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Energy Transition in the Context of Crisis: A Comparative Analysis of Lebanon and Sudan

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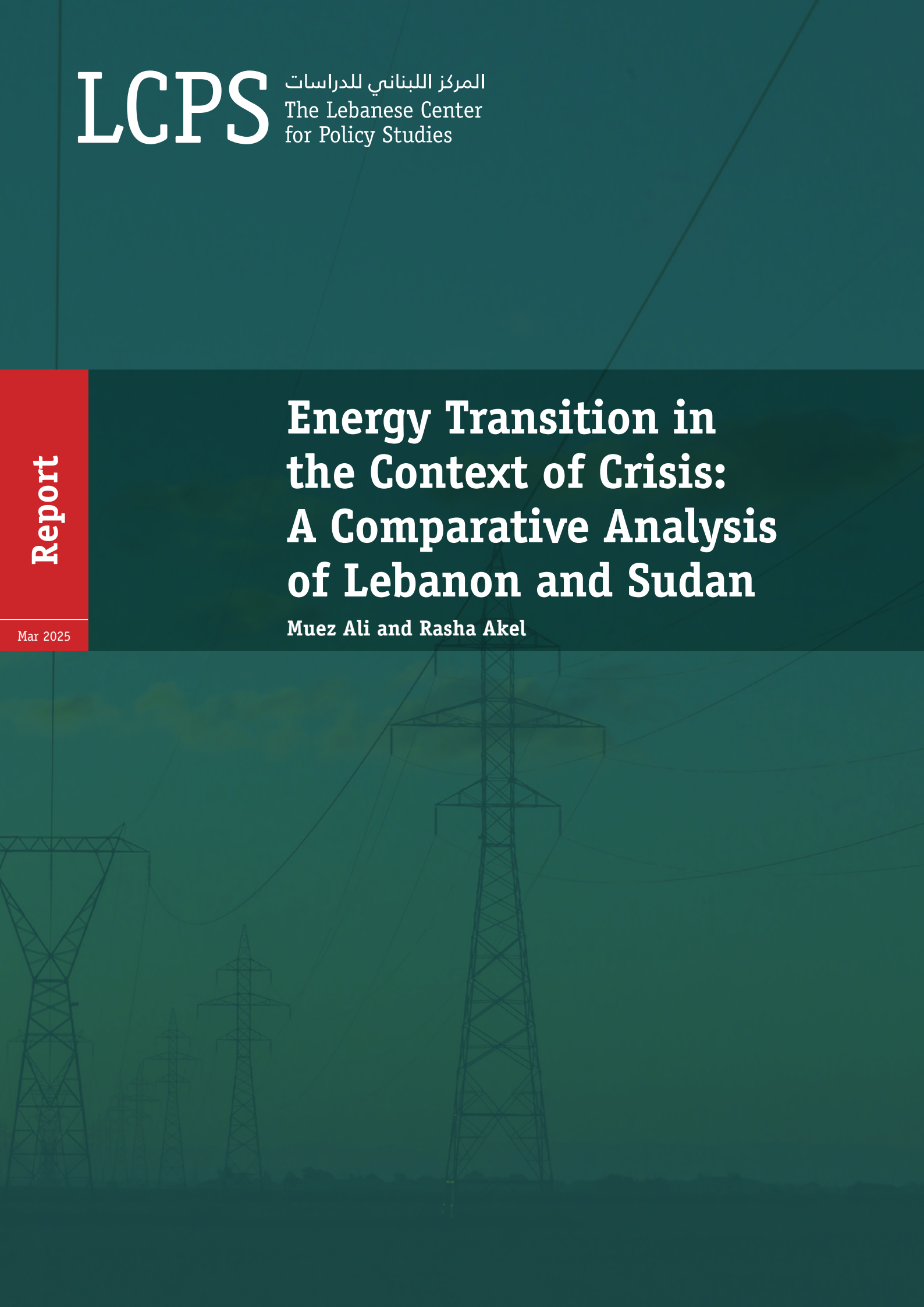

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Disclaimer: The Lebanon sections of this brief are based on data collected from October 2023 to July 2024, reflecting the MSME landscape and stakeholder perspectives up to that time; similarly, the Sudan sections are based on similar data collected between October 2023 and January 2024 and historical data on the energy sector. The information contained in this brief, and the recommendations generated, do not fully reflect the impact of recent conflict-related destruction and displacement in both countries.

Introduction

The UN's Intergovernmental Panel on Climate Change (IPCC) indicates that greenhouse gas emissions must peak before 2025 at the latest and decline by 43% by 2030 to limit global warming to 1.5 degrees Celsius relative to pre-industrial levels.[1] While the urgency of anthropogenically induced climate change calls for global cooperation, the impact of climate change will be differentiated across regions.[2] Given the scale of potential impact and infrastructure investment requirements, some communities and countries will be unable to absorb the acute and chronic effects of the impending crises.[3]

According to the World Bank, the MENA region is one of the world's most vulnerable to the impact of climate change, potentially enduring higher temperatures, rising sea levels, droughts, floods, intense water scarcity and polluted air.[4] This differentiated impact is significant considering that the MENA region's greenhouse gas (GHG) footprint is low compared to other regions, accounting for only 8.7% of global emissions.[5]

Both Lebanon and Sudan are ill prepared to face climate change threats and are very vulnerable to its negative consequences. According to the Notre Dame Global Adaptation Initiative Country Index, Lebanon ranked 116 and Sudan ranked 183 out of 192 countries.[6] Lebanon is particularly vulnerable to urban heat island effects, drought and water scarcity risks, and faces adaptability issues due to financial crises, weak institutions, social unrest and exposure to spillovers from conflict.[7] Climate change impacts are also expected to impede service provision (especially in energy and water), which may affect the agricultural and tourism sectors.[8]

Similarly, Sudan faces severe environmental risks, including increased incidences of drought and water scarcity, and increased desertification, while also lacking the necessary institutional infrastructure to adapt. Sudan's reliance on the agriculture and livestock sectors makes climate change a primary threat to economic stability and growth. Finally, the contribution of both countries to global greenhouse gas emissions is negligible (Figure 1), and, on a per capita basis, both emit significantly less than the global and regional averages.[9]

1 World Wide Fund for Nature. Climate change and nature loss pose greatest risks for humanity: WEF Global Risk Report 2024. (2024).

2 Kumar, Ankit, Auke Pols, and Johanna Höffken. 'Urgency Vs Justice: A Politics of Energy Transitions in the Age of the Anthropocene.' In Dilemmas of Energy Transitions in the Global South, edited by Höffken, Johanna, Auke Pols and Ankit Kumar. 1st ed. Vol. 1, 1-17. United Kingdom: Routledge, 2021;2023; p.11

3 World Economic Forum: Global Risks Report 2024. https://www.weforum.org/publications/global-risks-report-2024/

4 World Bank Group. Climate and Development in the Middle East and North Africa. 2023. https://www.worldbank.org/en/region/mena/brief/climate-and-development-in-the-middle-east-and-north-africa#:~:text=The%20Middle%20East%20and%20North%20Africa%20(MENA)%20region%20is%20one,water%20scarcity%20and%20polluted%20air

5 World Bank Group. Middle East and North Africa Climate Roadmap (2021-2025). https://thedocs.worldbank.org/en/doc/6f868d4a875db3ef23ef1dc747fcf2ca-0280012022/original/MENA-Roadmap-Final-01-20.pdf. This figure includes high-income GCC countries, which account for almost 40% of the region's emissions but only 10% of the population; without GCC countries, the MENA region's contribution is only 4.5%.

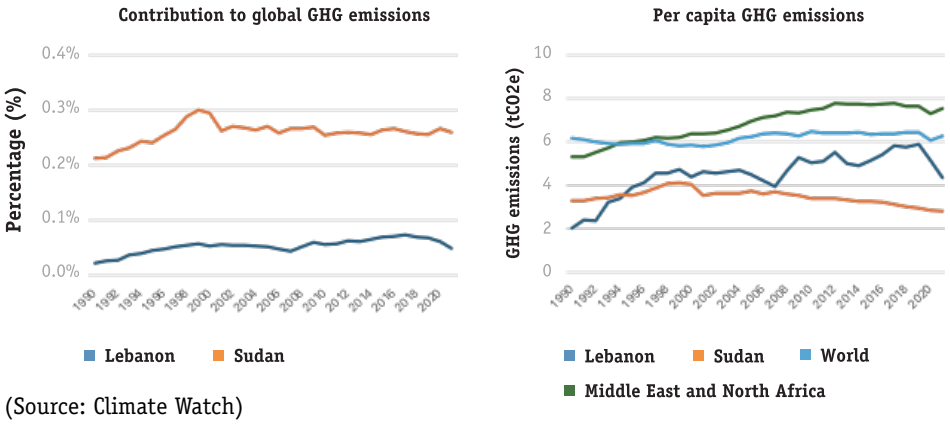
6 Notre Dame Global Adaptation Initiative. Rankings. https://gain.nd.edu/our-work/country-index/rankings/

7 World Bank Group. Lebanon Country Climate and Development Report. 2024. p. II.

8 Ibid, p. II.

9 Climate Watch. 2024. Washington, DC: World Resources Institute.

Figure 1 **Per capita GHG emissions and contribution to global GHG emissions**



(Source: Climate Watch)

Amid the urgency to reduce emissions and combat climate change, renewable energy presents a major economic and social opportunity.[10] The MENA region is endowed with wind and solar potential whereby MENA's solar energy potential per square kilometer is equivalent to energy produced by 1-2 million barrels of oil annually, which could meet at least 50% of global electricity demand.[11] Renewable energy adoption has recently increased in both Lebanon and Sudan, but in both cases, increased adoption was driven more by necessity than deliberate policy decisions.

How developing countries transition to renewable energy and the diversity in the energy mix they aspire to must consider several factors, including energy security and energy equity. Given both Lebanon and Sudan are net energy importers, renewable energy could have several positive contributions. Lack of dependence on energy imports reduces vulnerability to volatile global energy markets and depletion of foreign currency reserves. Off-grid systems provide opportunities for expanding economic activities to underserved regions, which alleviates existing equity concerns regarding energy access. And, more importantly, the sustainability of the transition will depend on whether the push for renewables is planned or spontaneous, and whether the institutional structure exists to maintain it.

10 World Bank Group. Middle East and North Africa Climate Roadmap (2021-2025).

11 Ibid.

Compounded Crises: Why Lebanon and Sudan?

The deficiencies of the energy sector in Lebanon are symptomatic of 'elite capture of the State's resources for private gains.'[12] Politicians

12 The World Bank, Lebanon Public Finance Review: Ponzi Finance?, p. 80. Cited in Human Rights Watch, p. 84.

use the weakened electricity sector as a space to exercise and perpetuate clientelist practices through the preferential distribution of jobs at Electricité Du Liban (EDL) and profit from contracts made at the state's expense.[13] In 2019, Lebanon experienced one of the worst economic and financial crises in modern history:[14] GDP contracted by around 40 percent.[15] More than 15 years of economic growth had been erased; the severe economic contraction and deterioration in service provision led to increases in unemployment, poverty, and emigration of skilled labor.[16]

The limited supply of power deteriorated further as the financial crisis progressed.[17] The shortage of foreign currency at the central bank threatened fuel supply and rendered EDL unable to perform its daily operations, pay its obligations, and carry out maintenance,[18] thus following a severe rationing program. Compounding this fragile state, the Beirut port blast on August 4, 2020, caused damage to the distribution network and the transmission assets (National Control Center), and destroyed the headquarters of EDL.[19] Since October 2023, Lebanon has faced increasing hostilities which have damaged infrastructure in targeted areas.

The central bank subsidized diesel imports from 2020 until June 2021 using an official exchange rate significantly lower than the parallel market rate.[20] Gradually, the official exchange rate for imports was increased until it aligned with the parallel market rate in September 2021, causing the removal of subsidies.[21] During the subsidy regime, fuel smuggling into Syria increased, with an estimated 10 to 20% of imported fuel being smuggled across the border.[22]
In Sudan, the secession of South Sudan in 2011 can be characterized as a sudden stop,[23] introducing a balance of payments crisis, a severe trade deficit, and an economic recession. Sudan became a net importer of fossil fuels almost overnight, and fossil fuel production decreased from a peak of 450,000 in 2010 to 80,000 barrels per day.[24] The reduction in fossil fuel exports led to a decrease in government revenues and foreign exchange reserves. As a consequence, the Sudanese Pound (SDG) lost significant value and a parallel currency market emerged.[25] To control price increases, the government introduced a subsidy regime for fossil fuels, wheat, and medicine. Two attempts to remove subsidies in 2012 and 2013 led to large-scale protests.[26]

The trade deficit, lower foreign currency reserves, and exchange rate depreciation led to a significant decrease in foreign direct

13
Human Rights Watch. 2023. p.7.

14
World Bank. 'Lebanon Economic Monitor, Spring 2021: Lebanon Sinking (to the Top 3).' World Bank, Washington, DC. 2021 https://documents1.worldbank.org/curated/en/394741622469174252/pdf/Lebanon-Economic-Monitor-Lebanon- Sinking-to-the-Top-3.pdf

15
World Bank Group. Lebanon Country Climate and Development Report. 2024. p.II.

16
World Bank Group. Lebanon Country Climate and Development Report. 2024. p.II.

17
World Bank Group. Lebanon Country Climate and Development Report. 2024. p.6.

18
Ayoub, Marc., Rizkallah, Pamela., Abi Haidar, Christina. Unbundling Lebanon's Electricity Sector. Issam Fares Institute for Public Policy and International Affairs. 2021. https://www.aub.edu.lb/ifi/Pages/publications/research_reports/2020-2021/unbundling-lebanon-electricity-sector-research-report.aspx.. p.6.

19
World Bank Group. (2020). Lebanon Reform, Recovery and Reconstruction Framework (3RF) cited in Ayoub, Marc., Rizkallah, Pamela., Abi Haidar, Christina. p.6.

20
Boukather Ayat, Carol. Re-energize Lebanon: 5 Action Steps to Rebuilding Lebanon's Collapsed Electricity Sector. Issam Fares Institute for Public Policy and International Affairs. 2023. https://www.aub.edu.lb/ifi/Documents/publications/research_reports/2022-2023/Re-energize%20Lebanon%20Feb%202023.pdf. p.9

21
Boukather Ayat, Carol. 2023. p.9

22
Ibid.

investment after 2011. In parallel, political instability across the country, especially civil wars in Darfur, Blue Nile and South Kurdofan, resulted in higher defense and security spending accounting for almost 80% of total government expenditure.[27] Between 2011 and 2018, government spending on security, like the subsidy regimes for certain commodities, was politically driven, mainly to keep the regime in power. During this period, installed electricity generation capacity increased significantly but access to electricity remained modest due to the limited coverage of the national grid.[28] Even in areas with access, economic distortions, reliance on thermal power generation and cost recovery issues meant that power outages were frequent.[29]

These crises culminated in the Sudanese revolution of December 2018.[30] While the protests were an initial response to increases in the price of bread because of subsidy removal from wheat, broader social, economic and political discontent manifested in a wider social movement. However, the post-revolution period suffered from similar economic and political distortions, despite attempts by the transitional government to introduce new economic and social policies between 2019 and 2021.[31] The fragile civilian-military partnership of the transitional government ended in a military coup in October 2021, after which political instability increased.[32] Tensions within the military resulted in the conflict that started in April 2023.

The compounded and multifaceted crises in both Lebanon and Sudan have resulted in dysfunctional energy sectors characterized by political capture, low energy access, and poor reliability. As a consequence, in both cases a transition took shape away from centralized, fossil-fuel-dominated energy systems to decentralized, renewable energy. While the primary motivation is access and sustenance, there are several positive implications in terms of energy security and energy equity. Despite the obvious differences in geography, demographics, and history, the respective economic and political crises in both countries and their implication for the energy sector make a comparative study of the energy transition that transpired in these different contexts worth pursuing.

Methodology

The analysis in this paper looks at the prospects of an energy transition in the context of the recent crises in Lebanon and Sudan.

23
'Sudden stop' as defined by Calvo, Guillermo A. 2003. Explaining Sudden Stop, Growth Collapse, and BOP Crisis: The Case of Distortionary Output Taxes. IMF Staff Papers Vol. 50. Special Issue. Washington, DC.

24
LDK. 2019. Electricity Sector Recovery Plan: Sudan Electricity Sector Diagnostic Study. World Bank Group. Washington, DC.

25
Elbadawi et al. 2023. Post-Conflict Reconstruction, Stabilization and Growth Agenda for Sudan. ERF Policy Brief No. 122. Cairo.

26
James, L. 2014. Recent developments in Sudan's fossil duel reform process. International Institute for Sustainable Development (IISD) and Global Studies Initiative (GSI).

27
Elbadawi, I. and Alhelo, Z. 2023. The Sudan Syndrome: State-Society Contests and the Future of Democracy After the December 2018 Revolution. ERF Working Paper Series No. 1644. Cairo.

28
World Bank. 2024. Electricity access (% of population): Sudan. World Bank Group. Washington, DC.

29
LDK. 2019.

30
Elbadawi and Alhelo. 2023.

31
Ali, M. and Mann, L. 2023. Misaligned Social Policy? The Origin and Limitations of Cash Transfers in Sudan. Development and Change 54(4): 841-869.

32
Ibid.

In Lebanon, long-term economic mismanagement and corruption have culminated in the crises of the last five years. In Sudan, the secession of South Sudan in 2011 had a significant impact on the economy, and in turn on economic policy and the energy landscape. The secession exposed the political mismanagement of the previous two decades. The loss of oil revenue introduced various economic distortions and shed light on the political capture of the Sudanese state by the incumbent regime. In response, the government introduced systems of commodity subsidies to stave off political attacks.

The paper aims to present a comparative analysis of the increase in the adoption of renewable energy in Lebanon and Sudan. The research for this paper uses a mixed method approach, including primary qualitative and quantitative data, and grey literature, which consists of research produced by organizations outside the traditional academic publishing and distribution channels (for example, reports produced by international organizations and research institutes).

In Lebanon, this study benefits from qualitative and quantitative primary data. Three focus group discussions were conducted with municipalities that implemented renewable energy projects. The focus groups brought together members of municipal councils, technicians, MSME owners, and residents from the area with municipal-level renewable energy projects.

The remaining two topics covered included the renewable energy and energy efficiency sectors, as well as the competitiveness of MSMEs using renewable energy (RE) and energy efficiency technologies. These two focus group discussions could not be convened and so were replaced with key informant interviews each due to the security concerns and the unstable situation since October 7, 2023. Also, key informant interviews were conducted with various stakeholders involved in Lebanon's energy transition, including representatives from international organizations and donors.

In Sudan, two focus group discussions were conducted with owners of MSMEs in eight states across the Eastern and Northern parts of the country. In addition, key informant interviews were conducted with policymakers, energy experts, and private sector entities operating in the energy sector. Quantitative data was only collected in Lebanon. The quantitative data collection involved a firm-level survey covering 804 MSMEs. The survey instrument included questions on electricity consumption and utilization of renewable energy.

This paper has several limitations. First, the different geographies and demographics in the two countries make a comparative analysis more difficult. For example, Sudan's large land mass and hydroelectric resources afford it opportunities for alternative energy sources that are not available to Lebanon. Lebanon's higher population density may make off-grid systems easier to implement, a problem that Sudan has struggled with in the past. Equally, differences in the structure of the economy mean that respective energy policies must be designed accordingly. In addition, in both countries, due to their respective conflicts, focus group discussions and expert interviews were limited to areas that were accessible given security concerns. In Sudan, the security situation did not allow for quantitative data collection. Another limitation of this comparative paper pertains to the lack of literature on the sector in Sudan, whereas more literature is available for Lebanon.

Energy in the Context of Crises

This section provides a detailed overview of the characteristics and operation of the energy sectors in Lebanon and Sudan. It provides details on the vulnerable nature of the sector, the impact of political instability and political capture on sector operation, and highlights the regulatory environments of the sector. Each subsection covers either Lebanon, Sudan, or both, depending on relevance and information availability. In general, this section aims to highlight the characteristics of the sector and the respective economies, and the conditions under which a spontaneous transition to renewable energy took shape.

Ailing Energy Sector

With the onset of the financial crisis in Lebanon, the electricity sector reflected the collapse of the economy and service provision.[33] The failures of the electricity sector, chiefly the national utility (EDL), epitomize the consolidated failures of the state's duties towards its citizens and the collapse of the social contract. The failings of Lebanon's power sector go back to the Civil War (1975-1990), which contributed to the destruction of EDL's generation, transmission, and distribution assets.[34] Post-war reconstruction and privatization schemes failed to ameliorate problems in the electricity sector.[35] Even

33 Ayoub, Marc., Rizkallah, Pamela., Abi Haidar, Christina. Unbundling Lebanon's Electricity Sector. Issam Fares Institute for Public Policy and International Affairs. 2021. https://www.aub.edu.lb/ifi/Pages/publications/research_reports/2020-2021/unbundling-lebanon-electricity-sector-research-report.aspx. p.4.

34 Ahmad, Ali. Distributed Power Generation for Lebanon: Market Assessment and Policy Pathways. 2020. World Bank Group.https://documents.worldbank.org/en/publication/documents-reports/documentdetail/353531589865018948/distributed-power-generation-for-lebanon-market-assessment-and-policy-pathways. p.12.

35 Abu-Rish, Ziad. On Power Cuts, Protests, and Institutions: A Brief History of Electricity in Beirut. https://www.jadaliyya.com/Details/30564

before the 2019 financial crisis, EDL supplied only 55 percent to 64 percent of Lebanon's electricity needs (approximately 12 to 14 hours per day on average until 2018) due to a 1,500 MW long-standing capacity deficit.[36]

Lebanon's power sector has taken a toll on both the country's economy and environment. Over the last decade, annual budgetary transfers to EDL averaged 3.8 percent of GDP.[37] These transfers accounted for close to half of the country's overall deficit.[38] The cost of electricity to consumers is among the highest in the MENA region and power generation is a major source of air pollution and carbon emissions.[39] Despite this reality, the state-owned utility has been operating at a deficit since 1992, relying on advances from the Ministry of Finance to finance fuel imports and other costs in foreign currency.[40] According to Ayat (2021), the cumulative costs of transfers to EDL ($22 billion), including interest ($21 billion) over the period 1992 to 2020, total $43 billion.[41]

EDL suffers from a high cost of production, high technical and non-technical losses, and low cost recovery.[42] The power sector also suffers from corruption and kleptocracy which will be mentioned later below. Owing to the use of heavy fuel oil (HFO), highly polluting and cost inefficient, EDL has high production costs.[43] High technical losses are a consequence of the lack of investment and proper maintenance of power infrastructure, which resulted in inefficient assets in generation, transmission, and distribution.[44] Furthermore, the power sector is characterized by a high level of non-technical losses resulting from electricity theft, unpaid, and uncollected bills.[45]

In addition to the losses, EDL's tariff had been unchanged for a very long time, whereby it was fixed since 1994 at 142 LBP/kwh on average, when the price of oil was below $20 a barrel.[46] In 2023, in the first tariff hike since the 1990s, electricity tariffs were increased to $0.10 per kWh for the first 100 kWh consumed in a month and $0.27 per kWh for higher consumption.[47] With the cost of electricity becoming very high from the utility, this tariff hike had a severe impact on businesses and households who were already experiencing the impact of a deep economic crisis and high inflation. Despite the tariff hike, service provision did not improve. On average, over the last ten years, the utility has experienced high financial losses averaging $1.5 billion per year.[48]

36 World Bank Group. Lebanon Country Climate and Development Report. 2024. p.1.

37 World Bank Group. Lebanon Country Climate and Development Report. 2024. p.6.

38 Ibid, p.6.

39 Ibid, p.6.

40 Ayat, Carol. Bridging the Banking Crisis to Crowdfund Electricity Reform in Lebanon. Issam Fares Institute for Public Policy and International Affairs. 2021. https://www.aub.edu.lb/ifi/Pages/publications/research_reports/2020-2021/20211020_comprehensive_solution_to_the_lebanese_electricity_sector_report_pdf.aspx. p.15.

41 Ayat, Carol. Bridging the Banking Crisis to Crowdfund Electricity Reform in Lebanon. Issam Fares Institute for Public Policy and International Affairs. 2021. p.15.

42 Ayat, Carol. 2021. p. 11.

43 Ayat, Carol. 2021. p. 11.

44 Ibid, p. 12.

45 Ibid, p. 12.

46 Ibid, p. 12.

47 Nada Homsi, 'Lebanon Raises Electricity Tariff, Lifting Hopes of Increased Power Supply.' The National, 3 Nov. 2022, cited in Bitar, Yusra. Lebanon's Solar Rollout: In What Ways Has It Been an Unjust Energy Transition. 2024. https://www.arab-reform.net/publication/lebanons-solar-rollout-in-what-ways-has-it-been-an-unjust-energy-transition/

48 Ayat, Carol. 2021. p. 12.

Furthermore, relying on imported fuel for electricity generation has contributed to a balance of payment crisis.[49] EDL's advances from the Ministry of Finance are funded by Eurobond issuances or from the central bank (BDL) transfers.[50] Therefore, increases in renewable energy adoption would decrease reliance on fossil fuel imports, which would consequently increase savings of foreign currency and diversify the country's energy mix. This diversification enhances energy security and reduces vulnerability to global energy price volatility.

Mismanagement and Corruption

Since the beginning of post-war reconstruction in Lebanon, the power sector has been characterized by poor governance and mismanagement.[51] One of the main challenges has been the diffuse decision-making within this sector where no single entity has been held politically accountable for sector failures.[52] This has resulted in a lack of reforms, and an inability to address EDL's technical, human capacity, and management challenges.[53] Political turmoil, deadlocks, and the absence of a clear investment plan all negatively impacted the sector as EDL was facing spiraling costs.[54] Although perceived as a 'comfortable way' to remedy the power deficit, temporary solutions such as power ships—ships with an on board power plant, usually operated by a foreign company, connected to the local grid—did not solve the inherent problems facing the sector.[55]

Furthermore, vested interests in Lebanon's lucrative generator and fuel economy contribute to entrenching Lebanon's oil dependency.[56] Diesel generator networks have thrived from the failings of EDL, as have the fuel importers and distributors who are politically connected. Moreover, failure to appoint members to the independent Electricity Regulatory Authority (ERA), whose existence is mandated by law, further perpetuates the system of diffused decision making.[57] Without a regulatory authority, regulation of the sector is the responsibility of the Minister of Energy and Water, who acts as the key policymaker, supervisor, and regulator for licensing and sector planning.[58]

Institutional Reform

In Sudan, the Electricity Act of 2001 provides the legal framework for the operation of the electricity sector.[59] The Act launched the National Electricity Corporation as a vertically integrated, state-owned utility and the sole generator, transmitter, and distributor of electricity.[60] The

49 World Bank Group. Lebanon Country Climate and Development Report. 2024. p. 6.

50 Ayat, Carol. Bridging the Banking Crisis to Crowdfund Electricity Reform in Lebanon. Issam Fares Institute for Public Policy and International Affairs. 2021. https://www.aub.edu.lb/ifi/Pages/publications/research_reports/2020-2021/20211020_comprehensive_solution_to_the_lebanese_electricity_sector_report_pdf.aspx. p.15.

51 Ahmad, Ali. p.34.

52 Ibid. p.34

53 Ibid.p.34

54 Ibid, p.35.

55 Ibid, p.35.

56 Human Rights Watch. 2023.p.29.

57 Ibid, p.6-7.

58 Ahmad A., Mahmalat, M., & Saghir, J. (2021). Lebanon's independent electricity regulator: Avoiding the 'political economy trap' [Policy brief]. The Lebanese Center for Policy Studies (LCPS). Cited in Ayoub, Marc., Rizkallah, Pamela., Abi Haidar, Christina. p.4.

59 Usui, K. et al. 2019. From Subsidy to Sustainability: Diagnostic Review of Sudan Electricity Sector. World Bank Group. Washington, DC.

60 Ibid.

Electricity Regulatory Authority (ERA) was set up as an independent regulator. While the framework allowed for private participation in all aspects of the sector, there were no clear mechanisms and procedures for how this could happen in practice.

In 2010, the sector was unbundled and assumed a horizontal structure.[61] In this new structure, the power sector has three levels.[62] Figure 2 below details the structure of the sector. Even after unbundling, each sector organization is dependent on budgets allocated by the Ministry of Finance and Economic Planning (MoFEP) through the Ministry of Water Resources, Irrigation and Electricity (MWRIE). The sector's investment decisions and financial management is determined by MWRIE.[63] The Sudanese Electricity Holding Company (SEHC) is provided with an annual budget which it distributes to its subsidiaries based on their operational requirements (including staff salaries). The Sudanese Hydropower Generation Company (SHGC) and the Sudanese Thermal Generation Company (STPG) provide electricity to the Sudanese Electricity Transmission Company (SETC), which in turn provides electricity to the Sudanese Electricity Distribution Company (SEDC). The SEDC is the only subsidiary that generates revenue from electricity sales to customers, which is partially used to cover sector operational costs (Figure 2 below illustrates financial flows in the electricity sector).[64]

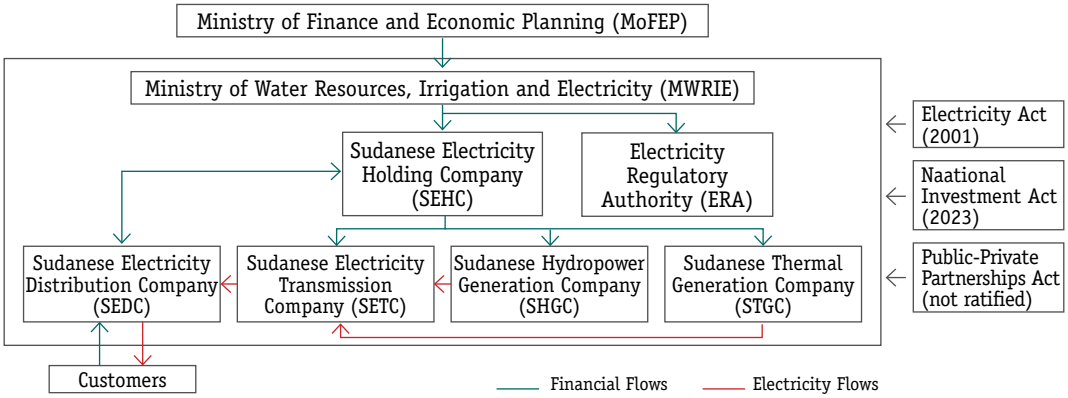
61
Ibid.

62
This is subject to change. In a recent seminar as part of the dissemination efforts for this project in September 2024, an expert in the sector mentioned that this structure is being amended and the likely outcome is a new structure similar to the initial vertical structure that resulted from the Electricity Act of 2001.

63
Usui et al. 2019.

64
Ibid.

Figure 2 **Institutional structure of Sudan's electricity sector**



(Adapted from Usui et al. 2019)

Moreover, the electricity sector, like other sectors, has suffered from Sudan's volatile political climate and the transitory nature of government departments. The constant changes at the ministerial level and shifts in political priorities introduced uncertainty in sector

oversight and loss of institutional memory.[65] Sectoral priorities were revised and the introduction of the Investment Encouragement Act 2021, the Public Private Partnership Law 2021 (a different version of the Public Private Partnership Act that was never ratified), and the Industry Organization and Development Act 2021 introduced new regulations that directly and indirectly affect the sector.[66] For example, while the Investment Encouragement Act 2021 aimed to supplement the provisions of the National Investment Act 2013 to increase private sector participation in priority sectors, it had a narrow view of who qualifies to benefit from government incentives.[67]

In some areas, Sudan's power sector performs well.[68] Transmission and distribution losses are relatively low and generally in line with regional averages.[69] Despite sanctions, good sector performance was partially due to the development of local industries that produced prepayment meters and transformers.[70] Yet, there are clear regional differences in the coverage of the electricity grid. The national grid is mostly concentrated in the central and northern parts of the country.[71] The states with limited connection to the grid, mainly the five Darfur states and three Kordofan states, rely on off-grid diesel-powered systems to satisfy electricity demand. Sudan is connected to the East African Power Pool (EAPP) but has not made good use of the interconnections with Ethiopia and Eritrea in the south eastern part of the country and with Egypt to the North.[72]

Political Instability

The proliferation of distributed power generation systems in Lebanon, whether fossil fuel based or renewable energy, has served as a safety net during forced or unplanned grid outages due to military attacks on power infrastructure.[73] The infighting during the Civil War (1975-1990) and external aggression by Israel have contributed to the destruction of EDL's generation, transmission, and distribution assets.[74] Attacks on power infrastructure by Israel during the 2006 war forced EDL to stop power generation, while the country resorted to running on diesel generators in order to mitigate a complete blackout.[75] Since October 2023, Israel's aggression in Southern Lebanon and the escalation of hostilities has contributed to severe damage to water, electricity, telecommunication, and road infrastructure.[76]

Regarding subsidy removal in Lebanon, diesel imports were subsidized until June 2021 by the central bank at an exchange rate of

65 Ibid.

66 Alneel, M. 2022. People-centered evaluation of industrial policies in post-revolution Sudan 2019-2021. The 10th International Conference for Appropriate Technology. 22-25 November 2022. Khartoum.

67 Ibid.

68 Usui et al. 2019.

69 LDK. 2019.

70 Usui et al. 2019.

71 Ibid.

72 Ibid.

73 Ahmad, Ali. p.8.

74 Ibid, p.57.

75 Ibid, p.57.

76 OCHA. Lebanon Flash Update #23 Escalation of hostilities in South Lebanon. 2024. https://reliefweb.int/report/lebanon/lebanon-flash-update-23-escalation-hostilities-south-lebanon-24-july-2024

1,507.5 LBP/USD while the parallel market rate for the LBP reached 25,000 in June 2021.[77] The exchange rate for diesel imports was gradually increased until the full lifting of subsidies in September 2021.[78] The removal of subsidies made fuel expensive for electricity generation, increasing the cost of electricity produced from diesel generators. As such, households and businesses resorted to solar energy to salvage their energy security.

In Sudan, the Transitional Government of Sudan[79] experimented with subsidy removal over a short timeframe.[80] While the economics of subsidy reform may seem straightforward, subsidy removal involves several political considerations. To understand why, it's important to get a sense of the political landscape during the early days of the transitional period in Sudan in 2019 and 2020. Fossil fuel subsidy reforms were a central pillar of the government's economic reform program. The reforms required the approval of a make-shift legislative council composed of members of the Ministerial Cabinet and Sovereign Council. The reforms were also a condition of the IMF's Staff Monitored Program, which would determine the amount and mechanisms of financial support Sudan would receive.

The Forces of Freedom and Change (FFC)—a coalition of political parties—saw the subsidy reform decision as a potential threat to their role in the Sudanese revolution at the time and a threat to the transitional government's credibility.[81] The government presented the long-term economic benefits from subsidy reforms, while the FFC highlighted the short-term political implications—mainly on the consequences of price increases.[82]

The first instance of subsidy removal came unplanned in early 2020. In February 2020, a heating malfunction in the pipeline feeding the Khartoum Refinery disrupted refinery operations.[83] New regulations were introduced where certain petrol stations were allocated a quota of fuel to sell at a 50% subsidy.[84] The new regulations also gave private sector entities licenses to import fuel for their own consumption – but not to sell in the market.[85] Ultimately, subsidies on fossil fuels were removed in September 2020.[86] In October 2020, inflation reached 230%, up from 58% a year earlier. Prices continued to increase for the rest of 2020 and the first half of 2021.

The military members of the transitional government had no explicit position on the subsidy reform debate. Yet, it is likely some of them understood the consequences of such reforms from their

77 Boukather Ayat, Carol. 2023. p. 9.

78 Ibid. p. 9.

79 Transitional Government refers to the civilian government in power between September 2019 and October 2021.

80 Ali and Mann. 2023.

81 Elbadawi et al. 2023.

82 Ibid.

83 Interview with ex-policy maker (February 2024, Online).

84 Ibid.

85 Ibid.

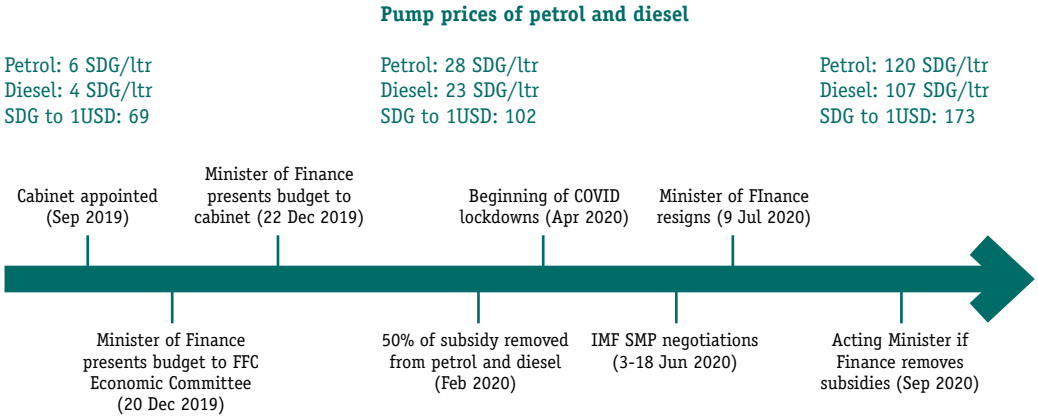
86 IMF. 2020. Sudan: Staff-Monitored Program, IMF Country Report No. 20/289. IMF. Washington, DC.

experience in various government positions between 2011 and 2019, when the previous regime made three attempts at removing fossil fuel subsidies: in January 2011, April 2012, and August 2013.[87] These were followed by a series of protests in 2011 and 2013.

Given the theoretically long-term stabilizing effects of subsidy reforms, and the security sectors' various investments in the private sector,[88] it was perhaps in the interest of the military members of the transitional government that subsidies be removed under the stewardship of the civilian faction of the government. This way the negative impact of the reforms can be attributed to decisions made by the civilian government while the benefits accrue to the wider economy, where the military has various economic interests.

In February 2020, the pump price of petrol and diesel increased from SDG 6 per liter and SDG 4 per liter to SDG 28 per liter and 23 SDG per liter, respectively.[89] In the final instance of subsidy removal, the pump prices of petrol and diesel increased by 330% and 365%, respectively (Figure 3 provides a timeline of subsidy removal in Sudan).

Figure 3 **Subsidy removal timeline, September 2019 to September 2020**



Weak Regulatory Environment

The Sudanese government introduced the National Investment Act in 2013 and initiated a Public-Private Partnerships Act in 2015 (yet to be ratified) to encourage private participation in infrastructure development and strategic sectors.[90] Moreover, the Electricity Act was updated around the same time to establish the SEHC as the government entity responsible for power purchasing agreements (PPAs) with the private sector.[91] Yet, despite these efforts, the sector remains highly dependent on MoFEP budget allocations for

87 James. 2014.

88 Hoffman, A. and Lanfranchi, G. 2023. Kleptocracy versus Democracy: How security-business networks hold hostage Sudan's private sector and the democratic transition. CRU Report. Clingendael.

89 Interview with ex-policy maker (February 2024, Online).

90 Usui et al. 2019.

91 Usui et al. 2019.

investments, maintenance, and grid expansion.[92] Because of the ambiguity of the procedures to private participation, the lack of a clear regulatory structure to govern long-term PPAs, and the volatility of the exchange rate and other macroeconomic indicators, private investment in the sector is almost non-existent.[93]

Before the secession of South Sudan, there was no sector specific strategy for electricity.[94] Instead, like other sectors, it was part of a long-term development plan to 2031.[95] After 2011, the Power Sector Development Framework was created to guide the expansion in generation capacity to meet growing demand and the extension of the grid network between 2015 and 2020.[96] The framework followed a least-cost approach, and therefore relied on power generation through heavy fossil fuels for certain regions of the country, primarily in the Eastern part of Sudan. Solar and wind did not feature in the government's least-cost power generation development plan and the government overestimated peak demand in its planning effort.[97]

In Lebanon, Law No.462/2002 provides the legal framework for the privatization, liberalization, and unbundling of the electricity sector. Under this law, the power sector is split into three components: production, transmission, and distribution, whereby transmission is restricted to EDL.[98] Private production and distribution are allowed under the Public Private Partnerships terms of law 228/2000 which delineates the governance structure of private operations.[99] The yet to be appointed National Electricity Regulatory Authority (NERA) is mandated by law No. 462/2002, which includes provisions through which the NERA issues licensing for new power generation projects.[100]

The current arrangement requires Independent Power Producers (IPP)s with a generation capacity higher than 1.5 MW to go through a two-stage process: first, the project must be proposed by the Minister of Energy and Water; second, the proposal is voted on by the Council of Ministers.[101] In 2018, the Ministry of Energy and Water (MoEW) signed 3 Power Purchase Agreements (PPAs) for a 200 MW wind farm in the northern governorate of Akkar.[102] Despite these and other Power Purchase Agreements initiated by the MoEW, the financial and political crisis lengthened the tender process and raised doubts about the PPA's bankability and investors' ability to achieve financial closure.[103]

Lebanon's crisis had an impact on donor engagement in the country, where donors have shifted their focus from financing large

92 Ibid.

93 Ibid.

94 Ibid.

95 Ibid.

96 Ibid.

97 Ibid.

98 Ali Ahmad. (2020). Distributed Power Generation for Lebanon: Market Assessment and Policy Pathways. p.19.

99 Ali Ahmad, p.19.

100 Ibid, p.19.

101 Ibid, p.19.

102 Ibid, p.66.

103 Ilias Tsagas. 2023. Lebanon signs 11 solar PPAs, but financial closure remains challenging. PV Magazine. https://www.pv-magazine.com/2023/05/17/lebanon-signs-11-solar-ppas-but-financial-closure-remains-challenging/

infrastructure projects to adopting a more decentralized approach that focuses on decentralized renewable energy and energy efficiency projects.[104] Despite existing project and procurement processes for large-scale renewable energy projects, financing remains a barrier for donor support for large scale projects in a context like Lebanon.[105] While financing for large scale projects has often been conditioned on structural reforms to offset the various political and economic risks, a lack of trust in state capacity and the utility's ability to reimburse have hindered progress.[106]

Transition as a Consequence of Crisis

Diesel Generator Sector

Despite all the post-war infrastructure development plans aimed to augment electricity generation in Lebanon, the supply gap left by the state-owned utility resulted in the emergence of an informal distributed highly polluting generator sector that has been, for the most part, resistant to regulation. Existing regulations only allow EDL and licensed independent power producers to generate and sell electricity.[107] Therefore, private diesel generators operate outside purview of existing legislation. However, given the failure of consecutive governments to solve supply deficiencies, the existence of this sector has been generally accepted, and for many years Lebanese policy makers and law enforcement turned a blind eye.[108]

The diesel generator economy consists of three main components: a commercial market, where generator owners sell electricity to consumers; a fuel economy, consisting of diesel fuel importers and distributors; and a generator economy, made up of generator sales, spare parts sales, and maintenance services.[109] The estimated value of the commercial diesel generator market is around $1.1 billion.[110] As a consequence of its informality, this sector is cash-based and mostly untaxed, which means there is a substantial amount of forgone tax revenue for the state.[111]

Based on a survey of micro, small, and medium enterprises (MSMEs) in 2023, the monthly cost of generator expenses for surveyed enterprises was USD 844, on average, with costs varying according to the size of the business: micro enterprises spent around USD 335, small businesses spent around USD 1,700, and medium enterprises spent around USD 2,200 per month.

104 KII with International Donor Representative conducted on 5/17/2024.

105 Ibid.

106 Ibid.

107 Ahmad, Ali, p.8.

108 Ibid, p.8.

109 Ahmad, Ali. p.22.

110 International Bank for Reconstruction and Development/ The World Bank, Distributed Power Generation for Lebanon: Market Assessment and Policy Pathways, Cited in Human Rights Watch. 2023. p. 91.

111 Ahmad, Ali. p. 8.

Government efforts to regulate the private diesel generator market began in 2011, however, little was enforced until 2018.[112] At the local level, commercial generator owners exert influence through forging strong connections with local authorities and law enforcement officers.[113] The diesel generator sector also relies on fuel imports, which comprise most of the diesel generator economy and market, to maintain its operations.

While the owners of generator networks often receive the most attention by the media and public discourse, there are less visible private sector actors who stand to benefit from the existence of the sector: fuel importers, fuel dealers, and agents, who play different roles in the supply chain process and whose revenues amount to around $2 billion per year.[114] At the national level, fuel importers are able to lobby for their interest due to the substantial amount of tax revenue generated from fuel imports, an important source of income for the government.[115]

In addition, an overlap exists between government officials and shareholders in the companies operating in the diesel generator sector. This overlap can manifest itself in the form of a politician owning shares in a company operating in the sector, or through donations to political and religious institutions, philanthropic work, and nepotism.[116] Moreover, some observers have noted that an oligopoly exists of 13 licensed private sector fuel-importing companies that have their own storage facilities and distribution network.[117]

The diesel generator sector, largely located in urban and rural residential and commercial areas, has a negative impact on the environment and on people's health. In 2018, it was estimated that diesel generators contributed to 39% of the total electricity Greenhouse Gases Inventory (GHI),[118] equivalent to 3400 Gg CO2eq.[119] Diesel generators contribute to high levels of fine particulate matter (PM) which has a serious impact on human health.[120] According to a 2013 AUB study, the use of diesel generators in Beirut contributes significantly to people's daily carcinogen exposure.[121] 2021 witnessed a 300% increase in pollution levels due to the increasing reliance on private generators, according to AUB's Nature Conservation Center.[122] It is worth noting that EDL and private generation have similar emission factors, since most of EDL power is generated with HFO and diesel.[123]

112
Ahmad, Ali. p. 14.

113
Ibid, p. 36.

114
Ibid, p.35.

115
Ibid, p.36.

116
Ibid, p.36.

117
Albin Szakola, "National Suicide': A Breakdown of Lebanon's Deepening Dependence on Diesel Fuel for Private Generators,' L'Orient Today, January 14, 2022. Cited in Human Rights Watch. 2023. p.95.

118
Ahmad, Ali. p.8.

119
Ibid, p.8.

120
Ibid, p.8.

121
Shihadeh, Alan., Al Helou, Marc., Saliba, Najat., Jaber, Sara., Alaeddine, Nader., Ibrahim, Elias., Salahieh, Zahra., Chiit, Maher. Climate Change and Environment in the Arab World: Effect of distributed electric power generation on household exposure to airborne carcinogens in Beirut. Issam Fares Institute for Public Policy and International Affairs. 2013. https://scholarworks.aub.edu.lb/handle/10938/21130 cited in Ahmad, Ali. p.60.

122
Cited in Boukather Ayat, Carol. Re-energize Lebanon: 5 Action Steps to Rebuilding Lebanon's Collapsed Electricity Sector. Issam Fares Institute for Public Policy and International Affairs. 2023. https://www.aub.edu.lb/ifi/Documents/publications/research_reports/2022-2023/Re-energize%20Lebanon%20Feb%202023.pdf. p.7.

123
Boukather Ayat, Carol. 2023. p.8.
124

Solar Surge

In Lebanon, the wide-scale adoption of diesel generators and subscriptions to local off-grid diesel generator systems emerged over the years as a coping strategy to the country's failing power sector. More recently, the fuel crisis pushed many households and enterprises towards solar energy. This was very much an individual and crisis-driven, bottom-up transition. With the declining cost of solar PV systems,[124] and increasing and volatile costs of diesel for power generation, many households and enterprises resorted to solar energy. In 2022 alone, a total of 80,315 tons of solar panels were imported, four times what was imported in the previous ten years combined.[125]

According to a USAID solar market assessment, employment within the solar energy sector increased by 70% in 2022 on average compared to 2020.[126] It should be noted, however, that installation of new solar PV systems has recently plateaued.[127] A recent survey of micro, small, and medium enterprises in 2023 revealed that 24% of surveyed enterprises had solar energy systems. The average installation cost for a solar power system across enterprises was around USD 9,000. Moreover, most enterprises installed their solar systems in 2021 (28%) and 2022 (41%), which coincides with the removal of fossil fuel subsidies.

The installation of solar systems allowed households and enterprises to gain some level of independence and to protect themselves from the volatility of diesel prices. One owner of an MSME who installed a solar system noted that their enterprise had largely stopped using grid electricity.[128] While the installation of solar systems comes with high upfront costs, it was a matter of necessity for survival. Had the enterprise been reliant on diesel generators to power their operations, their monthly costs would be significantly higher (at least 35% more). However, it should be noted that operations at this particular MSME have not recovered to their pre-crisis levels.[129]

MSMEs using renewable energy reported financial gains ranging from $750 to $2,500 per month, with up to a 40% reduction in their operation costs. This demonstrates the economic viability of renewable energy, which seems to be sustainable and cost effective.[130] Despite this evidence, the main challenge faced by most enterprises for adopting renewable energy systems is finance. In the absence of favorable finance, whether through bank loans or governmental

Our World in Data. Solar panel prices have fallen by around 20% every time global capacity doubled. 2024. https://ourworldindata.org/data-insights/solar-panel-prices-have-fallen-by-around-20-every-time-global-capacity-doubled

125
Boukather Ayat, Carol. 2023.p. 19.

126
USAID/Community Support Program (CSP) in Lebanon. Market Assessment: Solar Energy Sector in Lebanon.2022.p.5. https://csplebanon.org/wp-content/uploads/2022/08/Lebanon_CSP_Market_Assessment_Solar_Energy_Sector_APR_2022.pdf

127
Sally Abou AlJoud. 'Experts weigh in: Why is Lebanon's solar 'boom' no longer booming?', L'Orient Today. 13 May 2024 cited in Bitar, Yusra. Lebanon's Solar Rollout: In What Ways Has it Been an Unjust Energy Transition?. 2024. Arab Reform Initiative.

128
KII with MSME owner conducted on 5/31/2024.

129
KII with MSME owner conducted on 5/31/2024.

130
KIIs with MSMEs using RE.
131

support, many enterprise owners relied on personal resources or limited funding to finance these projects.[131]

Representatives from the renewable energy and energy efficiency sectors who were interviewed highlighted the recent shift in the demand for solar energy from the residential to the industrial and commercial sectors.[132] When it comes to the ability to deploy solar PV systems, the industrial and commercial sectors have advantages over the residential sector, such as the availability of space and access to finance.[133]

Recent legislation has emerged to support renewable energy efforts in Lebanon and to regulate the energy transition. In December 2023, a law on distributed renewable energy was ratified by Parliament. The law provides opportunities for private sector investment in renewable energy, through mechanisms that allow the sale of electricity directly to creditworthy clients using power purchase agreements.[134] The new legislation also allows for the 'peer to peer' trading of renewable energy: consumers and producers who are located within the same land or adjacent plot do not have to use the national grid to transfer electricity. A transmission fee will be incurred by residents who do use the grid to transfer electricity.

However, failure to appoint members of the National Electricity Regulatory Authority (NERA) remains one of the main obstacles to the successful implementation of the law. The regulatory body will play an important role in establishing a special net metering system, and determining the price ceiling for EDL's compensation to renewable energy generators for the surplus electricity fed into the grid.[135] Another challenge to the law's successful implementation includes the outdated billing system, which requires amendments in order to incorporate net metering, as well as a stable grid that can secure a base load generation capacity.[136]

Although subsidized loans were provided by the Central Bank in 2010 to encourage the growth of this sector (through the National Energy Efficiency and Renewable Energy Action (NEEREA) national financing mechanism), access to finance today constitutes another major challenge, due to the recent collapse of the banking sector. It is currently being mitigated through funds from international donors[137] and other informal financing mechanisms. As an indication of limited financial support through grants or loans, only 2% of surveyed

KIIs with MSMEs using RE.

132
KIIs with RE and EE enterprises.

133
Ahmad, Ali. p.9.

134
World Bank Group. Lebanon Country Climate and Development Report. 2024. p.11.

135
Taha, Ali., Akel, Rasha. Regulating the Energy Transition: Lebanon's New Law on Distributed Renewable Energy. The Lebanese Center for Policy Studies. 2024. https://www.lcps-lebanon.org/en/articles/details/4853/regulating-the-energy-transition-lebanon%E2%80%99s-new-law-on-distributed-renewable-energy

136
Taha, Ali., Akel, Rasha. 2024.

137
Taha, Ali., Akel, Rasha. 2024.
138

enterprises reported having received assistance in the past five years, half of which were acquired in 2023.

International organizations and donors play a prominent role in Lebanon's energy transition. They have set aside funds for expanding the deployment of renewable energy technologies across the country. Also, a significant amount of donor funding was dedicated to providing support, through the installation of renewable energy and energy efficiency systems, to the public sector, as most public services were interrupted due to the fuel crisis.[138] In addition, international organizations have been working with the Lebanese University and Technical and Vocational Education and Training (TVET) institutions to update their curricula according to the latest standards for solar PV.[139]

In Sudan, the government's broad development plan was hampered by the secession of South Sudan.[140] Yet the government's universal access to electricity target is set for 2031, in line with the timeframe of the quarter century development plan.[141] Also, part of the sector strategy was to increase off-grid solar solutions in areas where grid expansion is not feasible.[142] More specifically, the government had planned to provide 2.5 million people with solar home systems (SHS) by 2023.[143] This target was not achieved. But more importantly, given the distribution of the grid, and while it is not explicitly stated, the expansion of SHSs to underserved, hard-to-reach areas will most likely be implemented in Darfur and Kordofan.

The eight constituent states of the Western region of Sudan, along with Red Sea state, have the lowest rates of electricity access.[144] Given the importance of the Eastern region for the Sudanese economy, two of the 14 planned large scale power generation projects in the government's electricity expansion plans were in Red Sea state.[145] On the other hand, only three of the 14 planned projects were in the Western part of the country. This regional bias in electricity infrastructure development is likely to exacerbate existing regional inequalities.

In Sudan, grid expansion is the responsibility of state governments.[146] This decentralized approach requires state governments to invest in transmission and distribution infrastructure. Moreover, last-mile connection fees, including the cost of low-voltage lines, are assumed by customers.[147] Households living far from the grid pay more because of the need for longer transmission lines, and the fee fluctuates based on the value of the Sudanese pound against

KII with a manager at a UN organization conducted on 4/5/2024.

139
KII with a manager at a UN organization conducted on 4/5/2024.

140
Elbadawi and Alhelo. 2019.

141
This is set to change given the current conflict which started in April 2023.

142
Usui et al. 2019.

143
Ibid.

144
SLMPS. 2022. Sudan Labour Market Panel Survey. ERF. Cairo.

145
Usui et al. 2019.

146
Ibid.

147
Ibid.
148

the US dollar. A low electricity access rate of 32% is one consequence of the centralized grid, the need for state-level investment in grid expansion, and customers burdened with last mile connection fees.[148] In addition, most connected households are in urban areas in Khartoum, Gezira, and River Nile states, and only 5% of the bottom quintile are connected to the grid.[149]

The limited coverage of Sudan's national grid has pushed both local populations and international development organizations to explore alternative options.[150] While electricity for agriculture is subsidized, the connection costs make access to grid electricity for smallholder farmers unaffordable. In areas to which the grid can be extended, farmers have to pay for the connection costs, which includes installation costs, cost of cabling, and meter installation.[151] Only then can farmers get access to subsidized electricity. In response, development funding directed towards agricultural now includes solar powered pumps and off-grid solar systems for food processing.

The African Development Bank's Desert-to-Power Initiative in Sudan was designed to 'help farmers reduce their dependence on imported fossil fuels' through the provision of solar pumps to 1,170 farmers.[152] In addition to ensuring security of supply and improving livelihoods, the project stresses the added environmental benefits of reduced GHG emissions.[153] The project was conducted in partnership with the Ministry of Water Resources, Irrigation and Electricity (MWRIE), potentially highlighting that the deficiencies in electricity infrastructure are acknowledged by the government.

Similarly, a UNDP-GEF-supported project launched in 2016 to promote the use of water pumps for irrigation aimed to finance 1,440 solar pumps in the Northern State.[154] A demonstration phase of 28 solar pumps was followed by the establishment of the Northern State PV Fund to help finance the initial capital costs associated with purchasing solar pumps for farmers. The partnership with MWRIE managed to mobilize local finance and create tax and custom duty exemptions for imported solar pumps.[155] Similar initiatives continue to provide power for displaced communities during the current conflict.[156]

While most of these efforts are donor-driven, and most of the initial finance and guarantees are provided by international organizations, the increase in the adoption of solar pumps is a sign of a broader trend. After the policy changes instituted by the transitional government in 2020, particularly fossil fuel subsidy

World Bank. 2024. Electricity access (% of population): Sudan. World Bank Group. Washington, DC.

149
SLMPS. 2022. Sudan Labour Market Panel Survey. ERF. Cairo.

150
Interview with energy expert (February 2024, Online).

151
Usui et al. 2019.

152
AfDB. 2019. Sudan - Solar PV Powered Pumping for Irrigation Project (Desert-to-Power Initiative). African Development Bank. Abidjan. https://mapafrica.afdb.org/en/projects/46002-P-SD-FF0-001

153
Ibid.

154
UN. 2016. Promoting the Use of Electric Water Pumps for Irrigation in Sudan. UN DESA-SD. https://sdgs.un.org/partnerships/promoting-use-electric-water-pumps-irrigation-sudan

155
Ibid.

156
Reliefweb. 2024. Water, not War: How Solar Pumps Empower Displaced Communities in Conflict Zones in Sudan. https://reliefweb.int/report/sudan/water-not-war-how-solar-water-pumps-empower-displaced-communities-conflict-zones-sudan

157

reform, the solar PV sector boomed.[157] With diesel no longer subsidized, solar PV systems became more competitive. Enterprises operating in the solar PV sector saw an increase in sales, particularly in urban areas, where many households were looking for a safer, longer-term, and perhaps cheaper, alternative to diesel generators.[158] However, this increase in adoption of solar did not spillover to low-income households and adoption of solar home systems or to broader increases in large off-grid systems as the government had initially planned in its development plan to 2031.[159] Before the start of the current conflict, the increase in adoption of solar PV for self-generation was obvious to many observers, but no official record of sales or installations exists.[160]

Municipal Renewable Energy

While the central government in Lebanon has failed in the past to provide a consistent supply of electricity to residents, several local municipalities have taken initiative to cover the gap. Municipal governments have emerged as key players in Lebanon's decentralized, bottom-up, energy transition. Municipalities have acquired funding for their renewable energy projects through grants from international donors,[161] as well as donations from the diaspora.[162]

All focus group discussions highlighted the fact that municipalities play an essential role in the successful implementation of solar power installations. Municipal governments contribute to the management and oversight of project implementation, and serve as intermediaries between a diverse group of stakeholders: central administration, local businesses, expats, civil society organizations, and international donors. Several focus group participants mentioned that municipal level projects reduced the costs of using generators for subscribers, increased the availability of electricity, reduced air and noise pollution from diesel generators, and increased environmental awareness.

In the municipality of Kfarmishki, following the installation of a hybrid mini-grid which provided households and businesses with 24/7 electricity from solar and diesel generators, people experienced around 80% cost savings compared to using private generators alone. The main obstacle to the expansion and maintenance of these infrastructure projects is the lack of sustainable financing. Consequently, in the municipality of Bechmezzine, there is growing

Interview with the owner of an enterprise operating in the energy sector (January 2024, Online).

158
Ibid.

159
Interview with energy expert (February 2024, Online).

160
Ibid.

161
Ahmad, Ali. p.51.

162
Bitar, Yusra.
163

reliance on assistance and donations from donors and expats due to the lack of funding and decline in municipal revenues.

Conclusion

This report provides an overview of the characteristics and operation of Lebanon and Sudan's energy sectors, and of the conditions under which a spontaneous transition to renewable energy occurred. It also discusses the ways in which the energy transition unfolded as a consequence of crises in both countries. Drawing on primary quantitative and qualitative data, as well as literature on the topic, the report covers several thematic areas regarding Lebanon's ailing energy sector and Sudan's sectoral reform and political instability, focusing on the weak regulatory environments in both countries and their reactive transition to renewable energy. Furthermore, findings indicate that the donor community has played a supporting role in the transition, primarily to fill gaps where the state has fallen short in providing reliable access to electricity.

Reforming the energy sector is crucial for Lebanon's recovery process.[163] While the surge in individual and municipal-driven solar installations have helped limit the negative impacts of the crisis, they are no substitute for necessary reforms in the power sector. A functional grid and an adequate regulatory framework are essential foundational building blocks to drive and support the recent increase in bottom-up renewable energy uptake.[164] These would need to be supplemented by broader reforms and interventions, particularly efforts to increase the pool of relevant skills in the labor market to manage and deliver a sustainable energy future.[165]

Sudan faces similar problems, and given the current conflict, reforms are arguably more urgent. While it is difficult to implement any meaningful policy changes or institutional reforms during the conflict, leveraging increases in the adoption of off-grid solutions for post-conflict recovery could certainly play a crucial role in expanding energy access. This means that planning for energy sector reforms must be a priority for those thinking about post-conflict development and state building. More importantly, energy sector plans must align with a multi-sectoral development strategy, primarily to ensure that energy provision enhances wellbeing at the household level and supports economic and industrial activities more

163 World Bank Group. Lebanon Country Climate and Development Report. 2024, p.47.

164 Ibid, p.47.

165 Ibid, p.47-48.

166

broadly. Moreover, perceptions about Sudan being high-risk and the challenges of securing financing for large infrastructure projects will require alternative financing methods and more deliberative support mechanisms from both local and external sources of finance.[166]

Burdened with compounded crises over several decades, both Lebanon and Sudan have had to adapt to their realities. The transition to municipal scale renewables in Lebanon and the adoption of off-grid systems in urban areas in both countries are examples of a reactive transition that occurred outside and in spite of state intervention. Deliberate, targeted, and long term planning by governments in both countries is crucial for these efforts to bolster and inspire a broader, more long-term transition.

A recent proposal for 'Peace bonds', a new asset class that emphasizes peace-building in finance for climate related projects, has caught the attention of some donors. See Interpeace. 2022. Peace Bonds Feasibility Study. https://www.financeforpeace.org/peace-bonds/

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