From Crisis to Opportunity: Advancing Solar Energy in Lebanon Through Effective Policymaking

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Leila Dagher, Sara Diab, and Razan Zwein

Executive Summary

Lebanon faces an enduring energy crisis, characterized by persistent electricity shortages and an overreliance on polluting self-generation methods, particularly in urban areas like Beirut. Despite the lack of proper policy support, solar electricity adoption has increased significantly since 2020. This rise is driven primarily by the widespread distrust in the public utility and government, reduced costs, and growing public awareness of pollution and health concerns. This policy brief proposes reducing import red tape measures and exempting solar panels and related accessories from customs and VAT taxes. This initiative aims to encourage the adoption of renewable energy solutions, reduce pollution, and alleviate the electricity supply crisis, thereby contributing to a more sustainable and resilient energy future for Lebanon. Additionally, the brief addresses issues of equity and the just transition to renewables, ensuring that the benefits of solar energy are accessible to all segments of society, particularly vulnerable populations. By implementing these measures, Lebanon can promote an inclusive and fair energy transition, enhancing the quality of life for its citizens and mitigating the environmental impact of its energy consumption.

The Energy Crisis in Lebanon

Lebanon's electricity crisis is a long-standing issue stemming from a severe shortage of supply, which has left the country reliant on outdated and inefficient infrastructure. The electricity situation was further exacerbated by the 2019 financial crisis, described by the World Bank (2021) as being among the ten, and possibly three, worst crises globally since 1850. The public utility, Électricité du Liban, has since been struggling to provide even one to two hours of electricity per day to the households, forcing many to rely on costly and polluting private diesel generators. This reliance on self-generation not only worsens environmental degradation but also deepens social inequalities by imposing a disproportionate financial burden on low-income households. The lack of affordable, reliable electricity exacerbates energy poverty, leaving vulnerable populations with few alternatives.

Moreover, the health costs associated with Lebanon's reliance on diesel generators are increasingly unbearable. Researchers at the American University of Beirut have reported a dramatic increase in pollution from diesel generators in Lebanon, with toxic emissions soaring by over 300% since the onset of the economic crisis in 2019 (L'Orient Today, 2021). More specifically, the daily average concentrations range between 20 and 60 micrograms per cubic meter, significantly exceeding the World Health Organization (WHO) guidelines of 15 micrograms per cubic meter (L'Orient Today, 2024). This surge is largely due to the country's heavy reliance on diesel generators as a primary source of electricity, given the inadequate supply from the national grid. The consequences of this surge in emissions are profound. It is estimated that the heightened pollution could lead to an additional 550 cancer cases annually,

along with around 3,000 new cases of chronic obstructive pulmonary disease, and approximately 500 extra hospital admissions for cardiovascular conditions (Yuan, 2022). This would lead to an estimated $8 million increase in annual public health costs (Rose and Rida, 2021). Moreover, the study highlights that the risk of developing cancer in Lebanon has risen by 50% due to the doubling of carcinogenic pollutants from diesel generators in Beirut's air since 2017 (Atallah, 2024). This underscores how the country's energy crisis has exacerbated the public health crisis. In response to these alarming outcomes, local authorities have issued a decree requiring all diesel generator owners to install filters to reduce harmful emissions (Khalil, 2024). However, the effectiveness of these regulations remains uncertain, as compliance has been slow.

The country's current energy model heavily relies on heavy fuel oil plants and diesel generators, with 97% of energy being imported (Karam et al., 2020). Compounding the problem, nearly half of Lebanon's national debt is attributed to the electricity sector, largely due to unsustainable subsidies and widespread electricity theft (Ayoub et al., 2021). These factors have created a vicious cycle of fiscal strain and unreliable power, further crippling the nation's economy and the daily lives of its citizens. A recent Human Rights Watch (2023, p. 2) report concludes that "Electricity in Lebanon has effectively become a service only the wealthiest can afford, reinforcing the country's deep-seated inequality and further pushing people into poverty during one of the worst economic crises in modern history," while another recent study (Dagher et al., 2023) finds that more than 78% of households are unable to keep their houses warm (compared to 7.1% in the Euro area (Eurostat, 2022) and that on average households spend around 69% of their income on energy (compared to 19.5% in the OECD countries (OECD, 2021)). These results highlight the prevalence of energy poverty, where households are unable to afford adequate heating during the colder months, and the financial strain imposed by the energy crisis.

To address this crisis, a just transition to renewable energy, particularly solar power, is essential to ensure that all segments of society, especially the most disadvantaged, can access clean, affordable, and sustainable energy solutions. Ensuring that disadvantaged communities have access to clean and affordable energy requires a coordinated, multi-stakeholder approach that includes the government, municipalities, international organizations, NGOs, development agencies, and the private sector.

National RE Targets and Untapped Potential

Despite its abundant water and sun resources, Lebanon's renewable energy potential remains largely untapped (Heinrich Boll Stiftung, 2019). Transitioning to renewable energy offers a sustainable solution by providing clean, domestically sourced power and heat, while assisting in reducing the impacts of climate change. Lebanon has made limited progress in advancing renewable energy policies, lagging global standards. The country remains heavily dependent on fossil fuels, leading to high greenhouse gas emissions and exacerbating the effects of climate change. In 2010, the Ministry of Energy and Water set a goal of achieving 12% renewable energy in electricity and thermal supply by 2020, but with no clear path towards the aimed percentage (UNDP, 2017; UNESCWA, 2018). This target was further detailed in the National Renewable Energy Action Plan, which provided a roadmap to reach the 12% goal by 2020 (UNESCWA, 2018). Even though this target was not achieved, in 2018 the government declared more ambitious renewable energy targets in response to its energy challenges and the pressing need to mitigate climate change, but has yet to start serious implementation. The country aims to cover at least 30% of its energy consumption from renewables by 2030 (IRENA, 2020). This shift to

renewable energy is crucial, given Lebanon's heavy reliance on imported fuel oil, which is economically burdensome and environmentally unsustainable.

Solar energy is identified as a key renewable source that Lebanon can leverage to diversify its energy mix. Total investments in the solar photovoltaic sector amounted to US$125.83 million by the end of 2019, where 54% of the installed solar PV came through the National Energy Efficiency and Renewable Energy Action (NEEREA) financing mechanism and the remaining 46% were funded by non-NEEREA investments (Jabbour, 2021). Investments in the solar photovoltaic sector continued to grow, amounting to US$135.19 million by the end of 2020 (Abou Moussa, 2022).

Policy Landscape and Limited Incentives

Lebanon has faced several challenges in advancing renewable energy projects, including the need for a comprehensive legal framework to support large-scale initiatives that is easily implementable (Kinab and Elkhoury, 2012; UNESCWA, 2018). The current policy landscape lacks integration and is fragmented (IRENA, 2020), and issues with the intermittency and performance of some decentralized solar installations have persisted (Taha and Akel, 2024). Moreover, Lebanon's electricity sector struggles with "unreliable power supply, a distortive subsidy system, and a weak financial stability" of the state-owned utility Electricité du Liban (Ersoy et al., 2021), making it difficult to attract investment in renewable energy. Olleik et al. (2021) outline several challenges in the renewable energy sector, including the absence of a robust regulatory framework which promotes good governance. They highlight significant political, legal, and commercial risks that restrict access to credit and financing. Additionally, the study identifies issues in obtaining long-term power purchase agreements due to the structure of the electricity market and its associated tariffs. Lastly, they find that the development of local expertise necessary for fostering a sustainable renewable energy sector faces various barriers.

In an effort to address some of these problems, the Lebanese Parliament ratified the "Decentralized Renewable Energy Power Generation" Law (No. 318/2023) in December 2023, allowing consumers to produce and exchange electricity with the national utility, Électricité du Liban, and enabling private renewable energy generators to connect to the grid with a maximum capacity of 10MW (Taha and Akel, 2024; El Khoury and Haytayan, 2024). Unfortunately, since passing the law no further steps have been taken towards implementation.

Previously, the Central Bank of Lebanon (BdL) had implemented various financial initiatives, including subsidized loans, to promote the adoption of renewable energy in Lebanon. In 2010, BdL initiated the NEEREA financing mechanism to provide subsidized loans for renewable energy projects implemented by Lebanese commercial banks under the leadership and management of BdL (Climate Change Coordination Unit, 2014). The loan is available for private entities, both existing and newly constructed facilities, with a maximum limit of US$10 million and is offered at a low interest rate of approximately 1%. The repayment period can extend up to 14 years, which includes a grace period ranging from 6 months to 4 years (LCEC, n.d.; Hamdan, 2017). The NEEREA financing mechanism approved over 200 projects totaling over US$250 million, with 60% allocated to solar PV (Arayssi, 2023). However, due to the economic crisis, BdL discontinued these subsidized loans (Azhari, 2022). In response, a few commercial banks, including Banque de l'Habitat, have introduced solar loans for households. Running the scheme with the Lebanese Center for Energy Conservation, Banque de l'Habitat provides loans to

Lebanese households to purchase and install solar PV systems (Tsagas, 2022). Starting 20 June 2022 loans ranging from 75 million to 200 million Lebanese Pounds became available to households with a repayment period of 5 years at an interest rate of 4.99% (LCEC, n.d.).

In the National Budget Law of 2022, Lebanon temporarily exempted all renewable energy-related machinery and equipment from VAT (11%) and customs duties, including the 3% minimum customs duty, with the exemption effective from November 15, 2022, to December 31, 2023,[1] to encourage clean energy adoption (Lebanese Customs Administration, n.d.). However, in practice, the exemption was only implemented for three months in 2023. The VAT and customs duty exemptions on solar power equipment in Lebanon, outlined in the 2022 National Budget Law, primarily benefit importers, renewable energy companies, and suppliers by reducing their import costs. These cost reductions should, in theory, be passed down to consumers through lower prices for solar panels and other renewable energy systems, encouraging broader adoption of clean energy. However, since the exemptions were only implemented for three months in 2023, the impact on consumers was likely limited, and the short duration probably restricted the intended boost in affordability and adoption of renewable technologies.

Surge in Solar Electricity Adoption

The post-2019 surge in solar electricity adoption has been primarily driven by the dire need to counter massive power outages and a growing desire for independence from the unreliable public utility. As the national electricity grid fails to provide consistent power, both citizens and businesses have increasingly turned to solar energy as a practical solution to secure a stable electricity supply (World Energy Council, 2024). This shift towards solar energy has been largely organic and motivated by necessity rather than effective government policies. The lack of a comprehensive energy strategy from the state has led many individuals and businesses to take energy matters into their own hands, investing in solar systems to mitigate the impact of daily blackouts and reduce dependence on an unsustainable and financially burdened electricity sector. While the shift toward renewable energy, particularly solar power, is a positive development, it requires careful oversight and strategic planning through effective government policies to ensure long-term sustainability. Without a comprehensive regulatory framework, there is a risk of inconsistent quality in installations, potential environmental harm, and inequitable access to renewable energy resources, particularly for disadvantaged communities.

In 2022, Lebanon imported 80,315 tons of solar panels, quadrupling the total imported in the previous decade, with over US$500 million invested by the private sector in decentralized solar applications (Boukather, 2023). By June 2023, decentralized solar installations had reached an estimated capacity of 1,000 megawatts[2] (Taha and Akel, 2024).

[1] Article 72: Solar power equipment or any other clean energy are exempted from VAT, custom duties and the 3% additional duty from the publishing date of this Law till the 31 December 2023 (ALDIC, 2022).

[2] It is worth noting here that, according to Pierre Khoury the director of the government-affiliated Lebanese Center for Energy Conservation, the national utility has a total generation capacity of around 1,800 megawatts.

Policy Recommendations

To advance solar electricity in Lebanon while ensuring a fair transition to renewables without imposing additional financial strain on the country, several key policy options can be implemented:

Financial Support from International Organizations: Given the absence of banks and the financial instability since the 2019 crisis, targeted financial support from international organizations is crucial for promoting solar energy adoption. This external assistance would be essential in alleviating energy poverty, particularly for low-income households and small businesses, ensuring that the benefits of solar energy are equitably distributed across society.

Net Metering: Urgently implement net metering policies as per the recently passed decentralized renewable energy law (318/2023) that allows households to sell excess solar energy back to the grid. Special provisions should be made to ensure fair compensation for low-income families, encouraging decentralized energy production and reducing strain on the national grid.

Financial Incentives: The exemption of all renewable energy-related machinery and equipment from VAT (11%) and customs duties, including the 3% minimum customs duty, should be made permanent. In addition, reducing red tape in import procedures and removing bureaucratic barriers, would ensure broader participation in the renewable energy transition, making it easier for all segments of society to invest in solar power.

Community Solar Projects: Develop community solar initiatives where municipalities provide public lands free of charge for solar panel installations. These spaces could also serve as covered parking areas, offering dual benefits to the community. In urban areas, space constraints may limit large installations, while rural regions, with more available land, are ideal for solar farms. Consequently, such projects should prioritize low-income neighborhoods and rural areas, enabling shared access to solar energy for those who cannot afford individual systems. To expand these projects nationwide, the government should provide public lands and simplify permitting processes. Additionally, financing models like collective ownership and pay-as-you-go systems would make solar energy more accessible to low-income communities. This approach fosters collective ownership and ensures the sustainability, inclusivity, and success of community solar initiatives.

Concluding Remarks

Making the VAT and customs duty exemptions for solar electricity-related equipment permanent, along with streamlining import procedures that will eliminate bureaucratic barriers is crucial to reducing the overall cost of solar installations. It is essential to recognize the importance of making the exemption for renewable energy-related equipment permanent, as it is far more effective than renewing it annually because it eliminates uncertainty and avoids gaps in

implementation caused by delays in the budget law. An annual renewal process risks creating periods where the exemption is not in effect, disrupting the market and discouraging investment. Permanence provides businesses and consumers with the confidence to plan long-term investments in solar energy, knowing they can rely on consistent financial incentives. It also reduces bureaucratic hurdles and accelerates adoption, making renewable energy more accessible and affordable across all segments of society.

According to several suppliers, the global decrease in solar panel prices and accessories' prices, along with the proposed cost reductions, can lead to a 50% reduction in the solar system cost compared to 2019. These savings have the potential of making clean energy more affordable, thus alleviating energy poverty and ensuring that solar power becomes accessible to all segments of society. This approach has proven successful in several MENA countries. For instance, Jordan has experienced significant growth in solar energy adoption, supported by government policies and declining solar costs. Renewables' contribution to generating electricity increased from 0.7% in 2014 to over 13% in 2019, with solar energy being a key driver (IRENA, 2021).

In summary, this policy approach will not only promote an inclusive transition to renewable energy, but will also help in mitigating Lebanon's electricity crisis by expanding access to sustainable and reliable power.

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References:

ALDIC 2022. Available at https://www.aldic.net/wp-content/uploads/2022/12/ALDIC-Budget-Law-2022-Summary-2.pdf

Ahmad Taha and Rania Akel, *Regulating the Energy Transition: Lebanon's New Law on Distributed Renewable Energy*, The Lebanese Center for Policy Studies, February 2024, available at https://www.lcps-lebanon.org/articles/details/4853/regulating-the-energy-transition-lebanon%E2%80%99s-new-law-on-distributed-renewable-energy

Carboncopy, "UAE, Saudi Arabia Solar Tariffs Less Than Half of India's", September 2020, available at https://carboncopy.info/uae-saudi-arabia-solar-tariffs-less-than-half-of-indias/

Carol A. Boukather, *Re-energize Lebanon: 5 Action Steps to Rebuilding Lebanon's Collapsed Electricity Sector*, Issam Fares Institute for Public Policy and International Affairs, February 2023, available at https://www.aub.edu.lb/ifi/Documents/publications/research_reports/2022-2023/Re-energize%20Lebanon%20Feb%202023.pdf

Climate Change Coordination Unit, *Climate Finance Loan Schemes: Existing and Planned Loan Schemes in Lebanon*, Ministry of Environment, September 2014, available at https://climatechange.moe.gov.lb/viewfile.aspx?id=216

Leila Dagher, Ibrahim Jamali, and Ousama Abi Younes, "Extreme Energy Poverty: The Aftermath of Lebanon's Economic Collapse", *Energy Policy* 183 (2023): p. 113783, available at https://doi.org/10.1016/j.enpol.2023.113783

Department of Energy, "Federal Solar Tax Credits for Businesses", Office of Energy Efficiency and Renewable Energy, August 2023, available at https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses#_ednref6

Department of Energy, "Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics", Office of Energy Efficiency and Renewable Energy, April 2024, available at https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics

Elias Kinab and Michel Elkhoury, "Renewable Energy Use in Lebanon: Barriers and Solutions", *Renewable and Sustainable Energy Reviews* 16, no. 7 (2012): p. 4422-4431, available at https://doi.org/10.1016/j.rser.2012.04.030

Energy & Utility, "Saudi Arabia Achieves Two New World Record Solar Tariffs", April 2021, available at https://energy-utilities.com/saudi-arabia-achieves-two-new-world-record-solar-news111675.html

Eurostat. European Union, 2022. – Statistics on Income and Living Conditions (EU- SILC). Retrieved from. https://ec.europa.eu/eurostat/web/income-and-living-conditions.

FitchSolutions, "MENA Solar Power Growth to be Supported by Policy, Green Hydrogen, and Low Solar Power Prices", March 2024, available at https://www.fitchsolutions.com/bmi/renewables/mena-solar-power-growth-be-supported-policy-green-hydrogen-and-low-solar-power-prices-06-03-2024

Hadi Abou Moussa, *The 2020 Solar PV Status Report for Lebanon*, Lebanese Center For Energy Conservation, June 2022, available at https://www.lcec.org.lb/sites/default/files/2022-08/2020%20Solar%20PV%20Status%20Report%20-%20Final.pdf

Heinrich Boll Stiftung, *Renewable Energy in Lebanon: Can the Country Embrace its Resources Sustainably?*, 2019, available at https://lb.boell.org/en/2019/03/01/renewable-energy-lebanon-can-country-embrace-its-resources-sustainably

Henrietta L. Moore and Hannah Collins, "Decentralised Renewable Energy and Prosperity for Lebanon", *Energy Policy* 137 (2020): p. 111102, available at https://doi.org/10.1016/j.enpol.2019.111102

Human Rights Watch, "*Cut Off from Life Itself": Lebanon's Failure on the Right to Electricity*, March 2023, available at https://www.hrw.org/report/2023/03/09/cut-life-itself/lebanons-failure-right-electricity

Ilias Tsagas, "Lebanese Bank Introduces Solar Loan Scheme for Households", *PV Magazine*, 30 June 2022, available at https://www.pv-magazine.com/2022/06/30/lebanese-bank-introduces-solar-loan-scheme-for-households/

Internal Revenue Service, "Publication 525 (2023), Taxable and Nontaxable Income", n.d., available at https://www.irs.gov/publications/p525 accessed 26 June 2024.

International Renewable Energy Agency (IRENA), *Renewable Energy Outlook: Lebanon*, June 2020, available at https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Outlook_Lebanon_2020.pdf?rev=3428f261e0844245b748a2cb6458748f

International Renewable Energy Agency (IRENA), Renewables Readiness Assessment: The Hashemite Kingdom of Jordan, February 2021, available at https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Feb/IRENA_RRA_Jordan_Summary_2021_EN.pdf?hash=DE5015E14770A43E9BFF2DFF8FAE684CED6E8EEB&Ia=en

Karim Azhari, *A Solar Solution to The Energy Crisis*, Business News, October 2022, available at https://www.businessnews.com.lb/cms/Story/StoryDetails/11136/A-Solar-Solution-to-the-Energy-Crisis

https://www.businessnews.com.lb/EnergyCrisis/Energycrisisreseachpaper-K.Azhari.pdf

Lebanese Center for Energy Conservation (LCEC), "Banque De L'Habitat – Solar PV Loans", n.d., available at https://lcec.org.lb/PVLoans accessed 26 June 2024.

LCEC, "Decentralized RE Law", n.d., available at https://lcec.org.lb/our-work/partners/RELaw accessed 26 June 2024.

LCEC, “NEEREA”, n.d., available at https://lcec.org.lb/our-work/partners/NEEREA accessed 26 June 2024.

Lebanese Customs Administration, “Amendment No. 678 to the Harmonized System Customs Tariff”, n.d., available at http://www.customs.gov.lb/News_Details.aspx?Item_Id=76 accessed 26 June 2024.

L'Orient Today. (2021). Researchers estimate a 300 percent increase in toxic emissions due to generator use in electricity crisis. https://today.lorientlejour.com/article/1280014/researchers-estimate-a-300-percent-increase-in-toxic-emissions-due-to-generator-use-in-electricity-crisis.html

L'Orient Today. (2024). Air Pollution From Generators Has Doubled in Beirut. https://today.lorientlejour.com/article/1370213/air-pollution-from-generators-has-doubled-in-beirut.html

Mahmoud Arayssi, *Reframing Sustainable Finance: Lessons From Lebanon*, Economic Research Forum, July 2023, available at https://theforum.erf.org.eg/2023/07/24/reframing-sustainable-finance-lessons-from-lebanon/

Majd Olleik, Hans Auer, and Rawad Nasr, “A Petroleum Upstream Production Sharing Contract with Investments in Renewable Energy: The Case of Lebanon”, *Energy Policy* 154 (2021): p. 112325, available at https://doi.org/10.1016/j.enpol.2021.112325

Marc Ayoub, Pamela Rizkallah, and Christina Abi Haidar, *Unbundling Lebanon’s Electricity Sector*, Issam Fares Institute for Public Policy and International Affairs, September 2021, available at https://www.aub.edu.lb/ifi/Documents/publications/research_reports/2020-2021/20211020_unbundling_lebanon_electricity_sector_research_paper_pdf.pdf

MEES, “Dubai Sets New PV Cost Benchmark in 800 MW Phase Three of Solar Park”, July 2016, available at https://www.mees.com/2016/7/1/power-water/dubai-sets-new-pv-cost-benchmark-in-800mw-phase-three-of-solar-park/e54df070-4932-11e7-b98d-91e41adb2a5a

Melda Jabbour, *The 2019 Solar PV Status Report for Lebanon*, Lebanese Center For Energy Conservation, March 2021, available at https://lcec.org.lb/sites/default/files/2021-04/LCEC1.pdf

Middle East Solar Industry Association (MESIA) and Middle East Energy, *MENA Solar and Renewable Energy Report*, March 2021, available at https://www.middleeast-energy.com/content/dam/Informa/Middle-East-Electricity/middle-east-energy-2021/reports-mee/MEE_Mesia_Report_v3.pdf

Nadine Khalil, *Cancer Cases are Rising in Beirut. Are Diesel Generators to Blame?*, WIRED Middle East, April 25 2024, available at https://wired.me/science/beirut-rising-cancer-cases-diesel-generators/

OECD, 2021. Housing Conditions. Affordable Housing Database. Retrieved from. https://www.oecd.org/housing/data/affordable-housing-database/housing-conditions.htm.

Paul El Khoury and Laury Haytayan, *Decentralized Renewable Energy in Lebanon: A True Policy Solution or a Facade?*, Arab Reform Initiative, February 2024, available at https://www.arab-reform.net/event/decentralized-renewable-energy-in-lebanon-a-true-policy-solution-or-a-facade/

Rony Karam, Khalil Matta, and Alfred Kettaneh, *A New Energy Vision for a New Lebanon: Solar, Wind and Hydro Unleash a Green Energy Revolution*, The Lebanese Foundation for Renewable Energy, January 2020, available at https://static1.squarespace.com/static/5d80f7c51d0ebc135e8dfd66/t/5e1f40085a7e8d59fe1457fd/1579106318437/LFRE+Energy+Vision+%28JAN+2020%29.pdf

Rose, S., & Rida, M. (2021, 17 August). Lebanon: Electricity shortages linked to surge in respiratory illnesses. The National MENA. https://www.thenationalnews.com/mena/2021/08/17/lebanon-electricity-shortages-linked-to-surge-in-respiratory-illnesses/

Sibel R. Ersoy, Julia Terrapon-Pfaff, Marc Ayoub, and Rawan Akkouch, *Sustainable Transformation of Lebanon's Energy System: Development of a Phase Model*, Friedrich Ebert Stiftung, October 2021, available at https://aub.edu.lb/ifi/Documents/publications/research_reports/2020-2021/20211216_sustainable_transformation_of_lebanon_energy_system_report.pdf

SolarPower Europe, *Global Market Outlook for Solar Power 2023-2027*, June 2023, available at https://www.solarpowereurope.org/insights/outlooks/global-market-outlook-for-solar-power-2023-2027/detail

The Lebanese Association for Democratic Institutions and Compliance, *Decision #640/1*, n.d., available at https://www.aldic.net/decision-6401/ accessed 26 June 2024.

UAE Government Portal, "Customs Clearance", n.d., available at https://u.ae/en/information-and-services/finance-and-investment/clearing-the-customs-and-paying-customs-duty accessed 26 June 2024.

United Nations Development Programme (UNDP), *Lebanon: Derisking Renewable Energy Investment*, UNDP, New York, NY, September 2017, available at https://www.undp.org/sites/g/files/zskgke326/files/2022-09/DREI%20Lebanon%20Full%20Report%20%28English%29%20%28Sep%202017%29%20%28FINAL%29.pdf

UNESCWA, *Case Study on Policy Reforms to Promote Renewable Energy in Lebanon*, Lebanon: UNESCWA, 2018, available at https://www.unescwa.org/sites/default/files/pubs/pdf/policy-reforms-promote-renewable-energy-lebanon-english.pdf

UNESCWA, *Tracking SDG 7: Energy Progress Report 2019 – Arab Region*, 2019, available at https://www.unescwa.org/sites/default/files/pubs/pdf/energy-progress-report-arab-region-english_1.pdf

USDA REAP, "The Authority on the USDA REAP Program: Information and Tools to Make the REAP Program More Accessible", n.d., available at https://usdareapgrant.com/ accessed 26 June 2024.

Wael Hamdan, "BDL Financing Incentives", Banque Du Liban, 2017, available at https://www.economy.gov.lb/media/10381/presentation-mr-wael-hamdan-sme-forum-2017.pdf

World Bank. Lebanon Economic Monitor (Spring 2021): Lebanon Sinking to the Top 3. Washington DC. Available at https://documents1.worldbank.org/curated/en/394741622469174252/pdf/Lebanon-Economic-Monitor-Lebanon-Sinking-to-the-Top-3.pdf

World Energy Council 2024. Country Commentaries. Available at https://www.worldenergy.org/assets/downloads/Issues_Monitor_2024_Lebanon_commentary.pdf

Yuan, S. (2022). Electricity crisis in Lebanon exposes more to health hazards. *The Lancet*, *400*(10362), 1503. https://doi.org/10.1016/S0140-6736(22)02117-1