approach will allow for more immediate energy security and pollution reduction gains without relying on the slower-paced establishment of utility-scale projects by the government.



The primary goal should see renewable municipal micro-grids established to replace existing generator grids. To achieve this Law 462 must be implemented fully, with the establishment of a fully autonomous ERA. Further legislation, in the form of the drafted Distributed Renewable Energy Law must also be passed to allow net-metering in all forms. These measures must be supported by market incentives for generator owners to adopt renewable energy production, and authorities should be tasked with strict regulatory powers to clamp-down on non-compliance.

In parallel, grid and human resource enhancements, and the establishment of infrastructure required to transition to gas would increase the capacity of existing EDL power production. Key requirements include a transition to smart-meters across the grid; and reforming EDL staffing structure to upgrade technical capacities, remove channels of political patronage, and increase the capacities and (numbers of) fee collection staff. In parallel local communities and municipalities should be supported with training in the maintenance and management capacities required to manage micro-grids and expand local job creation from renewables. The unavoidable transition to natural gas to power EDLs existing capacity also requires the contracting and construction of appropriately scaled floating storage regasification unit(s) to facilitate the supply of natural gas to power plants.

International actors and/or the government must make immediate investments in renewable energy capacity for essential services. These include critical water infrastructure for residential, agriculture, and industry; hospitals, medical services and communications infrastructure; food and medical

supply chains; and military, security, administrative and other essential public services.

Financial stability and confidence must be re-established to underlay immediate and long-term investment. This requires restarting talks with the IMF to secure a bailout package that would provide a starting point for a stable exchange rate. Energy reform is so essential to the society and economy that it could be specifically defined in any IMF agreement.

Short of any international funding availability at present, Banque du Liban must seriously consider using a substantial portion of its US\$1.1 billion in IMF Special Drawing Rights as designated lending toward renewable energy projects. If combined with investment de-risking measures to improve regulatory and contracting transparency (worth US\$144 million) the government could create investment savings of \$318 million over 20 years.

EDITOR'S NOTE

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