CLIMATE RESPONSIVE ECONOMIC RECOVERY

Post-pandemic Opportunities in Mashreq

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ABBREVIATIONS

CIP	Capital Investment Program
CO2	carbon dioxide
ESCWA	Economic and Social Commission for West Asia
FCV	fragility, conflict, and violence
FSI	Fragile State Index
GDP	gross domestic product
GHG	greenhouse gas
HV	hybrid vehicle
IDP	internally displace person
MENA	Middle East and North Africa
MRV	monitoring, reporting, and verification
NDC	nationally determined contribution
PMR	Partnership for Market Readiness (Jordan)
PV	photovoltaic
RCP	representative concentration pathway
RE	renewable energy
SDG	sustainable development goal
TNC	Third National Communication
UKCA	United Kingdom citizen assembly
UNFCCC	United Nations Framework Convention on Climate Change

All dollar amounts in this document are US dollars unless otherwise indicated.

EXECUTIVE SUMMARY

In Mashreq, climate change and fragility form a vicious cycle wherein current fragility hinders climate action and climate threats will exacerbate fragility. The COVID-19 pandemic has brought an acute disruption to the global economy, yet its most profound effects have been felt in (and will continue to impact) weak and fragile states, including Mashreq countries. Reimagining a post-Covid-19 climate-responsive economic recovery presents a critical opportunity to break away from this cycle and align economic, development, and climate agendas. This report highlights some of the opportunities available for Mashreq countries, focusing on Iraq, Jordan and Lebanon, to couple climate action with post-pandemic economic recovery. The main audience of this report are the governments, policy makers, development community and stakeholders in Mashreq interested in exploring climate responsive opportunities to support economic recovery.

CLIMATE REALITIES IN MASHREQ

Achieving climate action, development, and short-term economic recovery objectives simultaneously is not easy, especially in a region with deteriorating macro-fiscal conditions, political economies that are not conducive to reform, and deepening socioeconomic challenges. However, economic, social, and climate goals are not mutually exclusive. Well-designed and well-executed recovery plans can leverage climate action to respond to the region's pressing economic needs by creating jobs, stimulating economic activities, and mitigating vulnerabilities in key sectors such as water and agriculture. And the costs of climate inaction are high. According to World Bank data, the estimated impacts of climate-change-induced water scarcity amount to 6–14 percent of regional gross domestic product. Agricultural productivity is likely to drop by up to 60 percent in some countries, costing the region hundreds of billions of dollars in lost export revenues.

Currently, the space for climate action in Mashreq can be characterized by (1) high vulnerability to nonlinear socioeconomic impacts that could further challenge regional peace and stability, (2) dependency on increasingly conditional and scarce international support and financing, (3) overwhelming attention to mitigation efforts with a small share of investments dedicated to adaptation projects, and (4) slow and limited adoption of technological solutions and innovations on both the mitigation and adaptation sides.

CATEGORIZATION AND RATIONALE OF PROPOSED INTERVENTIONS

The proposed interventions in this report are split into two categories. The first category covers interventions that have already been put forward by Mashreq governments or development partners. The second category covers targeted niche interventions that highlight new or unconventional climate approaches in Mashreq. While the first category is based largely on a sectoral lens of climate action, the category combines sectoral and spatial aspects. It is important to note that the niche interventions are examples of climate action entry points and not a priority list of interventions.

The rationale to incorporate niche climate interventions is to reflect on three emerging and pressing priorities in Mashreq: (1) need for expanding adaptation projects, (2) the need for creating low-skilled jobs, which are the most affected by the COVID-19 crisis, and (3) the need to promote community involvement and citizen engagement to reduce group grievances and facilitate the implementation of reforms. The adaptation focus stems from the fact that investments in adaptation projects in Mashreq are well below the needed level; they can have a substantial social impact, given their role in preventing further economic and social fragility, given the fact that households and private sector assets will be particularly vulnerable to the effects of climate change. In terms of the focus on low-skilled jobs, globally, the COVID-19 pandemic has uncovered existing fragilities and inequalities in labor markets; it has affected low-paid and low-skilled workers the most. As such, a focus on the potential of creating (or

protecting) jobs for low-skilled workers has been included in the targeted interventions. However, in the long term, given the sensitivity of low-skilled jobs to shocks such as the COVID-19 pandemic, the focus should shift toward creating skilled jobs in sustainable sectors, particularly jobs that will prove resilient in the face of climate change impacts. As for the focus on promoting community involvement, in the wake of the COVID-19 pandemic, it stems from the need to bring people together to construct a new social narrative based on solving common challenges such as climate change.

A summary of the highlighted interventions in both categories is outlined, alongside the various analysis components, in table 0.1 and table 0.2. Besides these pathways, complementary country-specific climate policy options are included in the dedicated country chapters. It should be noted that the analysis presented in this report is a preliminary one and the corresponding identified interventions can only be used for indicative purposes. The proposed interventions are not based on a specific model but rather on a mixed-method approach that, in parts, utilizes expert elicitation and subjective assessments. Specific projects and interventions would require their own extensive economic and social assessments.

Table 0.1: Summary of Highlighted Climate Action Interventions in Mashreq
Source: Original table for this publication.

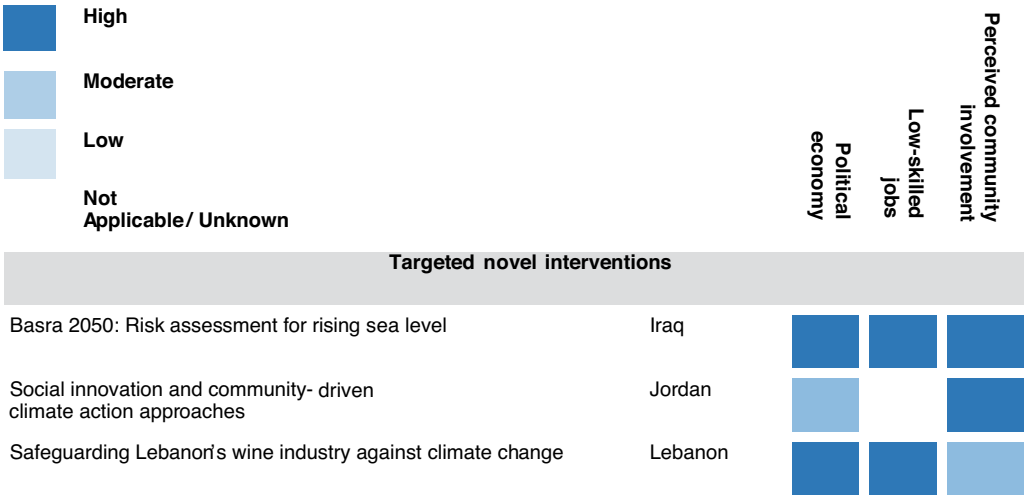


Table 0.2: Summary of Targeted Niche Climate Action Interventions in Mashreq
Source: Original table for this publication.

COUNTRY INTERVENTIONS

IRAQ

Without an adaptive response, climate change could create a destabilizing effect in Iraq. First, unfavorable climate projections (more heat and less precipitation) are an existential threat to Iraq's agriculture sector, risking food security, livelihoods and tens of thousands of jobs. Climate proofing Iraq's agriculture sector requires substantial modernization of policies and practices by both the government and the farmers. Promoting climate-resilient agriculture also requires extensive knowledge dissemination efforts to change behavior and improve land-use.

Second, projected sea level rise in Basra—Iraq's economic capital, its second largest city, and its only maritime access point—reveals that the city faces the possibility of being partially submerged by 2050. This could result in huge economic disruptions, losses, and, possibly, a wave of internal displacement, potentially fueling social and political instability in Iraq and beyond. Basra can still adapt to rising sea level but time is running out. In the short term, the urban area needs an extensive risk assessment that can inform the choice of adaptation options in consultation with local communities. Real estate and infrastructure hardening, and resilience are imperative as well as the involvement of local communities, who may have to face some of the unintended negative consequences.

In terms of mitigation efforts, even without renewable energy, Iraq can far exceed its climate commitments by fixing existing inefficiencies in the energy sector. From a technical perspective, non-flaring policy and action is Iraq's low hanging fruit among practices that could cut emissions, reduce the opportunity cost of burning oil for electricity, and improve energy security.

JORDAN

Despite notable climate action progress, the interconnectedness of economic activities and nonlinearity of climatic effects suggest that Jordan's service-based economy is not immune to climate shocks. The country's major climate-linked vulnerability is its increasing water scarcity. Technological solutions and investments on both the supply and demand sides are Jordan's best

bet to deal with its water challenges. The sustainability of the sector requires more intense demand side efforts by deploying technological solutions to lower water consumption and adapt to scarcity by ensuring no drop of water is wasted.

Jordan has been at the forefront of government-led climate interventions in Mashreq. Going forward, it can lead in social innovation and community-driven climate action. Citizen engagement around climate issues is a powerful tool to develop and test climate policies and overcome challenging political economy obstacles. Implementing effective and genuine citizen engagement in Jordan would provide a much-needed regional example to start tackling climate change as a collective issue rather than it being solely the responsibility of a central government and policy makers.

On the mitigation side, at the current growth rate, Jordan's transport sector will soon replace power generation as the kingdom's top emitter. Jordan can substantially cut its transport sector's emissions by deploying a combination of interventions. Moving toward a niche intervention to increase penetration of hybrid vehicles and investing in congestion relief projects appear to offer the most effective, job- and market-creating pathways for Jordan to lower its transport sector's emissions between 20 and 50 percent by 2030.

LEBANON

Lebanon is battered by concurrent shocks. Climate-oriented investments offer Lebanon an opportunity to respond to pressing needs in its energy sector and address its deteriorating infrastructure. Lebanon's power sector is currently dysfunctional, inefficient, and carbon intensive. It also exacerbates the current economic crisis. Replacing highly polluting heavy fuel and diesel-oil power generation with a combination of natural gas and utility-scale renewable energy assets while lowering technical grid losses could reduce the sector's emissions by more than 50 percent and achieve savings that could range between $2.5 billion and $3.6 billion per year.

In terms of adaptation, Lebanon's weak infrastructure is vulnerable to extreme weather conditions, resulting in frequent and unpredictable disruptions to basic services and economic activities. The majority of infrastructure projects proposed in Lebanon's capital investment program are vulnerable to climate change, opening opportunities for redesigning these projects to include resilience and climate-proofing considerations.

One niche intervention in Lebanon concerns the need to safeguard Lebanon's wine industry against climate change. Lebanese wine is more than just an exportable product; it is a well-recognized ambassador of the country's identity and culture and a substantial contributor to the local economy by providing thousands of low-skilled jobs. Technology ("smart agriculture") can play an important in role in protecting Lebanon's wine industry, but government-led programs are needed to maximize support and avoid information asymmetry.

REGIONAL INTERVENTIONS AND IDENTIFIED KNOWLEDGE GAPS

In terms of regional opportunities, the low level of regional integration and lack of regulatory harmonization are serious obstacles. Despite these challenges, Mashreq has great potential for cooperation on climate action. Based on Jordan 's pioneering efforts to accelerate climate action, government willingness, market readiness and accumulated technical expertise, it is uniquely positioned to emerge as a regional hub for climate services. The report explores the following levels of regional climate cooperation (ordered by increased level of complexity):

- Knowledge production and climate data sharing
- Regional cooperation on climate risk management and emergency preparedness
- Establishment of a regional market for climate-smart services
- Dedicated regional projects

Finally, the report recognizes the wide analysis and knowledge gap pertaining to the economic and social cobenefits of climate action in Mashreq. Climate policy analysis and research agenda in Mashreq should be sensitive to the region's socioeconomic profile and speak directly to governments priorities. Three analysis needs stand out in Mashreq: (1) understanding the political economy impediments to climate action and pathways to address them, (2) quantifying private sector climate risks and opportunities, and (3) assessing the prospects of a regional market for climate services.

1. INTRODUCTION

CLIMATE AND COVID-19

Climate change and pandemics are both shocks that affect fragile regions like Mashreq disproportionately, exacerbating existing economic and social challenges. The COVID-19 pandemic has brought an acute disruption to the global economy, yet its most profound effects have been felt in (and will continue to impact) weak and fragile states (UN 2020). Lack of adequate policy response to shocks—regardless of their nature—in fragile contexts poses short- and long-term challenges: the capacity to respond to immediate needs and development, respectively. In a way, the COVID-19 crisis is a wakeup call for countries around the world to reconsider priorities, including the need to prepare better for future crises, chief among being climate change. Unlike the COVID-19 spread, which brought the whole world to a sudden stop with little warning, climate change risks and vulnerabilities are well known and researched.

Despite challenges, climate-responsive economic recovery in Mashreq presents an opportunity to align economic, development, and climate agendas. There is a prevailing (and correct) narrative that Mashreq countries need to accelerate their climate action to avoid the intensifying impact of climate variability on their socioeconomic structure. However, climate action is more than just a threat-reduction measure; it can be a means for promoting economic efficiency, creating jobs, and reducing the burden of public and private spending, while achieving higher levels of resilience in key sectors such as water and agriculture (Batini et al. 2021). Also, the costs of climate inaction are too high. By 2050, the estimated impacts of climate-change-induced water scarcity amount to 6–14 percent of regional gross domestic product (GDP). Agricultural productivity will drop by up to 60 percent in some countries, having cost the region hundreds of billions of dollars in lost export revenues.[1] It has been estimated that climate change already eats away between 0.2 to 1.0 percent of the region's GDP due to heat and humidity impact on working hours. This range is projected to increase to 1–5 percent of GDP by 2030 (McKinsey 2020).[2]

This report aims to highlight sectoral and cross-sectoral (or spatial) climate action opportunities in Mashreq on the national and regional levels that are aligned with the region's needs. Although fiscal pressures and the region's deep reliance on fossil fuels remain major challenges, economic and climate goals are not mutually exclusive. Well-designed and -executed recovery plans can take advantage of climate action to respond to the region's economic needs. The alignment of these objectives is important to shift climate action from being a policy add-on to a central piece of the economic recovery in Mashreq. The COVID-19 pandemic has added a layer of complexity in terms of exerting downward pressure on the region's already strained financial resources and shifting the focus to dealing with emerging public health and economic crises. Additionally, external financing is expected to become more competitive and conditional, requiring Mashreq countries to become more self-reliant and position their funding requests more in line with global priorities. Amid such a shift in priorities, it is important not to forget targeted climate action, which can be a powerful tool to reignite Mashreq economies and fuel their journey toward a sustainable economic recovery.

The report is structured as follows. Chapter 2 outlines the adopted methodology in selecting the identified interventions. Chapter 3 summarizes Mashreq's climate realities. Chapters 4, 5, and 6 are country outlooks of Iraq, Jordan, and Lebanon, respectively. Chapter 7 discusses cross-sectoral opportunities of the identified interventions. Chapter 8 examines the regional climate action opportunities. Finally, chapter 9 highlights the research and analysis needs required to better integrate climate action with national policies.

THE CLIMATE-FRAGILITY NEXUS IN MASHREQ

In Mashreq, climate change and fragility form a vicious cycle wherein climate threats exacerbate fragility and fragility hinders climate action. Climate change has been a threat multiplier in Mashreq, intensifying environmental, social, economic, and

political drivers of discontent. The Syrian refugee crisis and waves of migration continues to be one of the challenges facing Mashreq region since 2011. While the role of climate change in contributing to the Syrian crisis remains a debatable topic (Selby et al. 2017), a 2014 World Bank study found evidence between the extreme weather induced by climate change and migration, particularly internal migration (Wodon et al., 2014). Additionally, climate change vulnerabilities are likely to deepen the region's economic and social stresses. This is projected to happen through a variety of impacts, such as internal migration, infrastructure damage, lower productivity, and increased water and food insecurity (see figure 1.1). Consequently, addressing climate change effects in Mashreq would be critical for ensuring the longer-term socio-economic stability in the region.

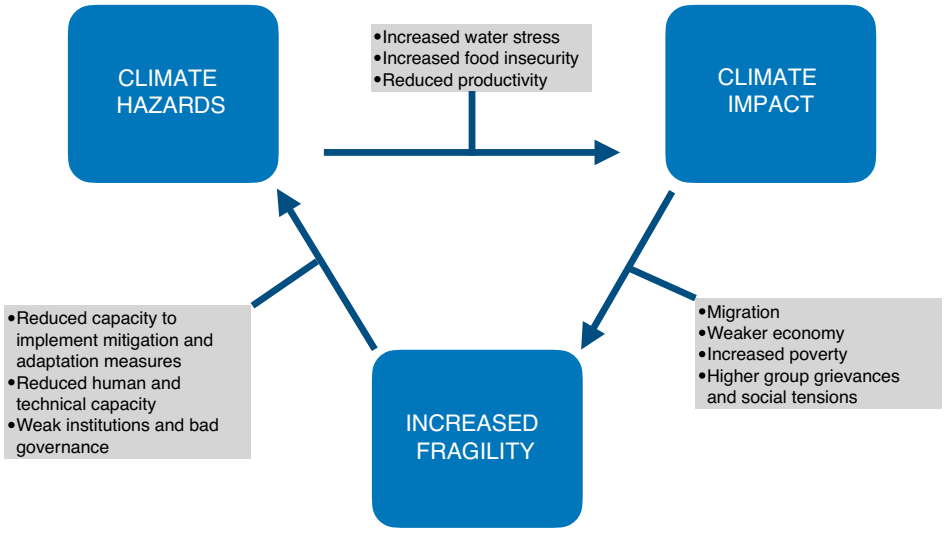
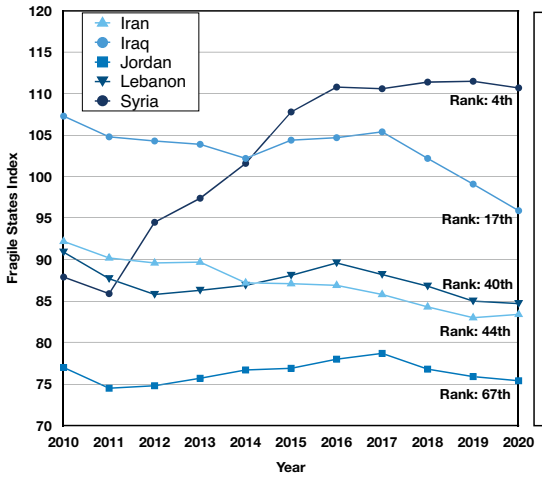


Figure 1.1: Climate-Fragility Nexus in Mashreq
Source: Original figure for this publication

MASHREQ'S FRAGILITY AND ECONOMIC PREDISPOSITIONS

Mashreq is among the most fragile regions in the world. However, the region's countries exhibit different vulnerabilities and levels of fragility. Currently, Mashreq countries span across the fragility spectrum (see figure 1.2 and map 1.1).[3] The region hosts a high-intensity conflict (Syria), a medium-intensity conflict (Iraq), a country with high levels of institutional and social fragility (Lebanon), and non–fragility, conflict, and violence (FCV) countries (Jordan). Figure 1.2 also shows the changes in the Fragile State Index (FSI) for Mashreq countries since 2010, and the FSI ranking in 2020.[4] In general, except for Syria, which currently ranks as the 4th most fragile country in the world, the FSI of Mashreq countries have been either stable or slightly improving over the past decade. However, the FSI of Iraq remains high, and the country is ranked 17th most fragile in the world.



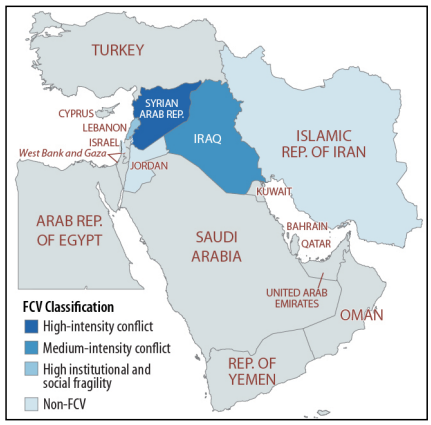


Figure 1.2: Fragility Index for Countries in Mashreq
Source: Messner et al. 2020

Map 1.1 Fragility Classification for Countries in Mashreq
Source: World Bank 2020

Fragility in Mashreq is driven by strained economies and high levels of group grievances and, refugees. Iraq, Jordan, and Lebanon experience an immense pressure due to the presence of high numbers of refugees. The situation is exacerbated in Iraq due to internally displaced persons. The FSI includes another component of fragility and discord in the form of "group grievances", which reflects the social and political division and schisms among different groups in society, and how these divisions impact groups' access to services and resources (Messner et al. 2020). Economically, Mashreq countries faced serious challenges even before considering the impact of the COVID-19 pandemic. These challenges are underscored by a substantial (and growing) public debt, slow economic growth (or even negative economic growth in Iraq), and high unemployment, particularly among youth and women.

CHAPTER ENDNOTES

[1] According to World Bank data

[2] Based on a high-emissions scenario (RCP 8.5), see McKinsey 2020, exhibit E10.

[3] The FCV classification shown in map 1.1 is based on the World Bank FY2021 classification. See World Bank (2020)

[4] The Fragile States Index (FSI) is based on a conflict assessment framework that was developed by Fund for Peace. The FSI is designed to measure state's vulnerability in pre-conflict, active conflict, and post-conflict situations. The methodology uses both qualitative and quantitative indicators, relies on public source data, and produces quantifiable results. For more information about FSI and its methodology, see Fund for Peace (2018).

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2. METHODOLOGY

The analysis presented in this paper is based on a mixed-method approach, which consists of the following components: interviews, data collection, literature review, and a selection framework developed for this report.. The contribution of each of these methodology components to the different analysis components of this report is shown in table 2.1. The analysis leveraged an extensive literature review that spanned the entire scope of the report. Country-specific data have been obtained primarily from publicly available official documents, as well as relevant World Bank reports. Data collection has been implemented to understand the projected climate variability in Mashreq (utilizing the World Bank's Climate Change Knowledge Portal)[1] and to develop, in consultation with regional experts, a selection framework, which requires data on costs, employment, and so forth. The authors have also conducted a number of key informant interviews with experts in the World Bank, development partners (such as United Nations Economic and Social Commission for West Asia, Islamic Development Bank, and the Global Center for Adaptation), as well as government officials representing the focus countries (Iraq, Jordan, and Lebanon). The methodology steps that were followed are shown in figure 2.1.

Analysis component	Literature review	Data collection	Interviews	Selection framework
Understanding climate realities in Mashreq	✓	✓	✓	
Country-specific interventions	✓	✓	✓	✓
Regional priorities	✓		✓	
Assessment of research and analysis needs	✓		✓	

Table 2.1: Methodology Tools Implemented to Generate Evidence for This Study
Source: Original table for this publication.

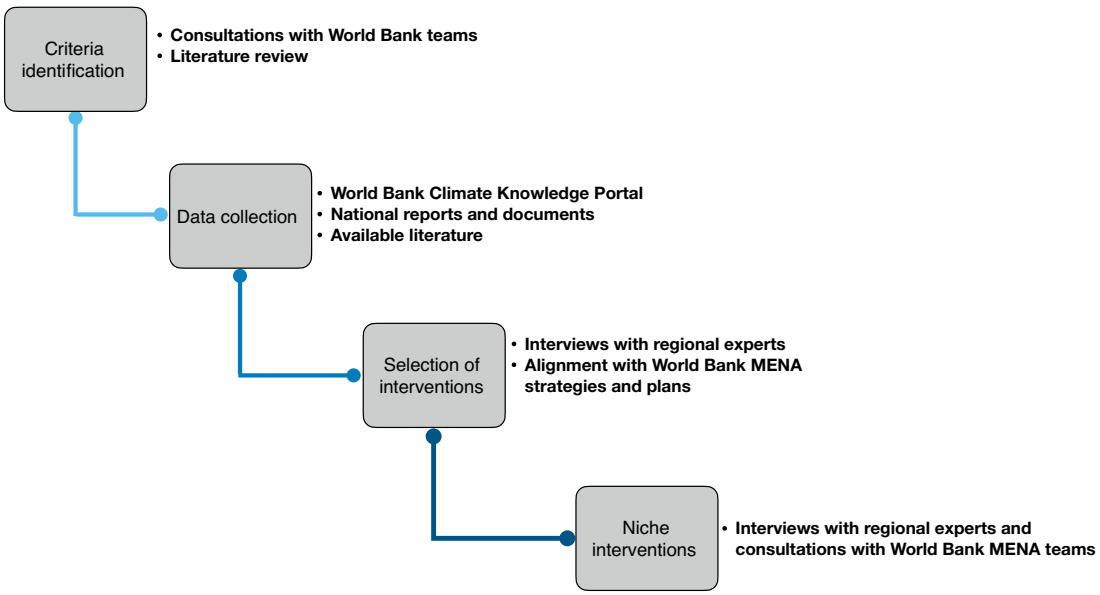

Figure 2.1: Methodology Steps
Source: Original figure for this publication.
Note: MENA = Middle East and North Africa

The categorization of climate action interventions that are highlighted in this report is split into two categories: sectoral and niche. The first is largely based on a sectoral lens of climate action, and the second combines sectoral and spatial aspects. To assess the relevance of the interventions in both categories, the analysis has relied on a selection framework, which has been tailored to Mashreq-specific and post-COVID-19 considerations (see table 2.2 and table 2.3).

Component	Scoring value/option	Source(s)
Policy objective	Yes: High	
Alignment with identified country priorities	No: Low Unknown	World Bank Middle East and North Africa Climate Action Plan 2021-25, verified with interviewed official representatives of Mashreq countries
Economic impact		
Responding to existing economic inefficiencies	Yes: High No: Low	Interviews andanalysisfor this study
Jobs creation (or protection) potential per unit spending	Low Moderate High For jobs protection (such as in climate-smart agriculture): Numeric, normalized by existing percentage share of employment in concerned sector Less than 1 percent: Low 1 to 10 percent: Moderate Greater than 10 percent: High	Based on the available development literature: For example, for-energy projects, Garrett Peltier (2017); for other infrastructure projects, Estache et al. (2013) World Bank database on employment by sector [2]
Feasibility/viability		
Cost effectiveness: $ per ton of carbon dioxide equivalent (only for mitigation projects)	Low Moderate High	Available literature and, where available, nationally defined contribution documents
Perceived political economy impediments		Interviews
Technical complexity	Is there an existing capacity? Yes: High No: Low	Interviews andcountry analysis for this study
Institutional complexity	Is there an existing appropriate regulatory/institutional framework? Yes: High No: Low	Interviews and country analysis for this study

Table 2.2: Proposed Selection Framework of Climate Action in Mashreq
Source: Original table for this publication.

Component	Scoring value/option	Source(s)
Adaptation focus Responding to climate adaptation needs	Yes: High No: Low Unknown	Interviews and analysis for this study
Low-skilled jobs Job creation (or protection) for low-skilled workers	Yes: High No: Low Unknown	Analysis based on country data and available literature
Perceived community involvement Ability to leverage community dynamics, approaches and ideas	Yes, very much: High Yes: Moderate No: Low Unknown	Analysis based on reviewed development literature

Table 2.3: Proposed Selection Framework of Targeted Novel Climate Action in Mashreq
Source: Original table for this publication

For the sectoral interventions, the selection framework consists of three major components. The *policy objective* component aims to test for the (general) alignment of the proposed intervention with known country priorities identified by their national documents. Also, some of the proposed interventions (such as those related to renewable energy, establishment of a regional electricity market, and electrification of transport) have are highlighted for their potential to accelerate sustainable economic recovery in World Bank's ongoing programs . The economic impact component (table 2.2) aims to highlight the effectiveness of the examined interventions in contributing to economic recovery, specifically, their job creation potential and ability to address existing economic inefficiencies. The feasibility/viability component covers four subcomponents: cost effectiveness, perceived political economy challenges, and technical and institutional complexities that may hinder or delay implementation.

As for the targeted novel interventions, the selection framework is less quantitative and more geared toward social and community aspects. As shown in Table 5 below, three major decision components have been selected. The first component is adaptation focus, which reflects the relevance of the proposed intervention to adaptation efforts. Investments in adaptation projects in Mashreq are well below the needed level (Saghir et al. 2020). Additionally, adaptation projects generally have a greater social impact, given their role in preventing further economic and social fragility. The second component is low-skilled jobs, which is differentiated from the generic job creation component in the first category. Globally, the COVID-19 pandemic has uncovered existing fragilities and inequalities in labor markets; it has affected low-paid and low-skilled workers the most (ILO 2020). Therefore, a focus on the potential of creating jobs for low-skilled workers has been included in the targeted interventions. The third component is Perceived Community Involvement, which aims to measure the potential of the proposed targeted interventions to leverage community dynamics, ideas, and approaches to climate action.

The adopted decision analysis has several important limitations and caveats. First, this type of analysis can be used only for indicative purposes, because the proposed interventions are based, not on a specific model, but rather on a methodological approach that, in parts, utilizes expert elicitation and subjective assessments. Specific projects and interventions would require their own economic and social assessments. Second, the choice of components and subcomponents is generic. A longer country- and project-specific list of economic multipliers would be needed to fully understand the impact of a specific intervention. Third, the measurement of each subcomponent could be improved further by accessing more recent and country-specific data. Currently, some of the data used (such as jobs created) are based on regional and global averages at the sectoral level.

CHAPTER ENDNOTES

[1] The World Bank Climate Change Knowledge Portal, an extensive database, can be accessed at https://climateknowledgeportal.worldbank.org.

[2] See https://data.worldbank.org/

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3. CLIMATE CHANGE REALITIES IN MASHREQ

EMISSIONS PROFILE AND TRENDS

In Mashreq, most of the greenhouse gas (GHG) emissions can be attributed to fossil-fuel-based energy consumption. The combined emissions from primary (transport) and secondary (electricity) energy consumption contribute more than 50 percent of the total emissions in Jordan, Lebanon and Iraq (figure 3.1). Mashreq countries show a near-complete reliance on oil and gas to meet their energy demands. Across the three countries shown in figure 3.1, the share of oil and gas in the total energy supply is higher than 90 percent, with Jordan having the lowest share at 92 percent. Iraq is Mashreq's second-highest energy consumer after Iran, with around 18 percent of the regional total, while Jordan and Lebanon combined require less than 5 percent of the region's total energy supply, combined.

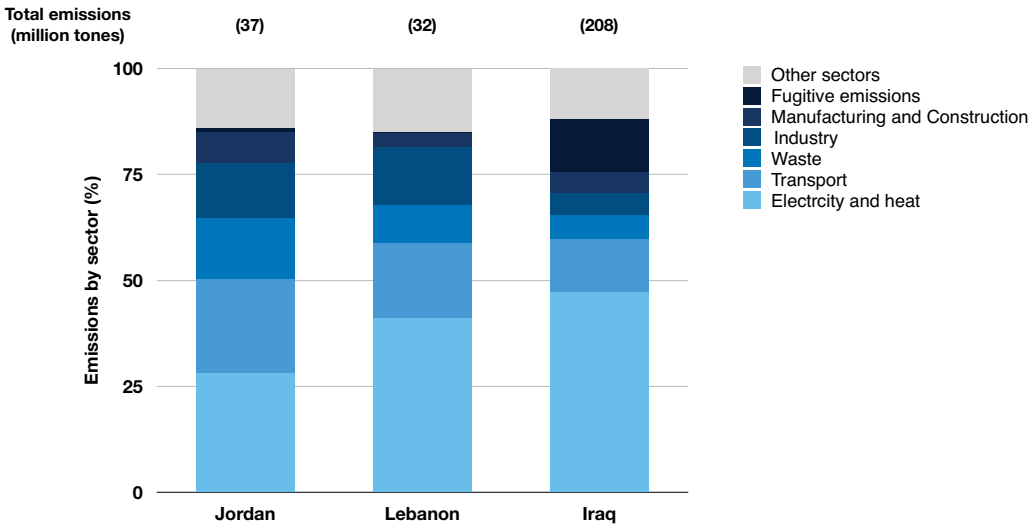

Figure 3.1: Total Emissions by Sector (2016)
Source: World Bank data.

Energy demand in the Mashreq countries is dominated by non-industrial end-use consumption. In the electricity sector, the residential and commercial sector forms more than 60 percent of the final electricity demand in Iraq, Jordan, and Lebanon (IEA 2020). Mashreq countries are characterized by a widening investment gap in sustainable public transport. As a result, and in the absence of safe and reliable public transportation means, transport sector emissions are dominated by passenger cars. As shown in figure 3.1, the transport sector's contribution to the total GHG emissions in Jordan, Lebanon and Iraq is 22, 18, and 13 percent, respectively, most of which is from privately owned passenger vehicles.

In Mashreq's oil-producing countries (particularly in Iraq), fugitive emissions that are mainly due to gas flaring are substantial. Fugitive emissions are generally connected to GHG emissions from the activities of the oil and gas industry. As shown in figure 3.1, the share of fugitive emissions to the total GHG emissions in Iraq is around 13 percent. These emissions are due to either direct release (or leakage) of methane or through the release of carbon dioxide (CO2) as a result of upstream gas flaring. Based on 2018 data, CO2 emissions due to flaring in Iraq amounted to 28.1 million tons of CO2 (Ritchie and Roser 2017)[1]. For Iraq in particular, flaring of associated gas (natural gas that is produced as a byproduct of oil extraction) presents a major economic and

environmental challenge; see the section "Non-flaring of Natural Gas" in chapter 4 and box 4.3, "What Is Natural Gas Flaring" for more details on the impact of gas flaring in Iraq.

Jordan is the only country in Mashreq that has established a trend of reducing emissions while increasing electricity supply. The growth rates of electricity generation and its associated CO2 emissions are shown in figure 3.2. Since 2000, Jordan has continued to reduce its power sector emissions by expanding its use of natural gas fuel instead of oil and leveraging the kingdom's renewable energy potential in recent years. The growth rate of Iraq's emissions, in contrast, has exceeded that of its electricity output. This "negative divergence" could be explained by the increased reliance on diesel generators in Iraq, because diesel generators have a higher emission factor compared to utility-scale thermal power generation. According to a recent International Finance Corporation report, Iraq ranks fifth in the world in the number of generators per capita (IFC 2019). Beside its evident environmental impact, the proliferation of diesel generators in Iraq (and in Lebanon) has a financial impact, because it involves government fuel subsidies. Unlike in Iraq, the negative divergence between electricity output and CO2 emissions in Lebanon is not observed. This can be explained by the fact that Lebanon's reliance on private diesel generators has proportionally increased with electricity demand since the early 1990s; additionally, data and methodological uncertainties might have led to underestimating Lebanon's power sector emissions.

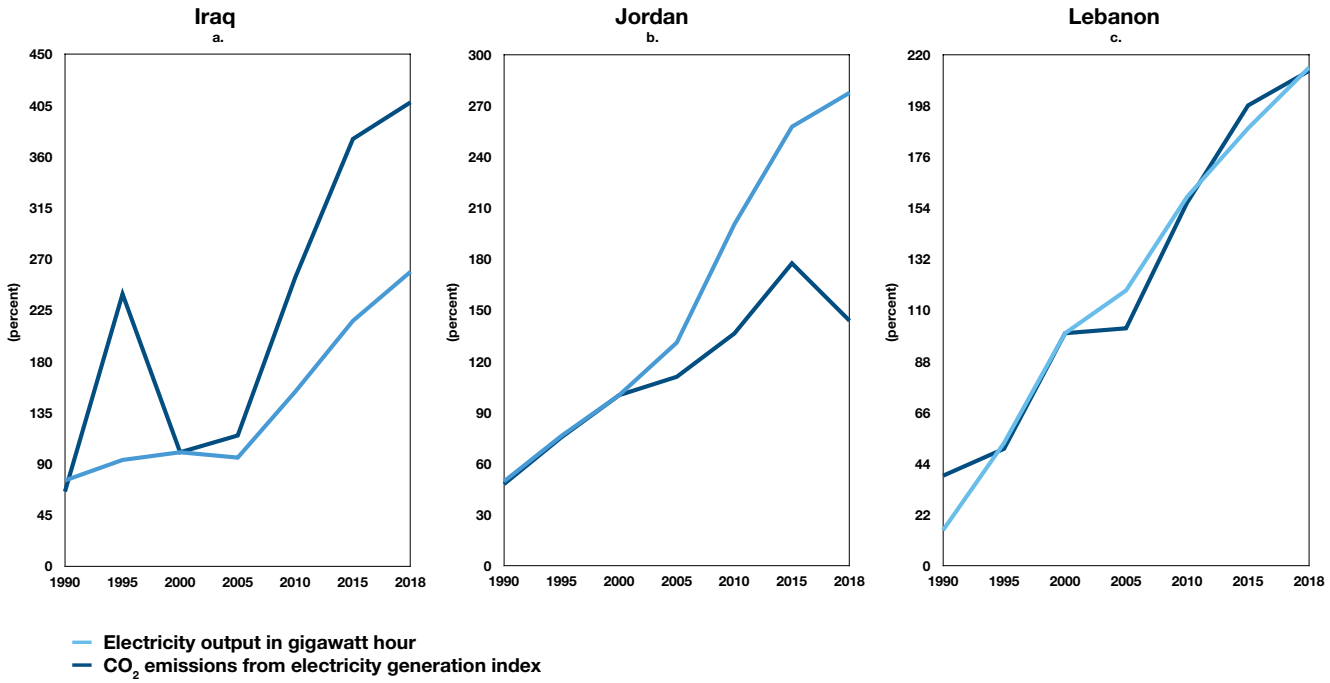

Figure 3.2: Growth of Electricity Output and CO2 Emissions in Mashreq Countries
Source: IEA, 2020.

MAPPING MASHREQ'S VULNERABILITIES TO CLIMATE CHANGE

Countries in Mashreq are aware of their vulnerabilities to climate change hazards. The national communications and submissions to the United Nations Framework Convention on Climate Change (UNFCCC) as well as a growing body of academic literature are full of information and rich analyses about the existing and projected impact of climate change in Mashreq. Figure 3.3 maps the major climate change effects and their corresponding physical and socioeconomic impacts as identified in the nationally submitted documents to the UNFCCC. The region faces three major climate change hazards: heatwaves, droughts, and severe storms. The frequency and severity of these hazards are expected to increase in the future, especially under high emissions scenarios (Tippett 2018).

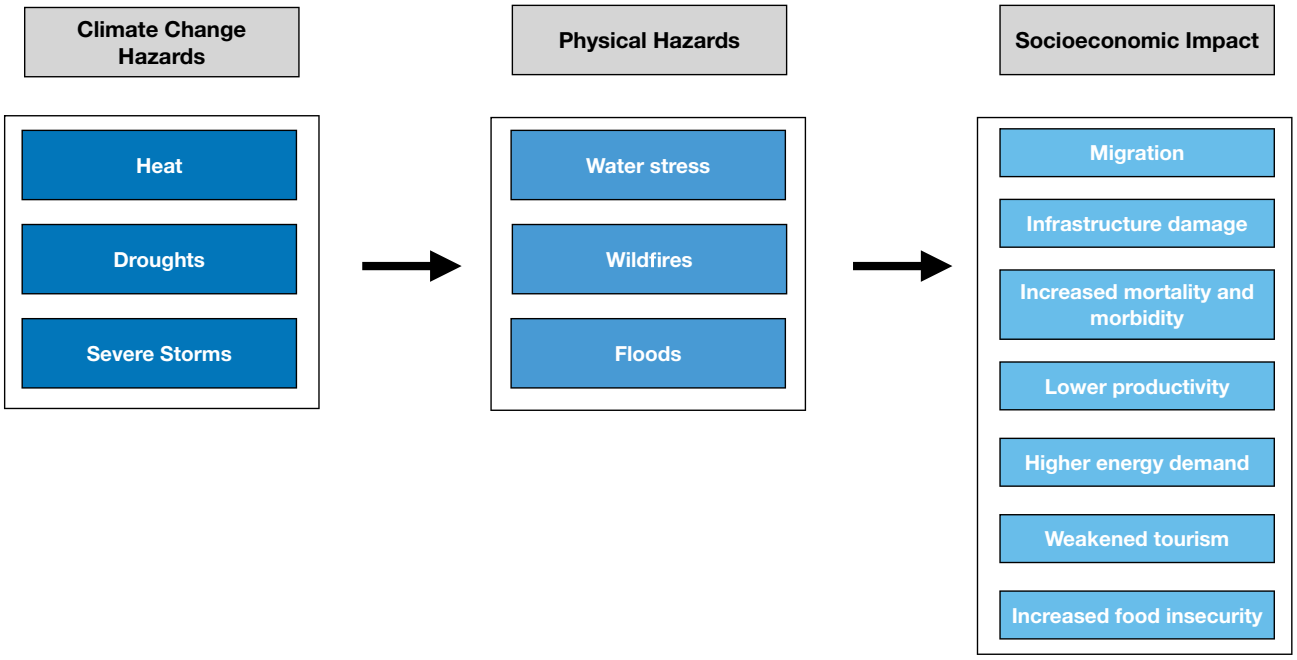

Figure 3.3: Mapping of Major Climate Change Hazards and Their Physical Hazards and Socioeconomic Impact in Mashreq
Source: Based on nationally submitted documents to the United Nations Framework Convention on Climate Change.

Climate change triggers a number of vulnerabilities in Mashreq, chief among which is water stress. The concern among countries is understandable, given that Mashreq countries are among the most water-stressed countries in the world. According to the World Resource Institute, Lebanon and Jordan are among the "extremely high baseline water stress" countries, while Iraq is among the "high baseline water stress" (Hofste et al. 2019). Besides increasing water stress and its implications, such as lower electricity generation from hydropower plants, national authorities have identified other physical hazards linked to increased frequency and severity of wildfires, floods, and storms (or dust storms, in the case of Iraq). According to a report by McKinsey, Jordan will suffer the most in the region in terms of experiencing hotter and more humid climate (McKinsey 2020).

Climate change vulnerabilities are expected to induce a plethora of socioeconomic impacts that can challenge peace, stability, and economic prosperity in Mashreq. The context dependency of climate change impact on economic productivity and the nonlinear response to climate change have already been demonstrated in the academic literature (Burke, Hsiang, and Miguel 2015). In Mashreq, nonlinear climate socioeconomic impacts can result from having unevenly distributed starting conditions (such as type of labor and where it is conducted) as well as varied investment levels and the extent and efficacy of adaptation and resilience measures.

THE CLIMATE ACTION LANDSCAPE IN MASHREQ

Despite awareness of climate vulnerabilities and their impact, economic fragility and limited political willingness are hindering climate action. As highlighted in the previous section, "Mapping Mashreq's Vulnerabilities to Climate Change," Mashreq countries faces grand challenges, be it in dealing with postconflict realities (Iraq and Lebanon) or struggling under strained economic conditions (Jordan and Lebanon). By and large, the presence of these "immediate" challenges and realities continue to absorb much of the finite attention and resources of governments in Mashreq.

Climate commitments in Mashreq countries are dominated by mitigation projects and largely dependent on the scarce and increasingly conditional international support and financing. According to a recent report by the Global Center for Adaptation, the Middle East and North Africa (MENA) region, including Mashreq, received just 6 percent of funds for climate adaptation in 2018-19 (Saghir et al. 2020). Lebanon, continues to struggle with political uncertainty, which presents a major obstacle in obtaining financial support. Jordan and Iraq face challenges in mobilizing financial resources due to domestic economic pressures and a challenging geo-political context. Figure 3.4 shows Mashreq countries' commitments to reducing emissions, compared to a 2030 business-as-usual scenario. Jordan and Iraq have a modest unconditional target. Lebanon's 20 percent target is debatable given the economic chaos facing the country and the inability to undertake reforms necessary to mobilize financial support from the international community. Adding to the challenges, the COVID-19 pandemic and need for critical healthcare and social development financing is expected to strain the resources of donor countries and multilateral institutions, at least until a post-pandemic economic recovery is achieved.

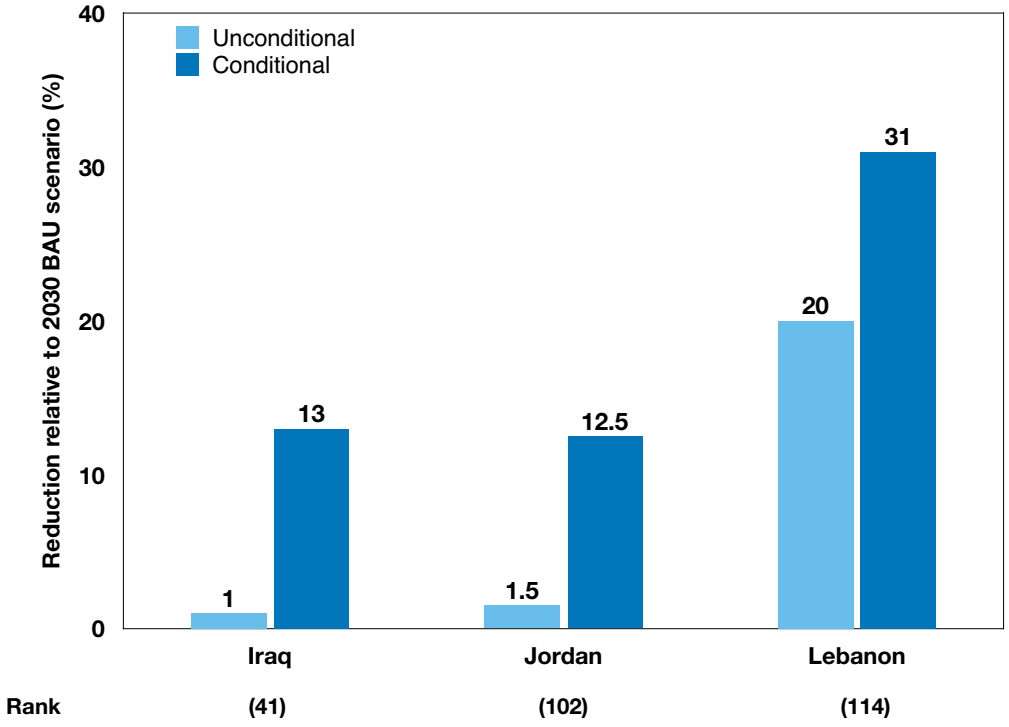

Figure 3.4: 2030 Emissions Commitments in Mashreq Countries
Source: Original figure for this publication.

Mitigation efforts in Mashreq are dominated by energy sector interventions with limited progress achieved so far. Reducing GHG emissions by targeting the energy sector (electricity, heat, transport, and gas flaring) is a natural entry point for countries in Mashreq, given their potential for reducing emissions compared to the current energy consumption and efficiency baseline. As outlined in table 3.1, on the energy supply side, shifting to natural gas power generation and introducing renewable sources into the energy mix are identified as the core mitigation measures by the governments of Iraq, Jordan, and Lebanon. On the demand side, improving energy efficiency has also received increased attention. In the context of Iraq, targeting energy efficiency carries additional importance as the country embarks on extensive rebuilding of infrastructure and institutions; this would allow for modern and efficient energy systems and policies to be adopted early in the reconstruction phase.

Country	Conditions and financing	Existing and proposed mitigation instruments	Progress summary
Iraq	Technical and financial support	• Renewable energy • Waste-to-energy initiatives and waste management • Increased energy efficiency • Sustainable (smart) agriculture • Public transport and importation standards	Little progress made on all fronts
Jordan	Financial aid and means of implementation	• Combined cycle power plants, renewable energies, and nuclear power • Increased energy efficiency • Deployment of hybrid and/or electric cars and public transport • Waste management • Industrial interventions • Sustainable agriculture and reforestation	Notable progress on the energy mix, energy efficiency , and electrification of transport levels
Lebanon	Technical and financial support	• Combined cycle power plants and renewable energies • Increased energy efficiency • Sustainable (smart) agriculture	Little progress made on all fronts, except some notable improvement on energy efficiency

Table 3.1: Overview of Existing and Proposed Climate Change Mitigation Instruments in Mashreq and Their Progress and Conditions as Reported in NDC Documents
Source: Original table for this publication.
Note: NDC = nationally determined contribution.

Adaptation measures in all Mashreq countries focus on the water and agricultural sectors; attention to building resilient infrastructure and social interventions are lacking. When it comes to building a climate change adaptive capacity, the water and agriculture sector deserve special attention in Mashreq, given the region's known water and food insecurities. However, other emerging vulnerabilities such as deterioration of infrastructure, provision of basic services, and social cohesion do not seem to be getting enough attention. A review of the national documents submitted by the Mashreq countries to the UNFCCC, it is evident that most of the analytical work on the adaptation side is focused on the water and agricultural sectors. This focus is highlighted in table 3.2, which summarizes the level of attention each sector received based on the information presented in the national documents as well as interviews with climate experts from the region.

	Iraq	Jordan	Lebanon
Water management and interventions	Moderate	High	Moderate
Sustainable/smart agriculture	Moderate	High	Low
Resilient infrastructure	Low	Low	Low
Restoration of degraded forests	Moderate	Low	Low

Table 3.2: Matrix of Identified Adaptation Measures in Mashreq
Source: Original table for this publication.
Note: Scoring is based on review of national documents and interviews of key informants.

MAJOR CLIMATE CHANGE POLICIES, LAWS, AND CONSTRAINTS

The current level of climate change policy and legislative action indicates that the climate change agenda is not yet a priority in Mashreq. Despite the existence of recently formulated environmental strategies and plans in Iraq, Jordan, and Lebanon, there have been varying degrees of progress and commitment. Compared to Iraq and Lebanon, which suffer from serious political and political economy constrains, Jordan has shown some notable progress with the depth and breadth of its climate action, dedicating a number of general and sector-specific climate strategies (see table 3.3) and approving the Climate Change By-Law of 2019. As discussed earlier, Jordan's main areas of progress have been in the shift to renewable energy and efforts to decarbonize transport. Also, Jordan is the only country in the region that has started working on a long-term climate change strategy by preparing the Roadmap for 2050 Long-Term Low-Carbon and Climate Resilient Strategy. In 2019, Amman, Jordan's capital city, also issued its vision towards achieving net-zero emissions by 2050 (Amman Climate Action Plan). Having such plans plays an important role in galvanizing all stakeholders to work toward a common goal and for laying the policy and political foundations for the long-term transformation.

	Policies	**Legislations**	**Policy constraints and limitations**
Iraq	National Environmental Strategy and Action Plan for Iraq (2013–17)	Act for the Protection and Improvement of the Environment (2009)	Depleted human and institutional capacity Political economy challenges relating to the role and governance of the oil and gas sector as well as energy subsidies Climate change agenda not seen as a priority
Jordan	National Climate Change Policy and Sector Strategic Guidance Framework, 2013–20 (extended to 2030) A National Green Growth Plan for Jordan (2017) Climate Change Adaptation and Low Emission Development Strategy (2013) National Action Program to Combat Desertification Climate Change Policy for a Resilient Water Sector	Renewable Energy and Energy Efficiency Law (2010 and 2012) Environmental Protection Law (2017) Climate Change By-Law (2019)	High dependency on external financing
Lebanon	National Renewable Energy Action Plan (2016–20) National Energy Efficiency Action Plan (2016- 20) National Forest Plan 2015- 25	Protection of the Environmental Law 444 (2002) Protection of Air Quality Law 78 (2018)	Frequent and extended periods of political paralysis Climate change agenda is not seen as a priority Political economy challenges relating to enacting power sector reforms

Table 3.3: Major Climate Change Policies, Legislation, and Policy Constraints in Iraq, Jordan, and Lebanon
Source: Original table for this publication.

Integrating climate policies into development plans remains a challenge as each country faces complex constraints in their political economy dynamics. Lebanon's primary challenge is political uncertainty and Iraq faces additional challenges due to depleted institutional capacity. . While Jordan demonstrates strong commitment towards climate action, the prevailing economic conditions result in any progress remaining conditional upon international financing support. This broader context poses a challenge to sustained long-term climate action.

On the legislative side, Mashreq countries need to enacting and strengthen implementation of laws that would help curb emissions, promote climate action, and implement reforms. Jordan has recently begun implementation of the Climate Change By-Law of 2019. However, the environmental protections laws of Iraq and Lebanon primarily emphasize protecting natural resources and combating pollution, with no specific mention of climate change and its vulnerabilities.[2] Given the urgent need to tackle climate change on both the mitigation and adaptation sides, climate legal frameworks need to be expanded in a timely manner to signal serious commitment toward addressing the macrofiscal and socioeconomic impact of climate change. Dedicated climate laws can go beyond promoting low-carbon energy transition to cover climate resilience, risk reduction, and land use (Nachmany et al. 2017).

Mashreq countries can accelerate climate action by aligning their financial management system with climate action. The domestic budgets in Iraq, Jordan, and Lebanon outweigh the available international support. As such, Mashreq countries could internalize and prioritize their financial management system to strengthen alignment between their national development priorities and climate goals. Jordan has recently started efforts to incorporate climate change assessment in its public investment management framework. Similar efforts to include climate considerations in fiscal risk statements, budget guidelines, and/or evaluations of spending could help improve quality of public spending in all Mashreq countries. Such levels of "climate-fiscal proofing" can be further supported by adapting existing and new public asset management system or creating one to address climate goals and reduce climate risk to public financing.

Reexamining subsidies and redirecting saved resources toward desired climate and social outcomes can also accelerate climate action. Pricing reforms (or signals) remain an underutilized policy instrument to induce climate-positive behavioral change, due to political economy challenges. Subsidies, particularly those linked to energy, are prevalent. Globally, removing or lowering subsidies , especially in energy and water sectors, is an unpopular measure, and Mashreq countries are no exception. As shown in figure 3.5, Mashreq countries provides deep electricity subsidies reflected by the vast difference between the cost recovery and average end-user tariffs, especially in Lebanon and Iraq. From an economic perspective, lack of pricing signals distorts consumption levels and hinders climate action, especially because energy consumption is by the far the largest contributor to emissions in Mashreq and globally.

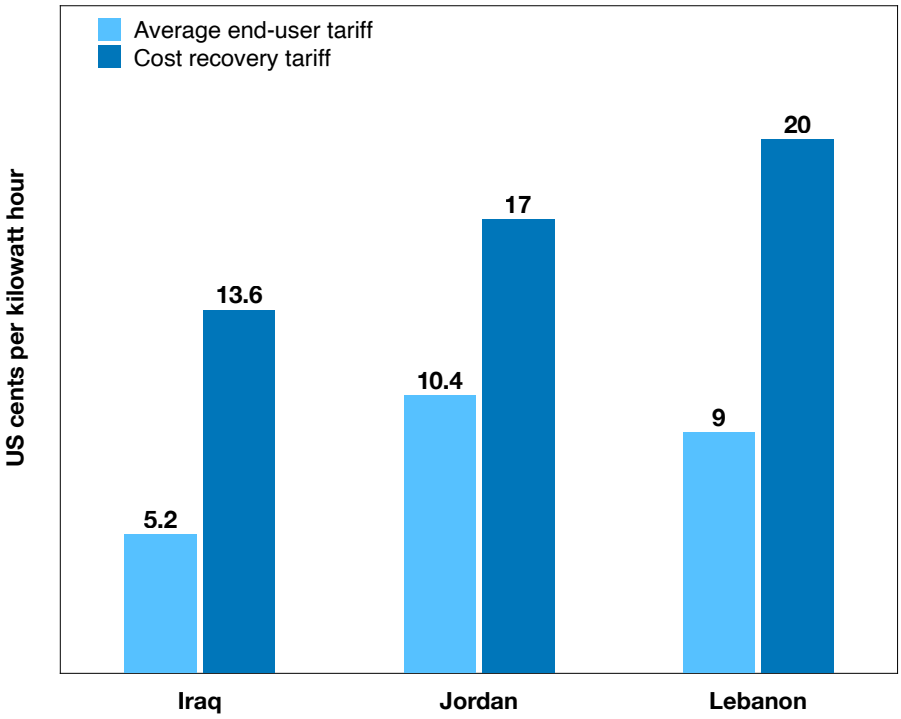

Figure 3.5: Comparison of Average End-User and Cost-Recovery Tariffs
Source: Iraq: 2018 data, intra-agency fuel subsidies inclusive. Source: World Bank Project Appraisal Document "Iraq's Electricity Services Reconstruction and Enhancement Project, April 19, 2019"
Jordan: 2020 data. Source: Jordan's Energy and Minerals Regulatory Commission
Lebanon: 2015 data. Source: Camos et al, 2017

Promoting inclusive citizen engagement and considering intra-generational equity are key to building public support and consensus for pricing reforms. The baseline for the citizen engagement process is awareness. Engaging the public is important to build awareness about how subsidies and pricing harm the financial health of the economy and society at large. The awareness needs to be coupled with a transparent mechanism to demonstrate the financial savings from these measures, how these savings are used efficiently to protect the most vulnerable groups, and to support reforms that will ultimately lead to a win-win scenario where citizens have access to better services without impacting the government's financial health. It is evident from the results of past pricing-reform efforts in the wider MENA region that, where countries have engaged in meaningful citizen engagement efforts, they have been instrumental in the success of reform attempts. The cases of Morocco or Egypt are notable examples (Usman 2019).

CHAPTER ENDNOTES

[1] Iraq flares natural gas more than any other country in the world except for Russia (Saadi and Carpenter 2020).

[2] For more details on the status of legislative side of climate change policies in Mashreq countries, see "Climate Change Laws of the World, database, Grantham Research Institute on Climate Changes and the Environment, London School of Economics, https://climate-laws.org.

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4. IRAQ

Macro-fiscal Overview

Iraq is one of the most oil-dependent countries in the world. According to the World Bank's Iraq Economic Monitor (2020), oil revenues accounted for more than 96 percent of exports, 92 percent of government budget, and 43 percent of gross domestic product (GDP) in 2019. Such high exposure to oil price volatility meant that Iraq's fiscal position was doubly impacted by the COVID -19 pandemic, which put downward pressure on oil prices due to lowered global demand. In the first half of 2020, Iraq's GDP shrank (year over year) by 6.8 percent, in line with a notable decline in oil production. Consequently, and due to the government's narrowing fiscal space, poverty in Iraq is estimated to increase in the short term by 7 to 14 percentage points.

INTRODUCTION

Climate change vulnerabilities threaten Iraq's high growth potential by straining already scarce natural resources, lowering productivity, and promoting social and economic fragility. Realizing Iraq's growth potential depends on lowering the fragility-linked political economy impediments and current oil dependency through economic diversification (World Bank 2020). These twin pathways to sustainable growth have a close climate change linkage. As a major oil producer and a country that relies heavily on oil revenues[1], Iraq's economy will be negatively impacted by the expected slowdown in global oil demand due to the wider adoption of climate policies and a transition to renewable energy sources, unless a degree of economic diversification is achieved. But an equally pressing risk is the one Iraq will face internally as its exposure and vulnerability to climate shocks grow. As shown in figure 4.1, by 2040-59, Iraq's average annual temperature will increase by 2.5 °C, its rainfall will decrease by 9 percent, and the number of days per year with temperatures higher than 35°C (known as heat index 35) will increase by about 24. Additionally, revised estimates of increased sea-level rise under a worst-case climate change scenario show that Basra, Iraq's second largest city, faces the possibility of being partially submerged, which could induce a wave of internal displacement (Kulp and Strauss 2019).

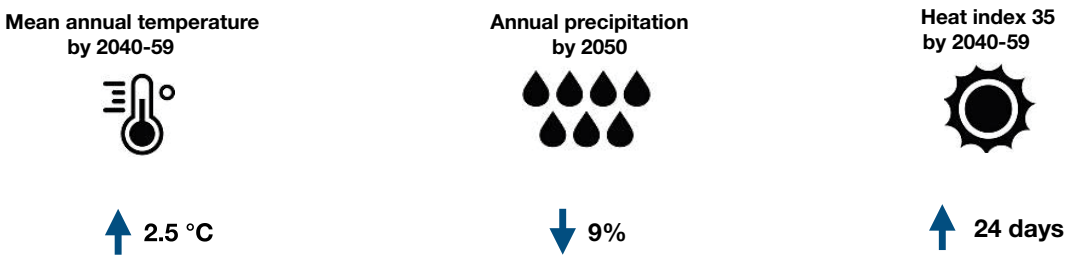
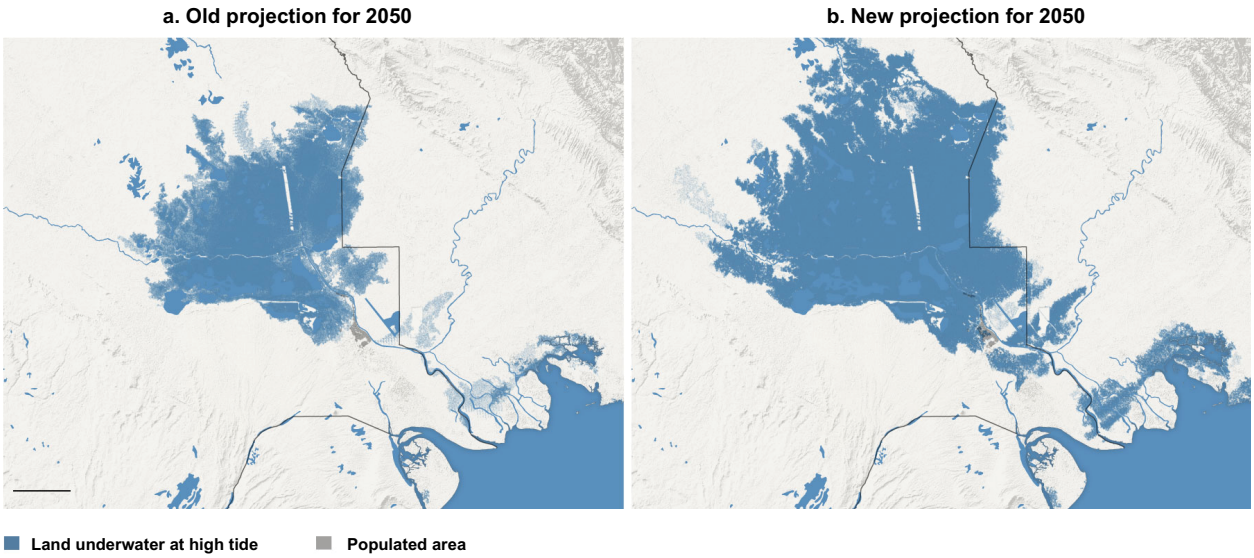


Figure 4.1: Selected Climate Indicators for Iraq under High Emissions and Low Mitigation Scenario, RCP 8.5
Source: World Bank, Climate Change Knowledge Portal database.
Note: RCP = representative concentration pathway, a series of scenarios developed for the Intergovernmental Panel on Climate Change.

BASRA 2050: RISK ASSESSMENT FOR RISING SEA LEVEL

Projected sea level rise in Basra, Iraq's economic capital and its second largest city, reveals that the city faces the possibility of being partially submerged by 2050. Recently, revised estimates of sea level rise under worst-case climate change scenarios have reassessed the vulnerability of major coastal cities to rising sea level, showing that previous assessments have underestimated the flooding and drowning risks (see map 4.1). Basra, Iraq's only maritime access point, is included in the revised risk category and is now being recognized as one of the major cities at risk due to its low-lying plains (Lu and Flavelle 2019). Basra's plain is reportedly only 50 centimeters above sea level, making the city particularly vulnerable to a rising water level (PSI 2020).



Map 4.1: Iraq's Basra Projections of Submerged Land by 2050
Source: Lu and Flavelle 2019.

This risk to Basra could lead to major economic losses and a wave of internal displacement, potentially fueling social and political instability in Iraq and beyond. Inundation of urban areas of Basra could have devastating human and economic costs with loss of real estate, infrastructure, and disruption of basic services such as water, electricity, and transportation. Table 4.1 lists the most vulnerable areas of Basra that are at risk of flooding at different sea level rises

Sea level rise	Areas at risk of submersion
30 centimeters	Lands adjacent to Shatt al-Arab (Siba) as well as the lowlands in the Iraqi coast in Khor Abdullah and lands adjacent to Basra Marshes
50 centimeters	The areas in row one plus the extreme coastal area of Ras El-Bisha, some of the lands adjacent to Shatt
	al-Arab near Siba, the marshes' edges, and the villages near Garmat Ali River
100 centimeters	The areasin rows one and two plus most of the eastern part of the Iraqi coast surrounding Ras Al -Bisha, most of Bubiyan Island facing the Iraqi coast, and the river banks of the middle and southern parts of Shatt al-Arab watercourse; also affecting the lands surrounding Hammar Marshes to the east

Table 4.1: Areas at High Risk from Rising Sea Level
Source: PSI 2020.n.

Basra can still adapt to rising sea level but time is running out. In the short term, the city needs an extensive risk assessment that can inform the choice of adaptation options in consultation with local communities. Although real estate and infrastructure hardening and resilience is imperative for Basra, there are a number of other mitigation measures that can be examined in parallel (see box 4.1). The involvement of local communities in such efforts is essential, because some of these options may have unintended negative impacts on local communities and result in maladaptation. For example, although building seawalls appears like a rational concept to protect coastal cities, its overall effectiveness has been mixed (Barnard 2020; Piggott-McKellar et al. 2020).

Box 4.1: Basra's Adaptation Options for Rising Sea Level

Basra is not the world's only city at risk of rising sea level. By 2050, more than 570 low-lying coastal cities where more than 800 million people live will face the prospect of rising waters (C40 Group n.d.) Some cities are already contemplating their options to solve this problem. Following are some of the measures cities across the globe are considering, which may be relevant to the case of Basra.

- Identify "no build" zones based on a revised study of the areas mentioned in table 4.1
- Initiate a voluntary relocation program.
- Study the concept of building dike chains (or a seawall), particularly facing the most vulnerable parts of the city.
- Upgrade and expanding the drainage system.
- Upgrade the water network and reservoirs.

CLIMATE-PROOFING OF IRAQ'S AGRICULTURE AND AGRIFOOD SECTORS

Agriculture is critical for Iraq's growth, economic diversification, and social resilience. With a 5 percent contribution to GDP, agriculture is one of the largest contributors to Iraq's nonoil economy. The agricultural sector is also the largest source of employment in Iraq, employing around 20 percent of workers in the country (World Bank 2019). A recent World Bank report highlighted the potential of Iraq's agricultural sector to become a pillar in the country's move beyond an oil economy through private-sector-led diversification and modernization (through the expansion to agrifood), creating jobs in the process (World Bank 2020). The report also makes a case for the importance of the agriculture sector in terms of maintaining stability postconflict, as it is concentrated in Iraq's rural regions where it can (re)absorb displaced civilians back into productive employment, improve food security, generate income, and thus lower group grievances. This view has also been reflected in the available literature (Birner, Cohen, and Ilukor 2011; FAO 2016).

However, without an adaptive response, climate change could destabilize Iraq's agriculture sector and, consequently, increase fragility and threaten food security. Agriculture is one of the most sensitive sectors to climate change, but the effects are uncertain and could be highly variable depending on crop type, soil type, location, and amount of rain fall (Kukal and Irmak 2018). Crop production is the main source of income of 75 percent of Iraqi farmers and is concentrated around a small number of crops (FAO 2012). Iraq's major crops are rainfed wheat and barley in the north and central areas. International cross-country studies have demonstrated that wheat and barley are both very susceptible to an increase in average temperature and decrease in rainfall. A multimethod study found that each one degree Celsius increase in the global mean temperature would reduce global wheat yields by 6 percent, on average (Zhao et al. 2017). For Iraq, the yield losses could be higher, given its higher vulnerability to such weather conditions as droughts, heatwaves, and lower levels of precipitation, which are major factors in determining crop yields[2]. As for barley, a study on the impact of climate change on barley yield in the Mediterranean Basin estimated that for dry scenarios, applicable to Iraq's climate future, the yield losses could be as high as 27 percent (Cammarano et al. 2019). Consequently, without an adaptive response, Iraq's agriculture sector will be hit hard by the predicted climate change effects, threatening food security, inducing higher volatility of prices (or government subsidies), and making the prospect of economic diversification even more challenging.

Climate-proofing Iraq's agriculture sector requires substantial modernization of policies and practices at both the government and the farmer levels. The adaptation of the agriculture sector to unfavorable climates has been extensively covered in the policy and academic literature, given the strategic importance of agriculture in global food security. Table 4.2 lists some of the policy and technology-based interventions that can assist Iraqi farmers in facing the variable and unpredictable impacts of climate change on their production. These interventions call for a concerted modernization overhaul that aims to protect farmers' yields (or income) against climate stresses. On the policy level, access to properly regulated and equitably distributed financial instruments that are specifically designed to increase farmers' resilience is of high importance if Iraq wants to limit the internal migration of farmers who face climate-related economic losses. Examples of these instruments include extending crop insurance, which could lower climate risks on farming, and the introduction of relief programs.

Policy-based strategies	**Potential challenges**
Agriculture financial instruments, such as crop insurance schemes	Regulatory oversight to ensure effectiveness and fairness
Drought relief programs	Availability of funds; fair and accurate assessment of losses
Establish an interdisciplinary institutional capacity specialized in climate-proof agriculture	
Technology-based strategies	**Potential challenges**
Early warning system for extreme weather conditions, particularly drought	Building technological, data, and human capacity
Climate-resilient crops	Information asymmetry and need to educate farmers
Introduce technology-based management of water, soil, and fertilizers	Information asymmetry and ensuring equity and inclusivity

Table 4.2: Adaptive Strategies for Iraq's Agriculture Sector
Source: Original table for this publication.

On the institutional level, an interdisciplinary mechanism mandated with safeguarding Iraq's agriculture sector against climate change may be necessary. This would address the need to convene an array of expertise on the technical, scientific, economic, and policy levels to generate comprehensive strategies and recommendations and ensure effectiveness of relevant policies. In September 2020, the Iraqi government launched its National Adaptation Plan for climate change resilience, which could be a good starting platform toward institutionalizing climate resilience.

Promoting climate-resilient agriculture also requires extensive knowledge-dissemination efforts to change farmers' behavior. Many of the proposed strategies to lower climate risks on farming can be initiated by farmers themselves utilizing community driven development models. The adoption of climate-resilient crops such as early maturing and heat- and salinity-tolerant crop varieties can help farmers better cope with climate shocks (Acevedo et al. 2020). Additionally, a better management of inputs—particularly water and fertilizers—can also mitigate some of the predicted stresses. However, to bridge any knowledge and information gaps, especially among resource-poor farmers, the Iraqi government, perhaps under the mandate of the already noted proposed center, should launch region-specific awareness campaigns on climate change impacts and adaptive measures. Additionally, modernizing Iraq's agriculture infrastructure is an opportunity to lower sector's emissions while also achieving cost savings

Box 4.2: Modernizing Iraq's Agriculture Infrastructure As an Opportunity to Lower the Sector's Emissions While Also Achieving Cost Savings

In 2016, Iraq's agriculture sector contributed around4 percent of the country's total greenhouse gas (GHG) emissions, mainly by producing methane (via livestock farming) and nitrogen oxide (application of fertilizers). Besides its potential to make Iraq's agriculture sector more resilient, the modernization of Iraq's agricultural practices could also contribute to lowering emissions through pathways such as the following:

- Introduction of smart-farming practices that use less fertilizer
- Adoption of energy-efficiency measures and deployment of renewable energy to power agriculture facilities
- Deployment of GHG-focused genetic and breeding solutions

With competition over water resources expected to increase, Iraq's agriculture sector must adapt to lower water availability. Lengthy droughts and lower precipitation levels are real threats to Iraq's water resources, and national projections state that Iraq's water sector will face significant stresses because of climate change (UNFCCC 2016). The agriculture sector is the highest consumer of water resources in Iraq, accounting for around 40 percent of water withdrawal (UN 2013). Expansion of both Iraq's energy (oil production) and agricultural activities will exert more demand pressure on water resources, which are already witnessing substantial decline due to decreased flow levels in the Tigris and Euphrates rivers (50 percent lower in 2020 compared to 2019), which are the primary sources of surface water in Iraq (Kullab and Yahya 2020)[3]. Recently, the issue of reallocation of water resources from agriculture to urban areas has become more relevant, given the lack of availability of municipal water.

With increased water scarcity, Iraq's water resources need to be allocated strategically and efficiently. In this regard, agriculture-sector-led initiatives need to be prioritized. Possible measures include improving water-use efficiency, soil moisture retention capacity, water storage, and water reutilization (Iglesias and Garrote 2015).

REDUCING FLARING OF NATURAL GAS

Even without renewable energy, Iraq can go beyond meeting its climate commitments by fixing existing inefficiencies in its energy sector. Iraq's energy sector is characterized by three major inefficiencies: use of oil for power generation, high technical electricity grid losses, and upstream gas flaring during oil production. By seriously tackling any of these three inefficacies, Iraq can reduce its greenhouse gas emissions significantly. As shown in figure 4.2, by tackling two of these inefficiencies, Iraq can meet its Paris Agreement nationally determined contribution target of lowering emissions by 14 percent. In an optimal scenario wherein all the inefficiencies are tackled, Iraq can reduce its total emissions by 30 percent relative to the 2016 emissions level. Stopping gas flaring (see Box 4.3) and replacing oil and diesel capacity with natural gas have the highest potential contribution to reducing emission. As for power grid losses, a World Bank (2015) report estimated the technical losses at around 20 percent. As such, the power grid emission savings shown in figure 4.2 assumes lowering these losses to a more globally acceptable level of around 10 percent[4]. It should be noted that between the subsidized tariffs and the huge nontechnical and commercial losses there is a severe underpricing, which leads to overconsumption and waste.

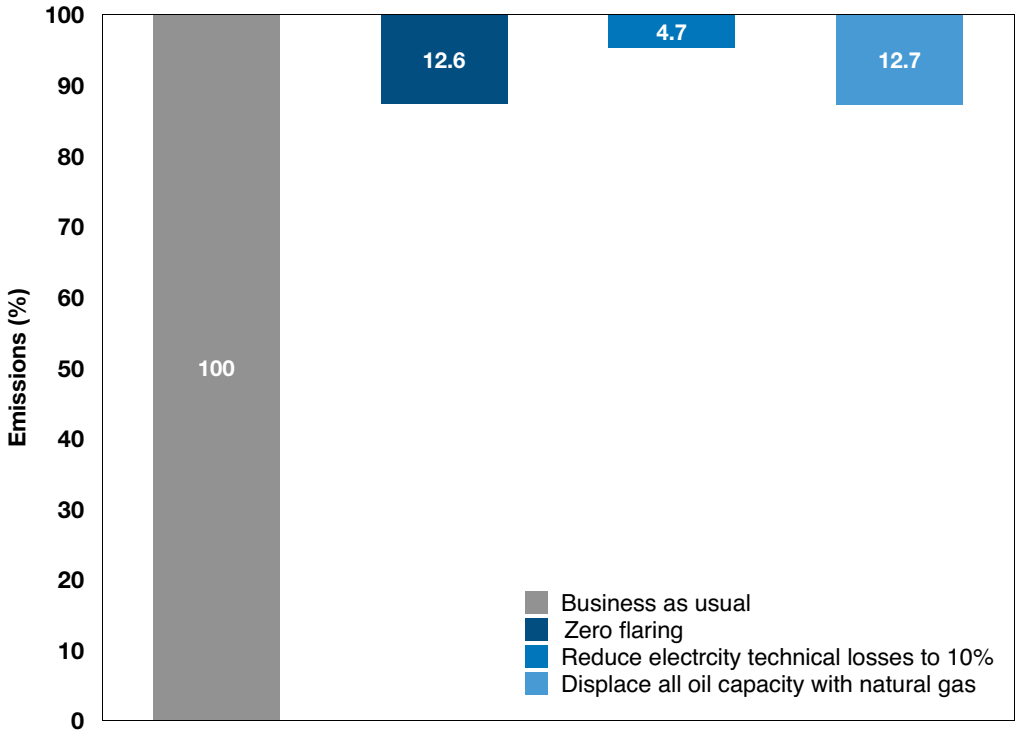


Figure 4.2: Potential Reduction in Iraq's Total GHG Emissions Relative to 2016 Levels Based on Energy Sector Interventions (without renewable energy)
Source: Original figure for this publication.Climate Change.
Note: GHG = greenhouse gas.

From a technical perspective, non-flaring policy is Iraq's "low hanging fruit" to cut emissions, reduce the opportunity cost of burning oil for electricity, and improve energy security. Iraq has the second highest volume of flaring in the world, behind Russia. However, in contrast to Russia, where flaring is less than 2 percent of the total emissions, Iraq's flaring makes up about 13 percent of its total emissions, as shown in figure 4.3. While Iraq continues to import natural gas and electricity from Iran to meet its growing energy needs, it could generate 3.5 gigawatts of electricity if it captured 40 percent of its flared gas (Saadi and Carpenter 2020)[5]. Reducing gas flaring represents an accessible entry point for Iraq to achieve multiple goals, including advancing its climate commitments, reducing the opportunity cost of burning oil domestically instead of selling it on the international market, and improving its energy security. Iraq has already committed to the Global Gas Flaring Reduction Partnership (World Bank n.d.), but it needs to acquire technical, institutional, and infrastructure capacity to build a gas industry that can ultimately help to achieve flaring reduction goals.

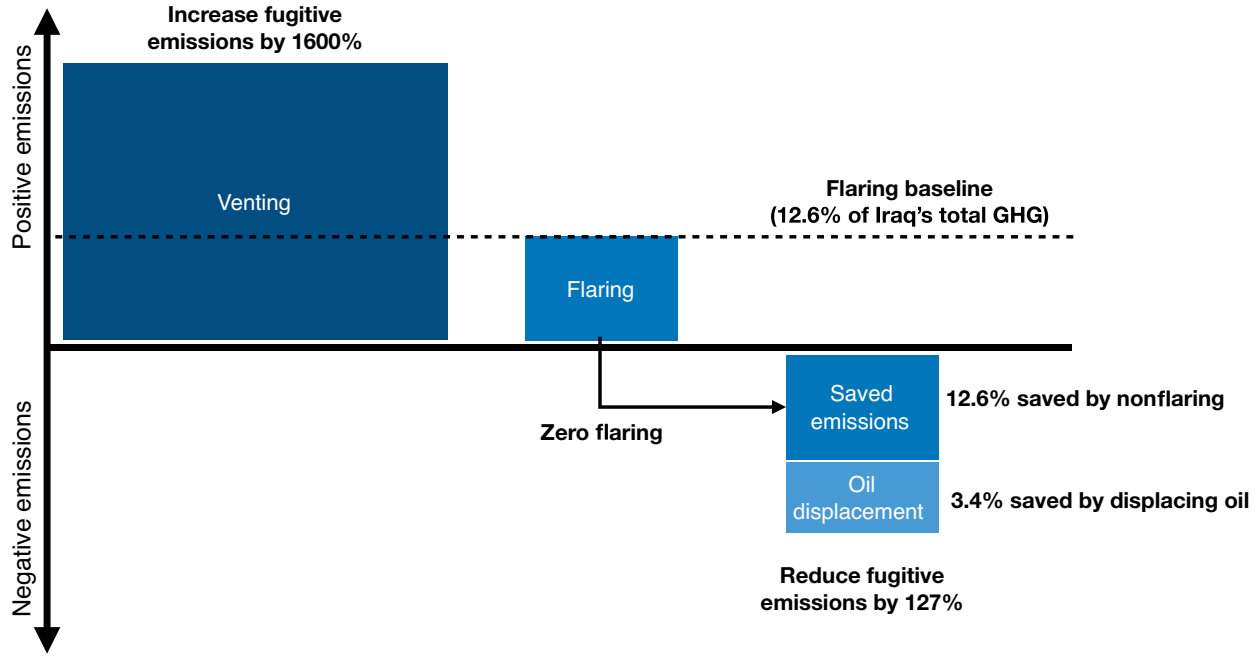


Figure 4.3: Visual Representation (not to scale) of Iraq's Option to Deal with Its Upstream Fugitive Emissions
Source: Original figure for this publication.
Note: GHG = greenhouse gas.

Reaching zero flaring emissions and instead putting the produced methane to use in power generation will reduce Iraq's 2016 total emissions level by 16 percent—13 percent from saved flaring emissions and 3 percent from displaced oil-based power generation. Figure 4.3 is a visual representation of Iraq's options to deal with its fugitive emissions, which can be assumed to be fully linked to upstream flaring. Based on Iraq's emissions in 2016 (see figure 3.1), its fugitive emissions are estimated at 26.2 million tons of carbon dioxide (CO2). If the associated methane gas was "vented" as opposed to flared, its impact on the environment will be much worse, given that methane makes about a sixteen-fold contribution to global warming compared to CO2. Venting is another policy option to discharge methane emissions during oil production. Unlike flaring, which can easily be detected with high-resolution satellites, detection of venting is less precise and costlier. As such, venting could be used by oil producers to avoid strict flaring regulations, inducing greater environmental harm (Calel and Mahdavi 2020). If Iraq chooses to capture the flared methane and use it to generate power instead of oil, it can lower the emissions further by 27 percent of the total emissions of the displaced oil capacity (approximately 3 percent of total country emissions in 2016). Iraq's emissions reduction potential has also been recognized as one of the highest in the world (Elvidge et al. 2018).

Box 4.3: What is Natural Gas Flaring?

Flaring is a practice used by oil companies when there is lack of incentive, market, and/or infrastructure to capture the associated natural gas produced during oil production. Although most flaring takes place during oil extraction, flaring can also take place at refineries, gas terminals, and industrial sites.

Thanks to having a lower carbon intensity than other fossil fuels, natural gas plays a increasingly important role in energy transitions—many countries around the world, including in the Middle East and North Africa, are increasingly relying on natural gas to move toward a cleaner, cheaper and more sustainable energy source. Consequently, flaring not only causes environmental harm,it resultsin economic inefficiency. In 2015, the World Bank introduced the Zero Routine Flaring by 2030 initiative to bring together governments, oil companies, and development institutions to eliminate routine flaring by 2030.

Environmentally, flaring produces greenhouse gases; pollutes the air, land, and water; and has been shown induce serious public health effects such as asthma, hypertension, and some cancers (Rubin et al. 2020).

With renewable energy, Iraq can become a regional leader in green economic diversification. Despite having a great potential for clean and affordable renewable energy, however, Iraq has the lowest share of electricity generated by non-hydropower renewable energy sources in the Mashreq region, revealing great potential. In 2018, Iraq's total share of non-hydropower renewables was at a mere 57 gigawatt hours—less than 0.1 percent of Iraq's total electricity generation, mostly coming from solar photovoltaics (IEA 2020). In contrast to Iraq's modest share of renewable energy, the academic literature highlights the country's vast potential for solar and wind energy (Abed, Al-Douri, and Al-Shahery 2014; Kazem and Chaichan 2012; Saeed, Ramli, and Saleh 2016). In February 2021, Iraq announced that it is seeking international investors to build seven solar power plants, with a total capacity of 750 megawatts. Reportedly, the government of Iraq is in talks with a number of international developers, including France's Total (Arab News 2021).

CHAPTER ENDNOTES

[1] In 2019, Iraq was the world's fifth highest producer of oil (5 percent of global production). Oil exports formed more 97 percent of the total value of exports (OPEC 2020).

[2] Additionally, crop yields are already low in Iraq, as farmers tend to minimize costs involved in land preparation, planting, weeding, and harvesting (FAO 2012).

[3] Water quality is another problem. In 2013, the United Nations reported that the quality of water used for drinking and agriculture is poor and violates both Iraqi national standards and World Health Organization guidelines (UN 2013).

[4] Iraq's power grid also suffers from nontechnical losses of around 23 percent, mainly due to theft and unbilled electricity (World Bank 2015). As such, these nontechnical losses are not considered when estimating emissions savings, since these are commercial inefficiencies. However, lowering commercial losses will ultimately lead to lower consumption, which is hard to estimate without available data.

[5] It should be noted, however, that one of the challenging aspects of using associated gas for power generation is the need for infrastructure to remove pollutants such as hydrogen sulfide and nitrogen and other impurities before it can be utilized as a fuel in gas-fired power plants.

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5. JORDAN

Macro-fiscal overview

Even before the unfolding of the COVID-19 pandemic, Jordan's economy was not doing well. According to the World Bank's *Jordan Economic Monitor* (2020) Jordan's growth rates over the past four years were around 2 percent, which is not sufficient to address the kingdom's pressing socioeconomic challenges. The pandemic and the economic disruptions it has caused have severely impacted Jordan's economy by limiting growth prospects and increasing unemployment numbers. Social-distancing measures drastically affect Jordan's service-based economy as well as its informal sector. In the meantime, Jordan's debt-to-gross-domestic product (GDP) ratio rose to almost 100 percent.

INTRODUCTION

Jordan has the most advanced climate change mitigation and adaptation efforts in Mashreq, but water insecurity remains the country's most pressing challenge. Despite strained economic conditions, Jordan has taken notable leaps in dealing with climate change. For example, as shown in figure 3.2, Jordan is the only country in Mashreq that has successfully reduced the emissions of its electricity sector in recent years while increasing supply. It has done this by replacing oil-fired electricity with natural gas and taking advantage of the kingdom's renewable energy potential.

However, these advances are at risk of reversal as Jordan commissions the Attarat Oil Shale Power plant. Jordan's comparative success in dealing with climate change is due to three main reasons: (1) establishing a clear and coherent government commitment toward sustainable development, (2) establishing and empowering existing public institutions targeted with planning and implementing climate policies, and (3) being able to receive stable and continued support from international partners. In terms of impact, climate change poses serious risk to water resources in Jordan. Already one of the most water-stressed countries in the world, Jordan gets two-thirds of its water from aquifers that feed on steadily declining precipitation levels (see figure 5.1).

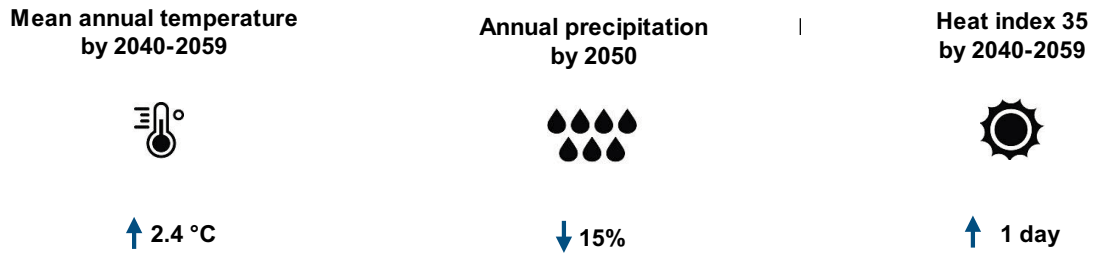


Figure 5.1: Selected Climate Indicators for Joran under High Emissions and Low Mitigation Scenario, RCP 8.5
Source: World Bank, Climate Change Knowledge Portal database.
Note: RCP = representative concentration pathway, a series of scenarios developed for the Intergovernmental Panel on Climate Change.

Spillover effects of neighboring climate-induced fragility could compound Jordan's development challenges. Historically, Jordan has been deeply affected by the successive waves of regional fragility and conflicts. Over the years, Jordan has received influxes of refugees from neighboring countries. As per UNHCR, Jordan currently hosts at least 750,000 refugees and has the second

highest share of refugees per capita in the world, after Lebanon (UNHCR 2019). Consequently, should climate-induced fragility intensify, Jordan may well find itself at the epicenter of another regional migration crisis and wave of refugees. This demographic pressure would only compound Jordan's stresses, and resource scarcity, particularly water, which will sharply deteriorate if no adaptive measures are implemented. Past regional instabilities have also proven costly to Jordan's economy, which depends on regional trade to large extent (World Bank 2020)[1].

The interconnectedness of economic activities and nonlinearity of climatic effects suggest that Jordan's service-based economy is also not immune to climate shocks. About two-thirds of Jordan's GDP can be attributed to tertiary sectors, which include information technologies, tourism, commercial and financial services, and so forth (EPC 2018). Such a high reliance on the service sector could lessen Jordan's economic vulnerability to climate change compared to Iraq, for example, which has a higher reliance on sectors that are far more exposed to weather conditions, such as agriculture. However, more frequent and intense weather events could still impact secondary economic activities. The agrifood sector is among the economic activities that are likely to be negatively affected, since its supply chain (usually crops or livestock procured domestically or from neighboring countries) and business model are vulnerable to climate-induced price shocks in the needed raw materials. The tourism and hospitality sector is also likely to be negatively affected, given that most of Jordan's tourist sites are at low altitude, which will experience hotter summers.[2] Additionally, a higher sea level in the Gulf of Aqaba means likely land loss in an already small gulf, which could affect tourism and Aqaba's local economy significantly (UNFCCC 2014). Other sectors will also suffer varying degrees of impact such as extra costs to the construction sector for adaptive measures, for intensifying insurance risk The construction sector will incur extra costs to put in place adaptive measures, insurance risk will intensify, and (public) health services could be stretched during episodes of extreme weather.

SOCIAL INNOVATION AND COMMUNITY-DRIVEN CLIMATE ACTION APPROACHES

Jordan has been at the forefront of government-led climate interventions in Mashreq; going forward, it could lead in social innovation and community-driven climate action. Facing climate change on the mitigation and adaptation sides requires concerted efforts by all segments of society: government, businesses, and the public. Climate discussions tend to remain within a small circle of government officials, experts, and development institutions, this circle needs to be expanded to enable social innovation and facilitate localized solutions. The global experience of social climate approaches is still developing, but a number of interesting case studies have surfaced recently, the results of which could be replicated in Jordan. One notable example is the United Kingdom's Climate Assembly (UKCA) on climate change, which was established in 2019. The UKCA brings ordinary people together to deliberate and make recommendations on how the UK should tackle its climate commitments (UKCA 2021). For more details about climate social innovations in Mashreq see Box 5.1.

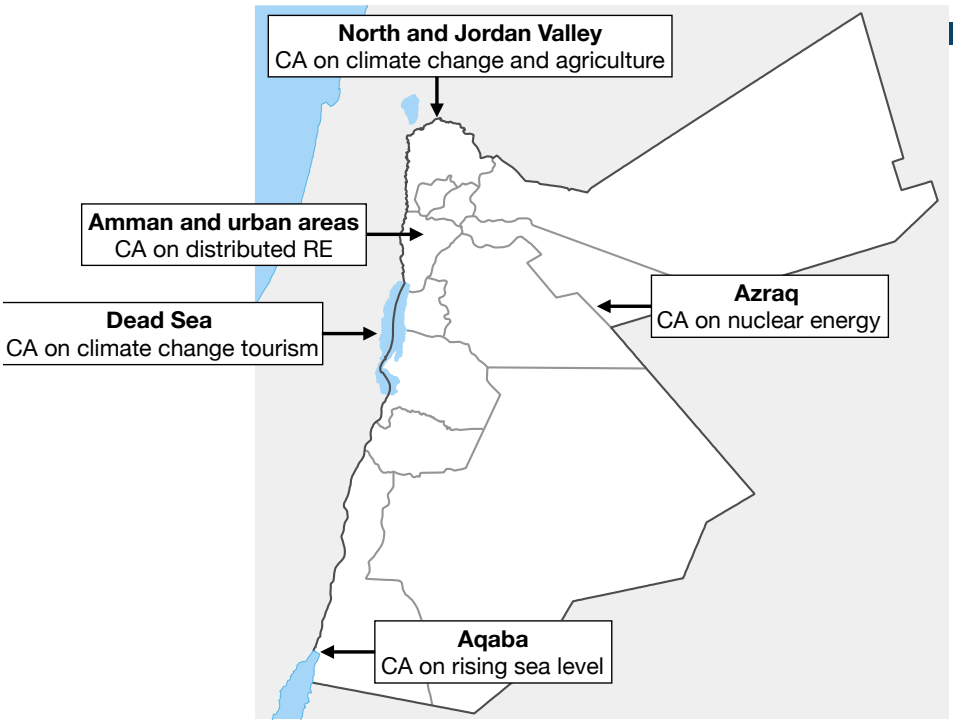
Box 5.1: Defining Climate Social Innovation in Mashreq's Context

Social innovation is an elastic phrase that is hard to define, given the diversity of concepts it entails. However, in the context of climate action in Mashreq, social innovation can refer to leveraging community dynamics to approach localized climate issues and involving stakeholders who are directly impacted by climate action but who have not been heard before. In a more general sense, social innovations are defined by the TEPSIE (2014) project as "new solutions (products, services, models, markets, processes etc.) that simultaneously meet a social need (more effect ively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources."

Citizen engagement around climate issues is a powerful tool to develop and test climate policies and overcome challenging political economy obstacles. The participatory nature of community-driven approaches would likely be effective in tackling several challenges in Jordan. First, it would allow for a better understanding of people's fears and concerns (loss of income and/or jobs, forced migration, climate-induced illness, and so forth). This can be useful in informing the government programs and enhance communication. Second, citizen engagement might lower public resistance toward climate-linked reforms (Ahmad and Maier 2020). The adoption of reforms is often met with widespread public disapproval and, in some cases, social unrest. Third,

bringing climate issues to the attention of nonexperts helps with creating and accelerating societal shifts. There is an individual level of climate action that can be reached only through cultural and behavioral changes. Important climate considerations such as resource conservation, energy consumption, waste recycling, and deforestation require behavioral shifts within communities.

Jordan faces a number of climate-related challenges that could be deliberated through various citizen engagement models, including citizen assemblies.[3] As shown in map 5.1, the Jordanian government could initiate several citizen assemblies with specific geographic relevance. In Aqaba, Jordan's only maritime access point, citizens might deliberate the impact of rising sea levels, resilience measures, and the prospects of having a water desalination plant. In the Dead Sea region, local population and owners of tourism businesses might come together to discuss the impacts of climate change on tourism in the area and their coping options. In Amman and other urban areas in Jordan, the public could be involved with studying the prospects of renewables-based distributed energy systems and energy-efficiency practices. A similar model of citizen assembly on energy has recently been explored in Beirut with support of the United Kingdom's RELIEF Center (RELIEF 2020). Additionally, citizen engagement in Amman and other Jordanian cities, could revolve around risk-informed urban planning and participatory approaches toward



Map 5.1: Proposed Citizen Assembly Initiatives in Jordan
Note: CA = citizen assembly;
RE = renewable energy.

Citizen engagement approached are also crucial for effective demand side solutions, especially in the water sector. Jordan can deploy technological solutions to lower water consumption and adapt to scarcity. Since a large share of Jordan's water is consumed by the agriculture sector (van den Berg, Al Nimer, and Agha 2016), existing and emerging technology solutions can help Jordan deal with water scarcity. For example, climate-smart crop varieties that are drought and heat resistant (Acevedo et al. 2020), better irrigation system control, and use of advanced remote sensing technology (such as satellite imagery) for land and crops mapping (Al-Azeez Hdoush 2020) all present relatively low cost mitigation options. On the industrial level, the deployment of increasingly affordable on-site water treatment technologies and industry-specific water-saving measures could also be encouraged and expanded. A recent study has shown that Jordan's industrial sector could save up to 38 percent of water demand by introducing on-site treatment (Saidan 2020). Achieving these water resource efficiency solutions could benefit from leveraging local understanding and participatory approaches.

DEEP DECARBONIZATION OF JORDAN'S TRANSPORT SECTOR

At the current growth rate, Jordan's transport sector will soon replace power generation as the kingdom's top emitter. As Jordan has introduced more renewables and shifted away from oil in its power generation base, power sector emissions have been declining since 2014. At the same time, transport sector emissions have been growing at an average annual rate of 8.4 percent. Jordan's emissions from the transport sector increased by 57 percent between 2010 and 2016 (see figure 5.3). These numbers show that while Jordan appears to have made notable progress in decarbonizing its power sector, its transport sector lags behind. This is not completely surprising, as decarbonizing transportation is a harder task than the decarbonizing electricity. This is mainly due to the decentralized nature of the transport sector in Jordan (and in Mashreq in general), wherein the public transport share is low—public transport dependency stands at only 11 percent, one of the lowest in the world (UNFCCC 2014). The lack of public transport infrastructure has resulted in an increased reliance on private passenger cars, leading to massive congestion in Amman, Jordan's capital. In 2014, Amman's mayor stated that 1.8 million cars are crowding the roads during peak hours, with an average of 1.3 passengers per vehicle (Obeidat 2014).

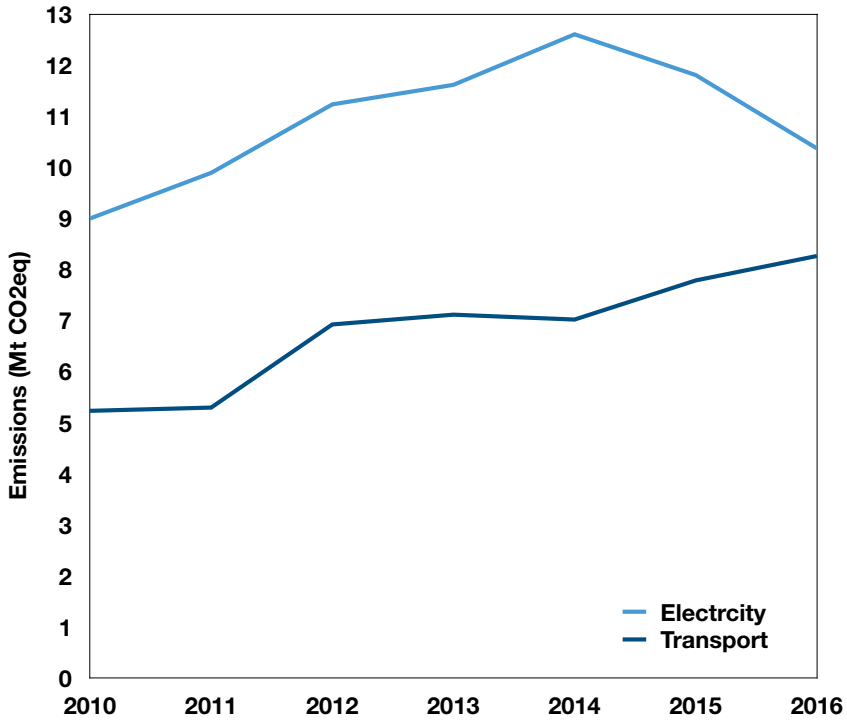


Figure 5.3: Growth of Greenhouse Gas Emissions within Jordan's Electricity and Transport Sectors between 2010 and 2016
Source: World Bank data.
Note: Mt CO2eq = million tons carbon dioxide equivalent.

Jordan can cut its transport sector's emissions by between 20 and 50 percent by 2030 through deploying a combination of different policy pathways. Based on Jordan's Third National Communication (TNC) on climate change, the transport sector is projected to contribute 16.2 million tons of carbon dioxide equivalent, around 40 percent of the kingdom's total greenhouse gas emissions, surpassing the electricity and heat sectors. The amount of reduction in emissions that can be achieved in the sector depends on how many reduction pathways are followed. The four proposed pathways are (1) 100 percent penetration of hybrid private vehicles, (2) investments in congestion relief[4], (3) improved fuel efficiency, and (4) expanding public transport.

Moving toward a high penetration of hybrid vehicles and investing in congestion relief projects appears to offer the most effective and best job- and market-creating pathways for Jordan to lower its transport sector's emissions. Jordan has already progressed toward incentivizing the use of hybrid vehicles and has included their deployment as one of the TNC target projects (UNFCCC 2014). However, the effectiveness of replacing conventional cars with hybrid ones depends on two main variables: the market share (penetration level) of hybrid vehicles (HVs) and the carbon intensity of the grid: that is, the energy sources that are used to generate electricity. Figure 5.4 shows the emissions reduction potential of achieving 100 percent penetration of HVs by 2030 under two electricity mix scenarios: a business-as-usual mix in which natural gas generates 80 percent and renewable energy (RE) 20 percent, and a low-carbon scenario in which gas generates 50 percent and RE 50 percent. Not surprisingly, deployment of HVs offers a significant reduction in emissions of between 43 and 48 percent, depending on the carbon intensity of the power generation mix

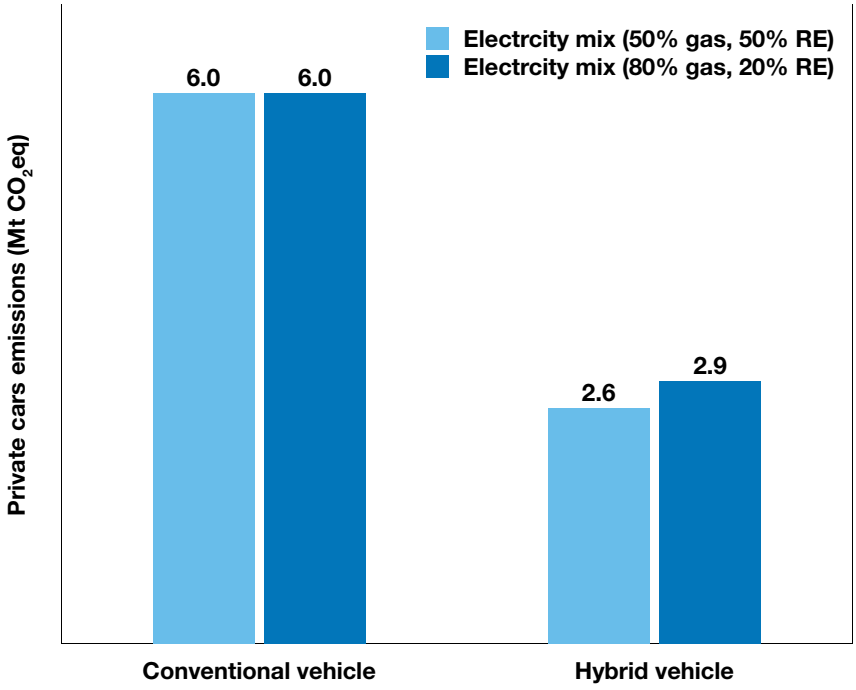


Figure 5.4: Comparison of CO2 Emission Scenarios in Jordan in 2030 at Different Electricity Generation Mixes
Source: Original figure for this publication.
Note: Mt CO2eq = million tons carbon dioxide equivalent; RE = renewable energy.

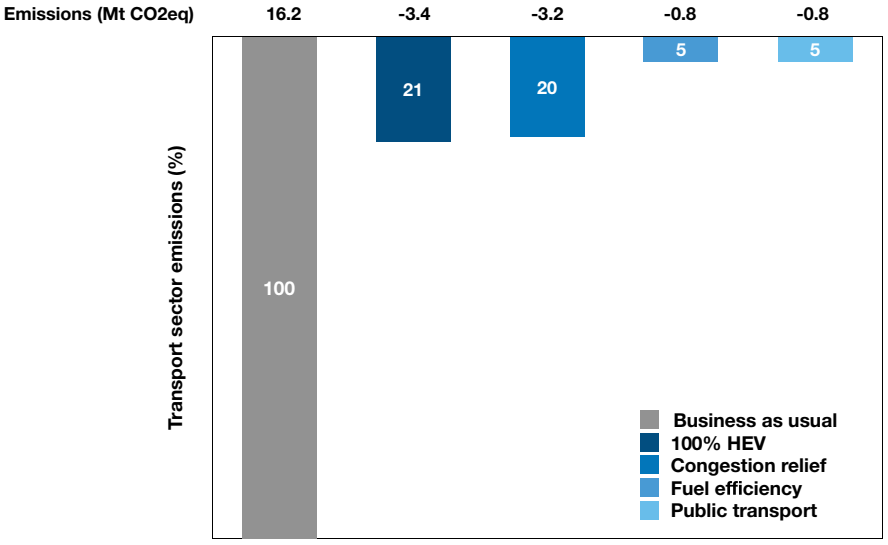


Figure 5.5: Reduction Scenarios of Transport Sector's Emissions in 2030 under Different Policies
Source: Original figure for this publication.
Note: HEV = hybrid and electric vehicles.

Box 5.2: Low-Cost Policy Instruments to Limit the Transport Sector's Emissions in Jordan

Decarbonization of the transport sector is challenging, particularly in a developing context like Jordan, due to the sector's decentralized nature and dependency on complex consumer choices. However, several policy instruments can be explored to accelerate the sectors transition to a low carbon future:

- Increasing Jordan's low average occupancy rate of 1.3 passengers per car through carpooling and establishing fast lanes for cars with high occupancy
- Increasing the safety, reliability, and quality of public transport (Added services such as WiFi onboard would help attract new customers, too)
- Introducing congestion charge (time, distance, or area -based systems)
- Limiting license plate registration to specific weekly or monthly numbers
- Enforcing strict emissions standards

CHAPTER ENDNOTES

[1] For example, the Syrian conflict has reduced Jordan's average annual GDP growth rates by 1.6 percentage points, in real terms, since 2011 (World Bank 2020).

[2] Although Jordan may benefit from boosted winter tourism.

[3] Citizen assemblies are just one form of citizen engagement, which can take place using several approaches of stakeholder consultations.

[4] Reducing traffic congestion through prudent infrastructure projects such as high-speed train lines and/or application of policy instruments that can lower traffic congestion (see box 5.2)

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6. LEBANON

Macro-fiscal Overview

Lebanon continues to suffer the impact of three major shocks: an economic and financial crisis that started in October 2019, the COVID-19 pandemic, and the devastating Beirut port explosion that took place in August 2020. According to the World Bank 's Lebanon Economic Monitor (2020), Lebanon's real gross domestic product (GDP) will decline by an estimated 19.2 percent in 2020 and a further 13 percent in 2021. These crises have already weighed heavily on Lebanon's strained fiscal position. Exchange rate pass-through effects on prices have led to high inflation, and poverty is likely to worsen, affecting more than half of the population in 2021.

INTRODUCTION

Battered by concurrent shocks, climate-oriented investments offer Lebanon an opportunity to reverse its economic contraction. Lebanon suffers from an economic and financial crisis, the COVID-19 pandemic, and the Beirut port explosion. The World Bank projects that Lebanon's real GDP will decline by an estimated 19.2 percent in 2020 and a further 13 percent in 2021 (World Bank 2020b). Even before the outbreak of the COVID-19 pandemic, the poverty rate was projected to reach 50 percent due to the severe economic crisis the country was facing (World Bank 2019). In the middle of these immediate challenges, climate change may be perceived as more of a "brewing" shock, given the already known climate projections (shown in figure 6.1) and their subsequent effects highlighted in Lebanon's TNC (UNFCCC 2016). However, assuming that international support that is currently conditional on the implementation of reforms is unlocked, climate-related investments hold great potential to help Lebanon to recover more quickly. Such a sustainable recovery could be boosted by (1) the appetite within the international support group to finance projects that are better aligned with their sustainable development goals, (2) the potential to claim climate cobenefits that could lower Lebanon's fiscal deficit (as discussed subsequently with regard to the introduction of renewable energy) and (3) the opportunity to build a resilient infrastructure that would mitigate the impact of further shocks in the future.

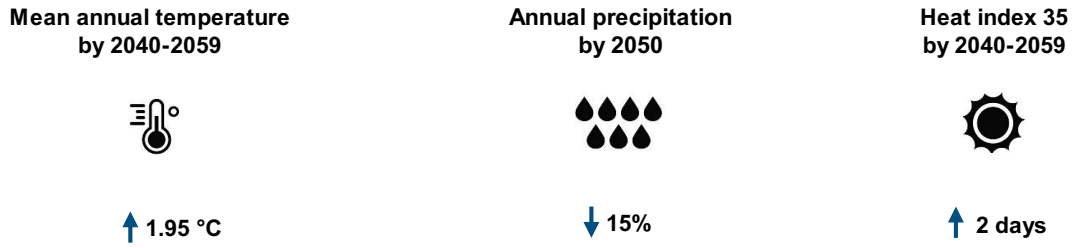

Figure 6.1: Selected Climate Indicators for Lebanon Under High Emissions and Low Mitigation Scenario, RCP 8.5
Source: World Bank, Climate Change Knowledge Portal database.
Note: RCP = representative concentration pathway, a series of scenarios developed for the Intergovernmental Panel on Climate Change.

In Lebanon, climate cobenefits would make a direct contribution to resolving known economic and social weaknesses. If there is one takeaway from the current economic crisis in Lebanon, it is that the country needs a new economic model that can generate a more equitable distribution of wealth and lower the public sector's costs and inefficacies. These twin goals can be achieved through sustainable investments that would create tangible added value and benefits beyond lowering emissions and promoting adaptation to climate change. Table 6.1 outlines the climate cobenefits across four major sectors in Lebanon. Cobenefits linked

to reducing public spending through cutting costs and lowering fiscal deficits by lowering demand for foreign currency are a pressing need for Lebanon. In this regard, energy sector interventions carry the highest potential and will be examined in more detail in "Making Renewable Energy a Centerpiece of Lebanon's Energy Future" in this chapter. However, interventions in waste management, sustainable agriculture, and transport also have important cobenefits across different aspects of public life.

	High benefits
	Moderate benefits
	Low or uncertain
	Not applicable

	Energy	Waste management	Agriculture	Transport
Economic (cost savings)	RE lowers cost of power generation by EDL	Reduce costs and promotes circular economy	Promotes economic growth in rural Lebanon	Hybrid cars and public transport
Financial (foreign currency needs)	RE lowers oil imports		Lowers agricultural and agri-food imports	Lower oil imports
Health	RE displaces diesel generators	Reduce spread of contamination and diseases		Reduce air pollution
Social	Functional power sector promotes equity		Lowers chances of migration	Increase safety and security of public transport
Services	Reliable and affordable mean better services			Lowers congestion and promotes mobility

Table 6.1: Climate Action Cobenefits across Major Sectors in Lebanon
Source: Original table for this publication.

SAFEGUARDING LEBANON'S WINE INDUSTRY AGAINST CLIMATE CHANGE

Lebanese wine is more than just an exportable product; it is a well-recognized ambassador of Lebanese identity and culture and a substantial contributor to the local economy. With a 2,600-year-old Phoenician winery discovered recently, Lebanon is among the oldest sites of wine production in the world (Metcalfe 2020). In a highly competitive global market, Lebanese wine has a place on experts' lists (Jefford 2017). Figure 6.2 lists several facts about Lebanon's wine industry. Interestingly, compared to other agricultural and agrifood businesses in Lebanon that have seen a decline in recent years, the wine industry continues to witness high growth of around 8 percent per year. Although this section focuses on Lebanon's wine businesses, other high value agricultural products also require climate proofing and would benefit from being resilient to climate effects.

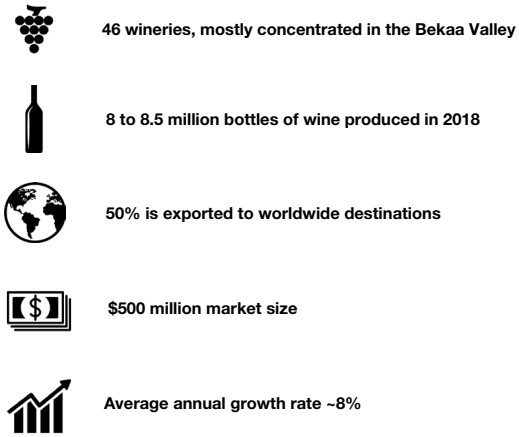

Figure 6.2: Lebanon's Wine Industry in Numbers
Source: Data from BLOM 2019.

Lebanon's wine industry is significant for its role in promoting exports and instigating growth and job opportunities in underdeveloped regions. Lebanon's wineries are mostly concentrated in the Bekaa Valley, the agricultural hub of Lebanon and one of its underdeveloped regions. The continued expansion of wineries in Lebanon creates two important opportunities for the Lebanese economy in general and for the regions where wineries are located in particular: (1) increasing exports, which would bring in much-needed foreign currency, and (2) creating job opportunities for low-skilled Lebanese and migrant workers. The role of the wine industry in the development of the Bekaa region, despite its small size, has already been highlighted (Antoun 2014)[1].

Climate change is a serious threat to Lebanon's wine industry, and adaptation action is needed to safeguard it. Globally, climate change is now recognized as a major threat to making of wine, which is among the most sensitive agricultural products (Asimov 2019; Mozell and Thach 2014). Lebanon's wine production is not an exception, and it has already been exposed to changing weather patterns induced by climate change (Darwish 2020). Hotter summers, warmer winters, and frequent droughts, which are all projected to intensify over time, are recognized by experts as the most harmful effects on wine making, and they pose an existential threat to Lebanon's growing wine industry.

Technology can play an important in role in protecting Lebanon's wine industry, but government-led programs are needed to maximize support and avoid information asymmetry. Smart-agriculture techniques are already deployed by some of the largest wine producers in Lebanon (Libelium 2017). These mainly revolve around the use of climate and soil sensors and analyzing impact on grapes quality. However, about 50 percent of Lebanon's wine production comes from medium and small wineries (BLOM 2019). These wineries may not have the financial resources or the same level of access to the required technical expertise as the big producers. Considering this, a government-led adaptation plan should be envisaged to bring all wine producers to the same level of support. (See box 6.1 for examples.)

Box 6.1: Strategies to Mitigate Climate Impact on Wine Production in Lebanon

The following strategies to mitigate the effects of a changing climate on Lebanon's wine production have been selected from a growing international experience of wine production adaptation. The main sources for the included strategies are Asimov (2019) and Mozell and Thach (2014).

- Examine the possibility of having vineyards at higher altitudes.
- Consider previously prohibited orientations (north facing) to prevent overripening.
- Undertake nighttime harvesting and quicker deliveries of berries
- Adopt water treatment and recycling to adapt to lower water availability.
- Consider heat and light practices such as canopy management and strategic vine orientation.

MAINSTREAMING CLIMATE CHANGE IN THE DESIGN OF LEBANON'S INFRASTRUCTURE

Lebanon's weak infrastructure is vulnerable to extreme weather conditions, resulting in frequent and unpredictable disruptions to basic services and economic activities. The quality of Lebanon's infrastructure is among the poorest in the world, with the country ranking 130 out of 137 in quality of overall infrastructure (World Bank 2018). Additionally, the vulnerability of infrastructure to climate change is receiving increasing attention in developed and developing countries alike. This attention is a natural result of the immense reliance of modern societies on energy, connectivity, and mobility and the need to build resilient infrastructure that can cope with climate shocks, recover, and resume operating with minimal disruption to service. Additionally, the increased economic complexity and connectedness across different sectors make infrastructure resilience an important consideration. Disruptions can have knock-on effects that could potentially result in substantial losses beyond the location where the disruption took place first. For example, a violent storm can lead to road blockages and cut off power supplies, which can halt the movement of goods and services and limit working hours. In Lebanon's often neglected rural and inland

towns and villages, where infrastructure is noticeably weak, roads are essential for livelihoods and economic activities. Although the roots of the disparity in infrastructure quality lie deep in Lebanon's legacy of fragility and the political economy, the spatial variation of the quality and the service outcomes of existing infrastructure are widening social gaps and inequalities (Verdeil 2018). However, the recent triple shock mentioned earlier means that the infrastructure in Beirut and other major coastal cities is also crumbling.

The majority of infrastructure projects proposed in Lebanon's Capital Investment Program (CIP) are vulnerable to climate change, opening opportunities for building resilient and climate-proof infrastructure. The CIP acknowledges Lebanon's need to improve the quality of its infrastructure as an essential ingredient to boosting sustainability and economic growth (World Bank 2018). Although the list of projects included in the CIP may well be revised in light of Lebanon's emerging priorities, particularly in the face of the economic crisis and the devastating impact of the Beirut port explosion, Lebanon would still need to invest in building new infrastructure and modernizing its existing infrastructure. By reviewing the projects included in the CIP, it is evident that there is an opportunity to include considerations of climate resilience and proofing based on the considerations mentioned in table 6.2. In the face of these considerations, adaptation measures could include the hardening of physical assets and ensuring backup capacity (electricity) or storage capacity (water). As a first step, however, there is a need to conduct an assessment of existing and planned infrastructure to determine where to introduce resilience measures.

Sector	CIP project	Adaptation and resilience considerations
Transport	Rehabilitation and Development of Beirut Rafic Hariri Airport	Extreme climatic conditions (temperatures, wind, storms, and so forth) may impose safety upgrades on runway length and other airport upgrades (Gratton et al. 2020).
	New roads and rehabilitation of classified roads and municipal roads	Violent storms and floods could speed up damage to the road network (Schweikert et al. 2014).
	Rebuilding of Beirut port; rehabilitation and expansion of Saida, Sour, and Tripoli ports	Climate risks are site-dependent, but in general, sea level rise may increase risks of flooding (Izaguirre et al. 2020).
Water	Upgrade of water supply systems	Sea level rise may lead to saltwater intrusion, which will increase corrosion and lower lifetime of physical assets such as pumps, pipelines,and so forth.
	Construction (or expansion) of water treatment plants	Droughts reduce ability to operate wastewater facilities.
	Rehabilitation and diversion of transmission lines	Storms and floods could damage water distribution and treatment network.
	Construction of dams	Reduced precipitation could render dam projects unfeasible or uneconomic. At the same time, reduced precipitation can be a reason to build a dam when the system is based on groundwater and snow contribution, which are expected to decline due to climate change.
Electricity	Construction of thermal and renewable energy power plants	Warmer temperatures of cooling water reduce plants thermal efficiency, and warmer air temperatures reduce efficiency of solar panels,
	Construction and rehabilitation of hydropower plants	Hydropower plants may suffer substantial disruptions during droughts.
	Upgrade of the power transmission grid	Heat reduces grid efficiency. Increased load due to cooling demand may bring grid to failure or cause load shedding. Violent storms may damage power transmission and the distribution grid.

Table 6.2: Adaptation and Resilience Considerations for Infrastructure Projects Included in Lebanon's Capital Investment Program (CIP)
Source: Original table for this publication.

MAKING RENEWABLE ENERGY A CENTERPIECE OF LEBANON'S ENERGY FUTURE

Lebanon's power sector is dysfunctional, inefficient, and carbon intensive. Also, it is one of the instigators of the current economic crisis. With regular power outages having become a norm, Lebanese often find themselves without access to reliable electricity. This has forced almost all Lebanese households to rely on diesel generators, the market share of which has been constantly increasing since the 1990s. In 2018, diesel generators supplied 37 percent of electricity demand, resulting in almost 40 percent of Lebanon's emissions (around 12 percent of Lebanon's total greenhouse emissions), as shown in figure 6.3. The expansion of the subscription-based diesel generator networks created a complex informal economy that has strongly resisted regulations and reforms (Ahmad 2020). In addition to its inability to meet a large part of Lebanon's electricity demand, EDL, the power utility, is one of the worst performing utilities in the Middle East and North Africa region (Camos et al. 2017). The constant government cash transfers to EDL to cover its deficit have contributed to the ballooning of Lebanon's public debt. Between 2010 and 2018, EDL received more than $14 billion in government subsidies (Credit Libanais 2016). Averaging 3.8 percent of GDP per year and accounting for half of Lebanon's fiscal deficit, Lebanon's power sector is one of the main sources of inefficiencies that have contributed to the current economic crisis.

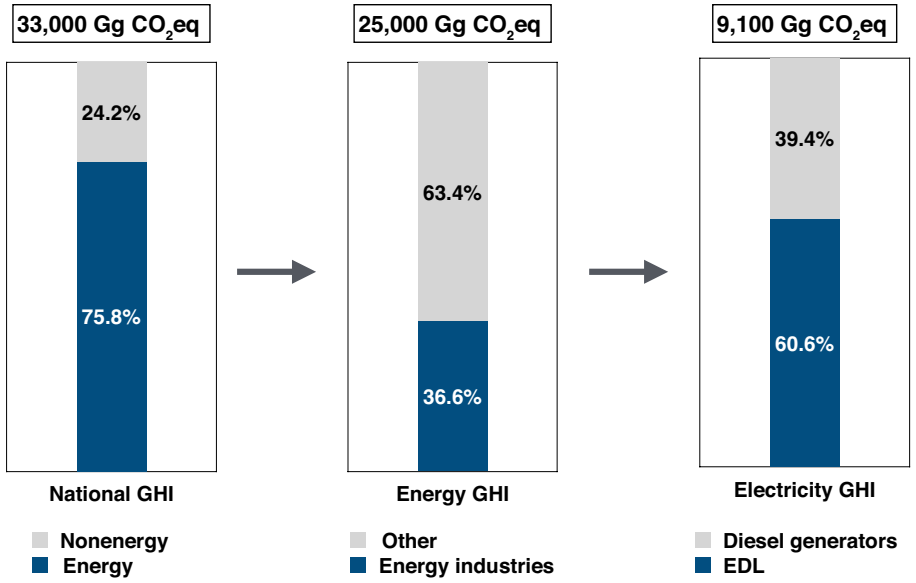

Figure 6.3: Estimate of Total Emissions Contribution of Power Generation in Lebanon
Source: Ahmad 2020.
Note: Gg CO2eq = ; GHI = greenhouse gases inventory; EDL = Lebanon's power utility.

Introducing natural gas and utility-scale renewable energy assets and lowering technical grid losses could reduce the sector's emissions by more than 50 percent while achieving savings that could range between $2.5 billion and $3.6 billion per year. These are well-known reform components that have been thoroughly examined in the Lebanese context (World Bank 2020a). The potential impacts of these interventions, in terms of their emissions and cost savings, are shown in figure 6.4. Replacing the existing heavy fuel oil (HFO) and diesel fuel thermal generation fleet (including diesel generators) with natural gas brings the highest emissions saving potential, with around 26 percent reduction. Next, reaching 30 percent utility-scale renewables in Lebanon's power mix (as per current government policy for 2030) also has a substantial potential, lowering emissions by around 21 percent. Lowering technical losses from their current high level of 20 percent to 10 percent, in line with globally

acceptable levels, would be a low-cost but effective measure. Last, the least-effective intervention would be simply displacing diesel generators while keeping the existing power mix. This would not result in substantial benefits, since the emissions profile of EDL is just slightly better than that of diesel generators (see table B.2, appendix B). These interventions would also result in substantial economic and financial benefits. Currently, EDL's cost of generation ranges between 10.6 and 18.4 cents per kilowatts hour (kWh)[3], which can be used to generate "high" and "low" cost saving scenarios, as shown in figure 6.4. Once again, shifting to natural gas yields the highest cost savings, between $1.4 billion and $2.1 billion, based on the assumption that EDL's short-run marginal cost, postreforms, will reach around 8 cents per kWh (see table B.2, appendix B). Renewables, particularly solar photovoltaics (PV), are already cost competitive in Lebanon, without government subsidies. A recent study of the potential of utility-scale solar PV in Lebanon's Bekaa region has estimated a cost range of below 6 cents per kWh (Ayoub and Boustany 2019).

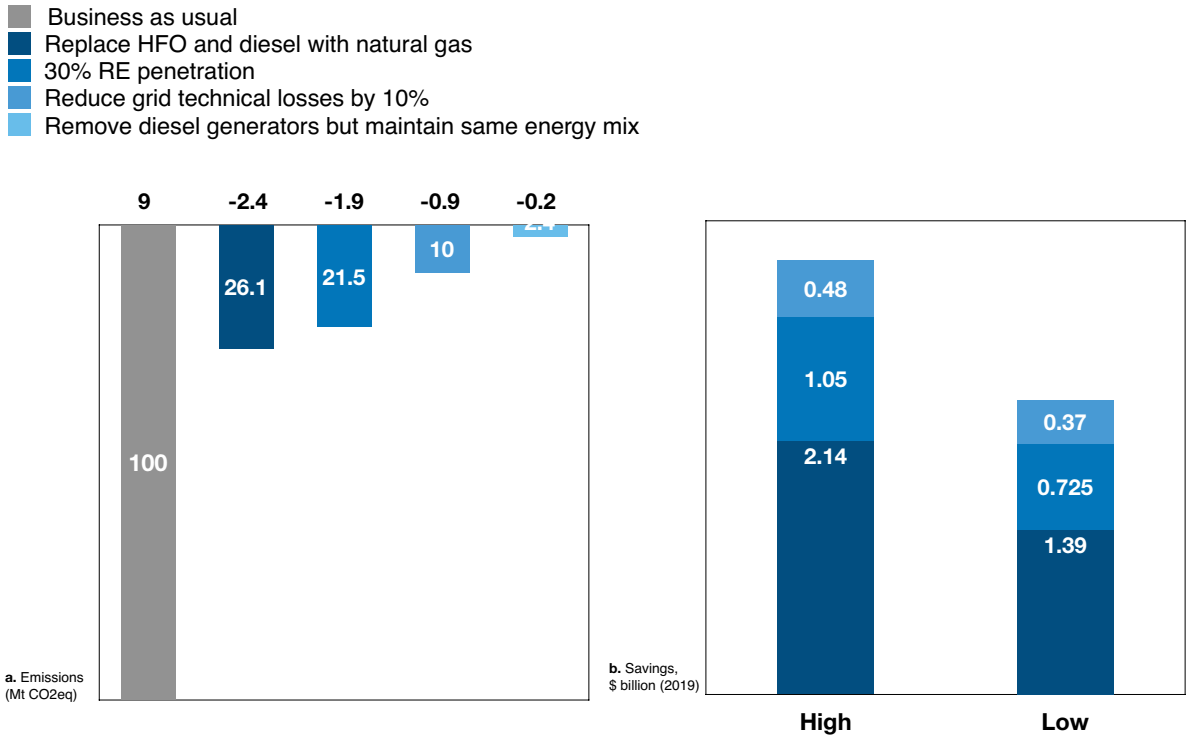

Figure 6.4: Potential Reduction in Lebanon's Electricity Sector Greenhouse Gas Emissions and Potential Savings per Year

Source: Original figure for this publication.

Note: Figure assumptions are listed in table B.2, appendix B. HFO = heavy fuel oil; RE = renewable energy; Mt CO2eq = million tons carbon dioxide equivalent.

Alongside utility-scale RE projects, distributed solar PV systems offer Lebanon immediate energy security benefits amid a looming prospect of severe disruptions to EDL's operations. According to a recent World Bank study, solar PV-based distributed energy systems, which can be adopted on various scales, from the household (rooftop) to larger municipal projects, are cost effective with the current costs of procuring electricity via private diesel generators (Ahmad 2020). In the medium and long terms, distributed RE systems could also benefit EDL as they might reduce required grid investments and the capital needed for installing day-peaking capacity. In addition to economic benefits, distributed RE systems are inherently more resilient than centralized power stations, since energy consumption is very close to where electricity is being generated. Lebanon already has thousands of private diesel generators. Adding distributed solar PV systems in a hybrid mode offers a compelling financial case, especially for commercial and industrial consumers (Ahmad 2020).

CHAPTER ENDNOTES

[1] On the downside, according to the current Lebanon Environmental Pollution Abatement project (LEPAP), Lebanon's wine industry has been identified as one of the highest polluting industries in Lebanon, along other agrifood businesses such as dairy, brewery, and food processing.

[2] It is important to note that, on the mitigation side, the use of fertilizers in Lebanon's wine farms and other agricultural activities is highly encouraged. Lebanon reports higher levels of fertilizer use than other countries with similar agroclimatic conditions. Fertilizer overuse contributes to greenhouse gas emissions, and excessive and inappropriate (ill-timed) application of pesticides reduces the quality of production and limits exports from entering markets that impose strict food safety and sanitary and phytosanitary standards.

[3] Based on an average oil price of $64 per barrel in 2019. As EDL's costs of generation depend on international oil prices, kilowatt hour costs can be much higher in high oil price cycles.

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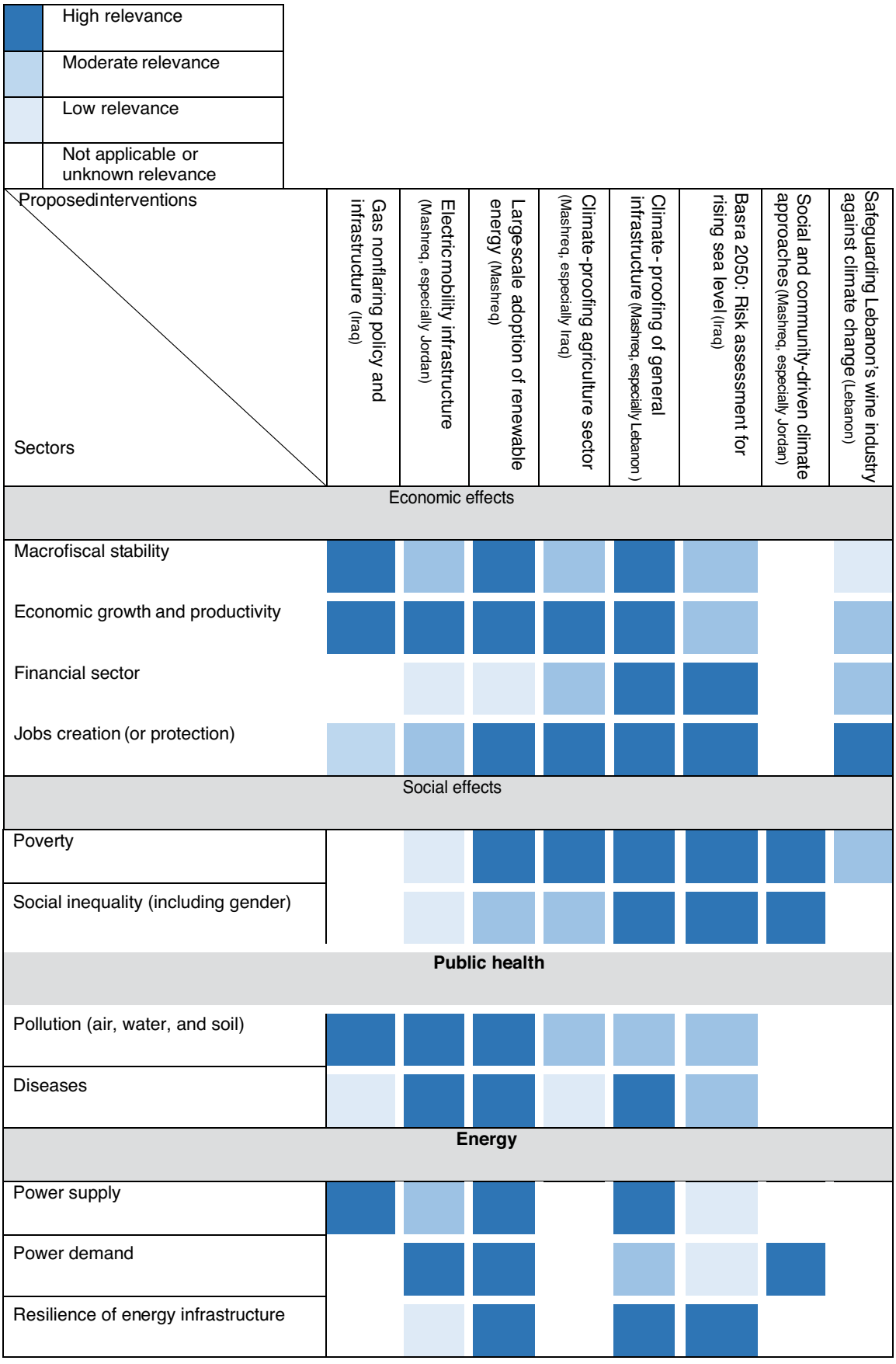
7. CROSS-SECTORAL OPPORTUNITIES

In Mashreq countries, cross-sectoral approaches can lead to higher levels of effectiveness in addressing the impacts of climate change. Globally, interdependencies among different resources and services such as food, water, and energy are strong (FAO 2014). In Mashreq, climate change compounds the existing stresses on the food-water-energy nexus created by population growth and increased urbanization (Farajalla, Haydamous, and Hajj 2016, 25). Consequently, an efficiency gain in one sector will likely be reflected positively in other sectors. For example, dealing with water stresses in Iraq's agriculture sector could result in a higher share allocated to urban areas, where shortages of municipal water are increasing. On both the mitigation and adaptation levels, cross-sectoral approaches offer real entry points, not only to maximize the return on investments of proposed interventions, but to also to promote coherent climate policies, regulations, and plans (England et al. 2018). At the same time, the lack of policy coherence and cooperation among different sectors and institutions, which is prevalent in Mashreq, could have a detrimental effect on advancing climate action. If implemented poorly, cross-sectoral approaches could entail the risk of diffused responsibilities, slowing progress.

Despite the sectoral opportunities discussed in this report, there are strong cross-sectoral opportunities that can be leveraged to maximize the impact of the proposed interventions. Table 7.1 shows a matrix of cross-sectoral opportunities of the proposed climate action interventions outlined in this report. It highlights the rationale to "think cross-sectoral," since all of the proposed interventions are at least highly connected to two or more sectors or policy domains. The following paragraphs discuss in more detail some of the important aspects cross-sectoral approaches in designing climate interventions in Mashreq


High relevance
Moderate relevance
Low relevance
Not applicable or unknown relevance
Proposed interventions
Sectors
Gas non-flaring policy and infrastructure (Iraq)
Electric mobility infrastructure (Mashreq, especially Jordan)
Large-scale adoption of renewable energy (Mashreq)
Climate-proofing agriculture sector (Mashreq, especially Iraq)
Climate-proofing of general infrastructure (Mashreq, especially Lebanon)
Basra 2050: Risk assessment for rising sea level (Iraq)
Social and community-driven climate approaches (Mashreq, especially Jordan)
Safeguarding Lebanon's wine industry against climate change (Lebanon)
Economic effects
Macrofiscal stability
Economic growth and productivity
Financial sector
Jobs creation (or protection)
Social effects
Poverty
Social inequality (including gender)
Public health
Pollution (air, water, and soil)
Diseases
Energy
Power supply
Power demand
Resilience of energy infrastructure

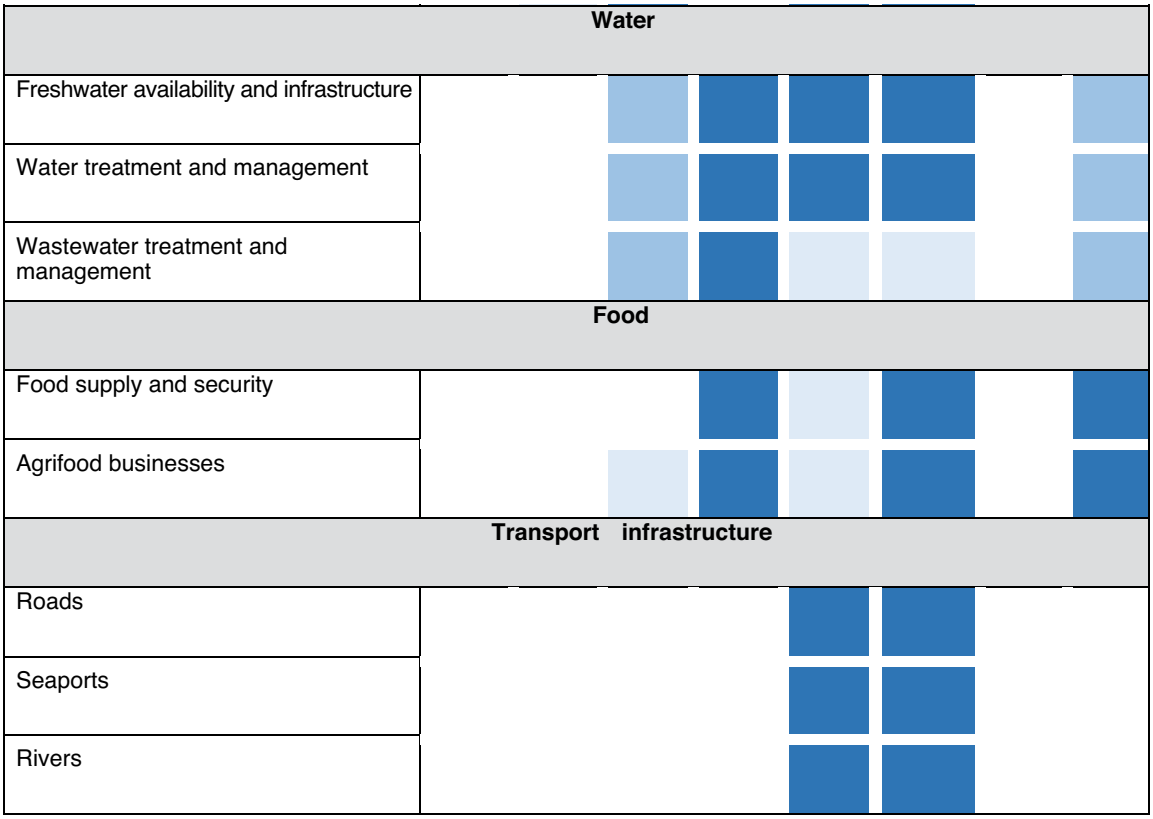


Table 7.1: Matrix of Cross-Sectoral Impacts of the Proposed Climate Action Interventions in Mashreq
Source: Original table for this publication.
Note: PV = photovoltaic.

The application of climate-smart agriculture in Mashreq (especially in Iraq) can induce cross-sectoral benefits, especially in dealing with water scarcity. Efficient, technology-based, irrigation and drainage systems are a powerful response to the increasingly irregular precipitation in the region (Bhattacharyya, Pathak, and Pal 2020). Treated wastewater can be utilized for irrigation, especially in countries with scarce water resources. In Jordan, treated wastewater represents around a quarter of the total water use in the country. Additionally, Mashreq countries can benefit from the expansion of vertical farming, hydroponics, and aquaponics to improve their water-use productivity. It should be noted that mitigation benefits (via carbon sequestration) can be achieved in all three countries through improved soil management. Already, widespread desertification affects 75 percent of the Iraq's land and has resulted in the loss of about 100,000 square kilometers of arable land annually, forcing many Iraqis to abandon their land[1].1 Nearly 79.6 percent of Jordan's land has been affected by desertification and another 11.2 percent is vulnerable to desertification. In Lebanon, desertification affects an estimated 40 percent of all land.

The refugee crises in the region adds additional pressure on natural resources and calls for the climate-smart transformation of the agrifood sector. Additional benefits of improved soil management and increased organic carbon additionally include improvement of soil quality through increased retention of water and nutrients, resulting in greater productivity of plants and soil structure, which reduces erosion, leading to improved quality in groundwater and surface waters.

The scaling up of renewable energy in Mashreq is expected to result substantial economic and socioeconomic benefits while it responds to the existing energy crisis in Iraq and Lebanon. As discussed in chapter 6, the incorporation of utility-scale renewables would, not only substantially reduce Lebanon's emissions, but achieve substantial hard currency savings, which would depend on oil prices but can be up to US$200 million for each terawatt-hour per year.[2] It is important to highlight the public health benefits of renewable energy, especially in Iraq and Lebanon, where diesel generators are widely used. In Lebanon, the thousands of diesel generators are spread across the country, but they are most concentrated in dense population centers. Their spatial concentration and emissions profile have been shown to negatively affect public health through various pathways,

from the known increased exposure to carcinogens to the more subtle noise-related illnesses (Nakhlé et al. 2015; Passchier-Vermeer and Passchier 2000; Shihadeh et al. 2013). In fact, emissions by EDL (the country's power utility) are not much better than those of diesel generators, and the utility's thermal power generation fleet is a major emitter that has been linked to serious air pollution and, consequently, health impacts (Salloum et al. 2018).

Designing for climate-resilient cities is intrinsically cross-sectoral and can go a long way in achieving economic and social benefits. The case of Iraq's Basra city, which is discussed in "Basra 2050: Risk Assessment For Rising Sea Level" in chapter 4, is an example of the urgency to make climate resilience a priority in the region. A review of the existing development literature shows that well-planned early adaptation can save money and lives later (Saghir 2020, 6). The intrinsic cross-sectoral benefits of building resilient cities and communities include efficient use of energy and water through modern, technology-based planning and construction, protecting food and water resources, and many others.

Climate change has a differentiated gender impact. Climate action in Mashreq can be leveraged to lessen gender inequalities. Table 7.1 indicates the degree of connection between the proposed climate interventions in Mashreq and achieving desired social change, including addressing gender inequalities. For example, in the agriculture sector, women farmers are more exposed to climate risks than men since women have less productive farms; have less access to information, services. and climate financing opportunities; and are less mobile.[3] Also, migration of men, possibly triggered by climate shocks, increases the stress and security risks of female partners left behind, who are usually tasked with maintaining agricultural production in an increasingly climate-stressed environment.

CHAPTER ENDNOTES

[1] The source for the information in this and the following paragraph is the World Bank Middle East and North Africa (MENA) Agriculture and Food team.

[2] This estimate is based on a cost differential of US$0.20 per kilowatt hour between thermal and solar-photovoltaic power generation in Lebanon

[3] Information from the World Bank MENA Agriculture and Food team

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8. REGIONAL OPPORTUNITIES

BENEFITS AND CHALLENGES OF REGIONAL CLIMATE ACTION APPROACHES IN MASHREQ

Climate change is a regional challenge with cross-border economic and social implications. As discussed in chapter 3, Mashreq countries are set to face common climate-related challenges, the most important of which are the exacerbation of water and food insecurities and further weakening of vulnerable infrastructure. Although the localized impact of climate shocks will depend on factors beyond the severity of climatic effects, such as each country's degree of resilience and preparedness, the regional interconnectivity will likely result in spillover effects from local climate crises that could impact the entire region and beyond. This would be particularly relevant in the case of a climate-induced crisis that could trigger a new wave of large-scale displacement. The Syrian refugee crisis is a recent example of how localized fragility and conflict can have a substantial regional impact. Syria's neighbors (Iraq, Jordan, and Lebanon) have suffered a heavy economic and social toll due to the Syrian conflict. While not directly attributable to the Syrian conflict, as of 2020, the combined gross domestic product (GDP) of Iraq, Jordan, and Lebanon has been reduced by 11.3 percentage points in real terms compared to their preconflict (2010) GDP (World Bank 2020).

Regional cooperation is key to accelerating climate mitigation and adaptation in Mashreq. However, the low level of regional integration and lack of regulatory harmonization are serious obstacles. So far, it would be fair to say that climate action in Mashreq is dominated by country-specific approaches with very little regionalization. Based on the global experience, the degree of success of regional approaches to climate change on the mitigation and adaptation fronts seems to primarily depend on three factors: the level of regional integration, the presence of empowered supranational regional bodies, and the degree of regulatory harmonization (Agrawala et al. 2014). Mashreq—and the wider Middle East and North Africa (MENA) region—lags in these factors (see "Challenges" in table 8.1).

Benefits	Challenges
Aggregating impact: Cross-country efforts open new pathways for cumulative impact that can complement national climate strategies.	**Low level of integration:** It has implications of uniformity of regulations, market access for climate-services, and perceived cobenefits.
Sharing burden: Climate disasters can strain the abilities of any country. Collective efforts can provide shared resources in times of need.	**Weak regional institutions:** Lack of willingness to transfer sovereignty to regional bodies is a global challenge.
Ensuring commitment: Regional climate initiatives signal long-term commitment and a new internal policy discourse.	**Strained economies:** It Primarily manifests itself as lack of liquidity to invest in sectors or projects perceived as non-priority.
Promoting cooperation: Regionalization of climate action can itself be a means of diplomacy to build trust and advance peace.	**Political fragility:** Unstable politics leads to unstable policy making. Presence of sanctions on some countries complicates regional approaches.

Table 8.1: Benefits and Challenges of Regional Climate Action Approaches
Source: Original table for this publication.

Despite its political and economic challenges, Mashreq has a great potential for cooperation on climate action on various levels. The cross-border nature of climate-related threats and challenges calls for transnational cooperation and joint initiatives. Regional approaches can open new, often overlooked, pathways for mitigation and adaptation measures (see "Benefits" in table 8.1). Climate initiatives can also play an important role in strengthening regional cooperation beyond climate change by leveraging "science and climate diplomacy." Figure 8.1 shows the different levels of regional cooperation on climate action that can be attained with increasing levels of regional integration and complexity, which will be discussed in more detail in the following sections.

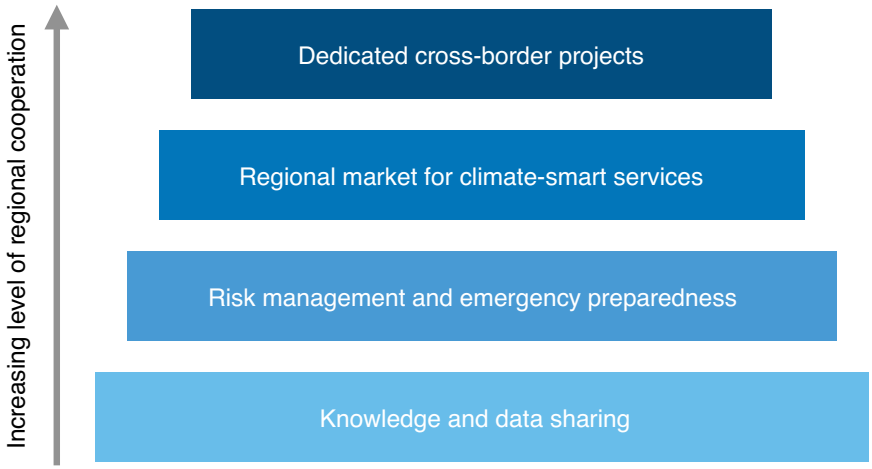

Figure 8.1: Levels of Regional Cooperation on Climate Action
Source: Original figure for this publication.

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CLIMATE KNOWLEDGE PRODUCTION AND SHARING

Despite the large deficit in research funding and limited resources, knowledge production around climate-related issues is growing in Mashreq. Two recent mappings of climate-change research in the Arab world have shown that research productivity in climate-related fields in the region is growing at an increasing rate (SH. H. Zyoud et al. 2017; Shaher H. Zyoud and Fuchs-Hanusch 2020). One of the possible ways to promote cross-border science and policy collaborations in Mashreq would be to create a climate-dedicated research grant facility that would require collaboration between different institutions in different Mashreq countries. The priorities of such a research fund could change according to the region's scientific and policy needs. Since climate change, as an academic topic, is a highly interdisciplinary topic, many research groups and institutions might benefit from the existence of such a facility.

Climate data and tools of data sharing and visualization are becoming increasingly available for Mashreq countries. However, there is little evidence that the assessments produced are coordinated with relevant institutions and fed into policy formulation. The World Bank's Climate Change Knowledge Portal, which has been utilized to generate part of the analysis in this report, is a one-stop shop for comprehensive climate-related data (historical and projections), tools, and information. More specific to countries in the region, the United Nations United Nations Economic and Social Commission for West Asia (UN-ESCWA) and the League of Arab States created the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region. The initiative also provides a comprehensive data portal with various functionalities that aim to assist with evaluating climate change impacts in the Arab region, with a focus on water resources (Tomaszkiewicz 2020).

Although climate data is becoming increasingly available, sharing of information, know-how, and good practices among Mashreq countries remain limited. Beyond the scope of the regional workshops often conducted by international donors and bodies such as UN-ESCWA, there is very little sharing of policy experiences among Mashreq countries. This siloed, inward-looking approach

results in missed opportunities to promote common good in a region that needs all the help possible. Regional openness toward a more collective policy and increased scientific and technical cooperation would accelerate climate action through the exchange of accumulated scientific and technical expertise, particularly in key common sectors such as agriculture and agrifood, water, and energy. Additionally, Mashreq countries face similar socioeconomic challenges that stand in the way of the adoption of sensitive policy reforms, such as the removal of energy subsidies. Although the political economy of each Mashreq country is unique, an exchange of approaches and policy instruments on citizen engagement and overcoming public resistance to reforms would be especially valuable. As will be discussed in the following sections, having a baseline of comprehensive data and information sharing in Mashreq is paramount to the success of any transnational initiatives on climate mitigation and adaptation.

RISK MANAGEMENT AND EMERGENCY PREPAREDNESS

Climate-linked disasters do not respect national borders. Regional cooperation on climate risk management and emergency preparedness is both a necessity and an achievable goal under the current political and economic environment in Mashreq. As was shown by the Beirut Port explosion, the latest disaster in the region, coping with large-scale disasters requires concerted efforts and engagement by all neighboring countries and stakeholders. Given the region's strained economies and existing social fragility, climate-linked disasters could well overwhelm the capacity and resources of impacted countries. The need for disaster risk management and preparedness measures, be they climate related or otherwise, has been well covered in the policy and international development literature. The intensifying effects of climate change have prompted governments and development agencies to give more serious thought to incorporating regional frameworks to deal with climate risks. One example is the Regional Cooperation on Climate Change Adaptation and Disaster Risk Reduction in South Asia (see Box 8.1).

Box 8.1: South Asia Disaster Knowledge Network (SADKN)

SADKN is a web-based platform created by the South Asian Association for Regional Cooperation's Disaster Risk Center with the support of the United Nations Office for Disaster Risk Reduction and the Global Facility for Disaster Reduction and Recovery. SADKN aims to collect and share information on hazards, vulnerabilities, risks, and disasters in member states. In terms of climate-related risks, SADKN provides a real-time weather and disaster dashboard and a digital vulnerability atlas with layers of digitalized visuals on administrative boundaries, physiographic features, housing, and critical infrastructure.

Establishing regional early-warning systems is a low-cost initiative that can promote climate adaptation and resilience, disaster management, and sustainable development benefits. According to a 2015 report by the United Nations Office for Disaster Risk Reduction, the vast majority of recoded major natural hazards disasters between 1995 and 2015 were linked to climate and weather events such as floods, storms, and heatwaves (UNISDR 2015). Consequently, early-warning systems have been receiving increased attention on the national, regional, and even global levels in recent years (Pozzi et al. 2013; UNDP 2018). In Mashreq, early-warning systems can build on the knowledge-sharing facilities previously discussed to provide timely disaster-monitoring information in a systematic way, promoting climate resilience in the region. Beyond climate threats, an early-warning system and emergency preparedness can also be effective in addressing other risks, such as those associated with the increased spread of pests and diseases.

In Mashreq, drought and flood early-warning systems are of particular importance because the region is already feeling the impact of these disasters. Refugees—particularly women and children—are among the most vulnerable to floods caused by heavy rainfall. In 2019, intense floods killed six refugees in Turkey and one in Lebanon as their camps were inundated (Middle East Monitor 2018; UNHCR 2019). On the other hand, droughts create threats to food security and livelihoods, and the adoption of drought early-warning systems is aligned with the sustainable development goals (SDGs). These systems, if implemented effectively, can reduce the risk of property and income loss by vulnerable groups, thus reducing poverty (SDG 1) as well as mitigating food security shocks (SDG 6). Regional cooperation could also strengthen cooperation among riparian countries and improve transboundary water-sharing agreements to address existing and future impacts of climate change on water availability.

REGIONAL MARKET FOR CLIMATE-SMART SERVICES

Climate services and regional trade have a bidirectional relationship; an improvement in one is likely to positively affect the other. Climate services can be an entry point for promoting regional trade and achieving higher integration benefits in the long term. At the same time, regional trade might need to be enhanced to adopt climate-friendly technologies based on other countries' experiences; each would build on its own comparative advantage. Global experience with regional trade agreements has shown that the purpose of such agreements can go beyond the objective of advancing regional integration. For example, the mandates of MERCOSUR, the Southern Common Market of South America, and ECOWAS, the Economic Community of West African States, have included other shared concerns of their respective member states, such as fighting drug trafficking and corruption (Gehring et al. 2013, 51). Similarly, climate change can now be added as a major shared concern in many regions around the world, including in Mashreq. Climate change and regional trade have a bidirectional relationship. On one hand, climate-linked extreme weather conditions and disasters often impact the supply pattern of agricultural production and the transportation infrastructure. On the other hand, regional climate-sensitive trade and regulations can advance common good through the use of shared resources, harmonized regulations, and greater ease of knowledge transfer (Monkelbaan 2014). Beyond Mashreq, Jordan and Lebanon fall within the European Union Neighborhood Policy. As such, there is an opportunity to learn from and expand to EU countries, and potentially export green goods to the EU economic zone. The EU Carbon Border Adjustment Mechanism (CBAM), developed in the context of the European Green Deal, will be operational by the end of 2022. The EU CBAM would place a carbon price on certain imported goods from outside the EU to reduce the risk of "carbon leakage" (EU 2021).

Jordan's experience with climate change, accumulated experience, openness and market readiness, positions it for a regional role in provide climate knowledge and services. As discussed in chapter 5, Jordan has emerged as a strong climate action leader in Mashreq and the wider MENA region. The kingdom has demonstrated a deep commitment to regional efforts through its promotion of technical cooperation in science and technology. For example, Jordan is the host of Synchrotron-light for Experimental Science and Applications in the Middle East, one of the important research centers with a regional mandate. Similarly, Jordan can play a pivotal role in pushing the regional climate agenda forward by hosting and/or coordinating regional institutions and efforts.

POWER POOL

Clean electricity trades would help Mashreq countries respond to their energy needs and reduce costs while integrating a higher share of renewables and, consequently, cutting down emissions. Grid interconnections between Mashreq countries already exist (see figure 8.2). However, electricity trade capacity is not utilized to its potential. If expanded, alongside a deeper adoption of renewable energy systems, regional electricity trade could become an anchor of economic growth in the region (Bjerde 2019). This would directly improve the integration of renewables into the energy mix in these countries, which is largely dependent on fossil fuels, while reducing power-generation costs and cutting down emissions in the process. Although some of the prerequisites of a regional electricity market—such as harmonization of grid codes—have already been achieved, several challenges remain. First, the presence of trade restrictions hinders electricity trade potential. Second, pricing mechanisms need to be coordinated, ideally, reflecting the share of renewables in the mix and supply and demand factors. Third, the expansion of grid interconnection capacity would require large investments in physical assets at a time when regional economies are struggling. However, if these expansions are linked with a shift toward a green electricity market, more financing opportunities would likely be available.

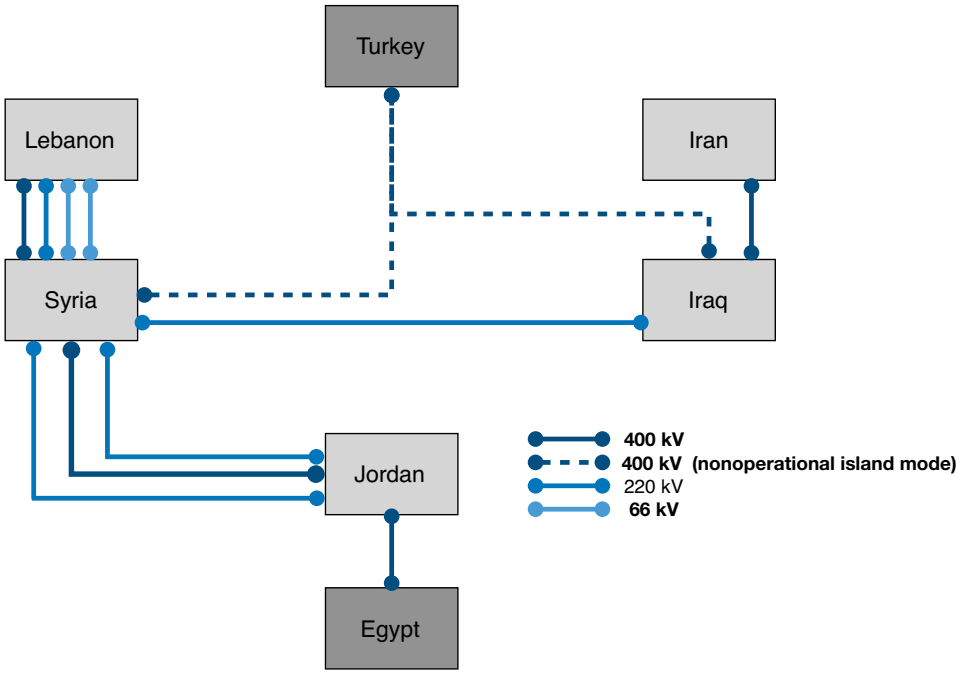


Figure 8.2: Existing Electricity Grid Interconnections in Mashreq
Source: Adapted from World Bank 2013.
Note: kV = kilovolt.

Besides clean electricity, there are other climate-friendly services that could be expanded regionally in Mashreq. These services include, but are not limited to, low-carbon transport, waste management, climate-smart agriculture, and advisory services. Allowing the flow of green services with minimal protectionism and legal barriers would encourage the private sector in Mashreq to shift toward investing in green sectors as it considers the wider regional market. This would also contribute toward a more integrated and connected region.

DEDICATED REGIONAL INITIATIVES AND PROJECTS

Dedicated regional initiatives in Mashreq can be designed to complement national climate agendas, advance development goals, and bring economic benefits. Given the region's climate vulnerabilities, dedicated initiatives and projects should focus on adaptation. Once a satisfactory level of regional climate cooperation is achieved (possibly through the mechanisms discussed in sections 9.2, 9.3, and 9.4), more ambitious dedicated projects can be envisaged to step up the region's climate response. In what follows, three examples of dedicated regional mechanisms are proposed.

VOLUNTARY REGIONAL CARBON MARKET

The carbon market remains an unutilized instrument to reduce greenhouse gas emissions and attract climate financing in Mashreq. Carbon markets are a recognized instrument to lower emissions through regulation and pricing mechanisms. Although there is no established carbon market or pricing mechanism in Mashreq as of 2021, some foundational activities related to carbon auditing and monitoring, reporting, and verification (MRV) have already taken place in countries such as Jordan and Lebanon. Although Iraq, Jordan, and Lebanon make a relatively small contribution to global emissions, the adoption of a

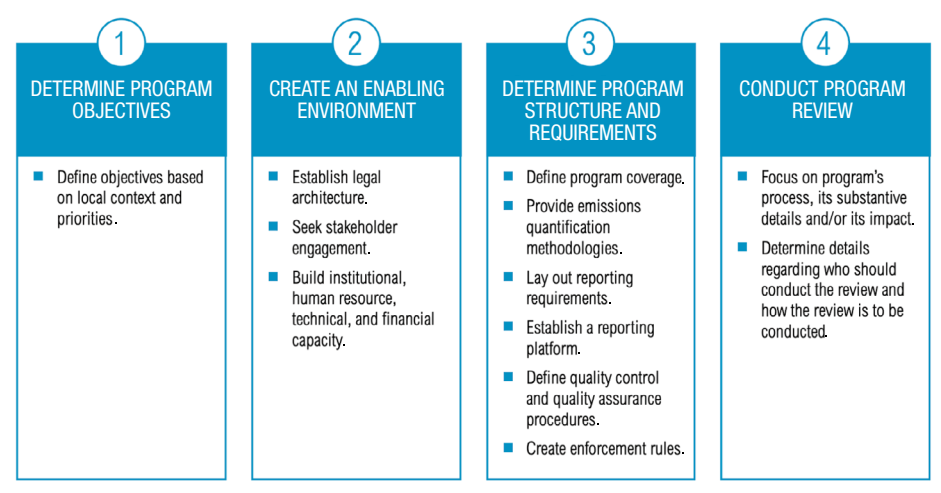
voluntary carbon market could unlock significant benefits, such as channeling private financing to hard-to-finance climate projects, which can have their own co-benefits, such as jobs creation and promoting a just transition. The voluntary (as opposed to compliance-based) nature of such markets fits well with Mashreq's economic and policy contexts. Although the concept of carbon-credit trading has been around for a long time, voluntary carbon markets have gained increasing attention in recent years through deeper involvement of emitting corporations (McKinsey 2020).

Given Jordan's advanced climate action, it is uniquely positioned to initiate a national voluntary carbon market that can be expanded to a regional level at a later stage. For carbon markets (voluntary or compliance based) to function properly, they require rigorous governance and transparency mechanisms that minimize error and fraud risks. Consequently, having effective MRV mechanisms is imperative. In this regard, Jordan presents the most advanced context, given the support it has received so far under the Partnership for Market Readiness (PMR) platform (box 8.2). The PMR collaboration has allowed Jordan to build capacity in designing and implementing a multitiered MRV framework (PMR 2018). As similar technical and policy capacity is reached in other countries in the region, Jordan's voluntary carbon market can be expanded to become a regional one. Clearly, this would require a high level of coordination on the regulatory, pricing, and MRV aspects. Therefore, it is important that the Jordanian experience be constantly shared with other regional partners, even if they are not envisioning getting involved in carbon markets anytime soon.

Box 8.2: Partnership for Market Readiness (PMR)

The mandate of the PMR initiative is to help countries develop pilot mechanisms and systems to design and implement carbon pricing and markets. These tools include setting greenhouse gas (GHG) reduction goals, undertaking emissions auditing, and developing MRV instruments.

Figure B.8.2.1 : PMR's Framework (or Steps) toward Establishing a GHG Reporting Program



Source: PMR, 2020

CROP MIGRATION

Crop migration could form an effective, low-cost, climate adaptation initiative that would contribute to higher regional food security and integration. As discussed in the country outlook chapters, climate change is already harming agricultural productivity in Mashreq and is projected to cause deeper disruptions in the future as extreme climatic effects intensify. However, climate change may have different impacts on different parts of the region. As some areas become less suitable for certain crops, they may

become suitable for others. Crop migration (change in crop choices, irrigation use, expansion, and abandonment), particularly in rainfed crops, may present a potentially effective, cross-border adaptation mechanism (Sloat et al. 2020). Clearly, the adoption of such a dedicated mechanism requires specific prerequisites, including having a high level of regional coordination, regional agreements, and extensive analytical work on how and where crops could be migrated.

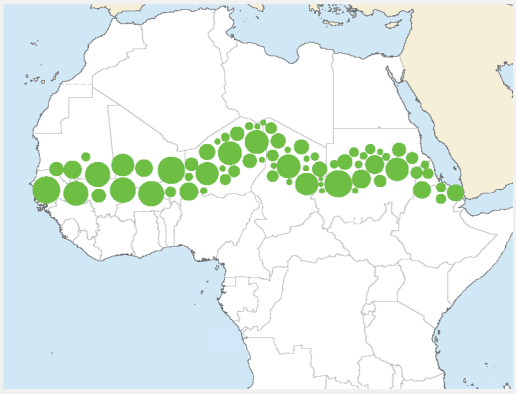
REGIONAL (RE)FORESTATION

Regional forestation initiatives could be a simple way to establish climate adaptation and mitigation benefits while creating job opportunities in underdeveloped areas. (Re)forestation has already been identified as one of the key climate interventions in Mashreq (see table 0.1 in the executive summary). The role of (re)forestation on the mitigation side is well-documented; on adaptation, forests contribute to creating ecosystems that reduce climate vulnerabilities (Locatelli et al., 2011). Although such initiatives are usually approached from a national perspective, having a coordinated regional initiative would offer more impetus, attention, and funding opportunities. One example in this context is Africa's Great Green Wall (see 8.3), an initiative through which 21 African countries have committed to restoring 100 million hectares of land by 2030, creating 10 million green jobs in the process (Nature 2020). Despite the inclusion of (re)forestation in Mashreq's climate action proposals, such efforts remain modest in scale[1]. Unlike the sparsely inhabited regions in the African Great Green Wall model, about half of Mashreq's population still lives outside urban centers (UNESCWA 2016). This demographic distribution highlights the importance of the job creation cobenefit of (re)forestation projects in the region, which could also contribute toward lowering economic displacement and migration.

Box 8.3: Africa's Great Green Wall

Africa's Great Green Wall is an ambitious initiative to plant 7,000 kilometers from west to east Africa. The audacious experiment aims to combat drought and desertification. Although the idea's effectiveness in achieving these benefits has been met with someskepticism (Watts 2020) , the little progress made so far has resulted in rehabilitating around 4 million hectares of land and created 350,000 jobs (Nature 2020). In January 2021, the project received a new funding pledge of $14.3 billion from the World Bank, African Development Bank,and France. See map B3.8.1.

Map B8.3.1: Visualization of Africa's Great Green Wall



CHAPTER ENDNOTES

[1] In March 2021, however, the kingdom of Saudi Arabia launched the Middle East Green Initiative to plant an additional 40 billion trees, which the prince said would be the world's largest reforestation program.

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9. ANALYSIS NEEDS FOR CLIMATE POLICY IN MASHREQ

There is a wide analysis and knowledge gap pertaining to the economic and social cobenefits of climate action in Mashreq. This report is an attempt to identify climate action entry points in Mashreq, and its country and sectoral analyses are preliminary. More in-depth analysis will be required to assess the costs and benefits of the identified niche interventions. Additionally, extensive assessment of important factors such as the political economy environment would be imperative to determine the feasibility of those interventions. Across the three Mashreq countries examined, information included in national climate plan communications and documents tends to focus on primary goals of emission savings and the vulnerability of identified priority sectors for adaptation. These documents demonstrate limited evidence on the economic and social multipliers of climate-smart development.

The climate action analysis and research agenda needs to be sensitive to the region's socioeconomic profile and speak directly to governments priorities. Post-COVID-19, Mashreq countries' priorities need to focus on restarting economic activities, creating jobs, and reducing spending. This chapter aims to identify the analysis gaps that need to be covered by evidence-based research to advance the understanding of Mashreq's climate policy space and possibilities and how they connect with these priorities. Additionally, for a region with pronounced socioeconomic disparities, the contribution of analysis toward understanding the direct links between climate action and social resilience and cohesion would also be particularly valuable.

Three analysis needs stand out in Mashreq: (1) understanding the political economy impediments to climate action and pathways to address them, (2) quantifying private sector climate risks and opportunities, and (3) assessing the prospects of a regional market for climate services. The analysis presented in this report and the corresponding literature review have allowed for a better view of the research gaps on climate policy issues. Table 9.1 summarizes the analysis venues with the highest potential to inform climate policies in Mashreq, based on the sectoral priorities that have been identified at the national and regional levels. The presented analysis in this report can be used only for indicative purposes. Further assessment and research are required to refine the approach that has been followed and the identified interventions, with more comprehensive analyses that includes fewer generic components and subcomponents and more specific indicators. Consequently, the identified research priorities summarized in table 9.1 are linked to one or more of these analysis needs.

Theme	Identified analysis gap
Political economy and social justice considerations of climate action in Mashreq	• What are the competing interests of climate action in Mashreq?
	• How can we ensure a just transition to a low-carbon future in Mashreq and avoid stranded workers and communities? • How can we promote gender equality in the design of climate policies and projects in the region?
Climate action as a tool to protect and create jobs	• What share of Mashreq's workforce is employed by major emitting industries? • How did other countries leverage climate action to create jobs? for example, India's Mahatma Gandhi National Rural Employment Guarantee Act (India MRD) and Brazil's Bolsa Verde ("green grant") program (Brazil MMA)
Quantifying the economic and business case for building a climate-resilient infrastructure	• How are Mashreq's power and water utilities exposed to extreme weather events and what can be done to improve their resilience and response plan? • What existing and proposed infrastructure proje cts in Mashreq are at highest risk? • How would integrating climate considerations and risks into the design of infrastructure project affect their business case? • What has been the reported experience of other countries?
Resilience and climate risk management for the private sector in Mashreq	• What are the climate risks that will affect businesses in Mashreq? • How would different industries and/or businesses in Mashreq be impacted by the different types of climate risks?
Climate services and private sector opportunities	• What is the regional market demand for climate services in Mashreq? • To what extent can these markets be expanded at the regional level? What policies and/or frameworks need to be adopted to facilitate that? • Can Mashreq countries leapfrog into specific types of climate services? What are they?
Lowering the carbon footprint of Mashreq's oil and gas industry	• What are the causes ofMashreq's high share of flaring emissions? Is it routine or nonroutine flaring? • What are the economic benefits of capturing flared gas in Iraq? • What are the other options available for Mashreq's oil and gas sector to lower it carbon emissions? For example, use of renewables as power source.
Dedicated regional climate initiatives and integration	• What are the regional initiatives that have the highest chances of success? • What innovative regional projects can be proposed?
	• What are the impediments of regionalized climate action? How can these challenges be addressed?

Table 9.1: Research and Analysis Gaps Related to Mashreq's Climate Policy Space
Source: Original table for this publication.

CHAPTER ENDNOTES

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APPENDIX A: DETAILED SELECTION FRAMEWORK COMPONENTS

		Policy objective	Economic impact		Feasibility			
Intervention	**Country**		**Economic need**	**Job-creating potential**	**Cost-effectiveness**	**Political economy impediments**	**Technical capacity**	**Institutional capacity**
Mitigation interventions								
Gas nonflaring policy and infrastructure	Iraq	Yes	Yes	2.2[a]	20[b]	High	Moderate	NA
Electric mobility infrastructure	Jordan	Yes	Yes	7.3[c]	282[d]	Low	Moderate	High
Large-scale adoption of renewable energy	Lebanon	Yes	Yes	7.2	33[e]	High	Moderate	Moderate
Adaptation interventions								
Climate-proofing agriculture sector	Iraq, Lebanon	Yes	Yes	18	NA	Low	Variable	High
Climate-proofing of general infrastructure	Lebanon	No	Yes	Variable but high[f]	NA	Moderate	Low	Moderate
Regional interventions								
Climate knowledge and data sharing	Mashreq	No	Yes	NA	NA	Low	High	High
Risk management and emergency preparedness	Mashreq	No	Yes	NA	NA	Moderate	Low	Low
Regional market for climate services	Mashreq	No	Yes	NA	NA	High	Low	Low
Dedicated cross-border projects	Mashreq	No	Yes	NA	NA	High	Low	Low

Table A.1: Numerical Components of Table 0.2
Note: NA = not applicable.

a. 2.20 full-time-equivalent jobs on average (0.70 direct plus 1.49 indirect).
b. Based on Gillingham and Stock 2018.
c. Conservative estimate, value can be as high 21 jobs per $1 million spent (IEA 2020a).
d. Value obtained from Jordan's TNC document
e. Based on IEA 2020b.
f Numbers range from 66 direct jobs per $1 million (roads and bridges) to 7.3 (transport and communications) based Lebanon's data obtained from Estache et al. (2013) then adjusted for inflation.

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APPENDIX B: TABLES OF ANALYSIS ASSUMPTIONS

Parameter	Value	Source/comment
Transport sector emissions in 2015	8 million tons carbon dioxide (CO_2) equivalent	IEA 2020
Share of emissions from private passenger cars	57%	UNFCCC 2014
Number of private passenger cars in Jordan in 2015	1.35 million	Obeidat 2015
Annual growth rate of private passenger cars in Jordan	2%	Jordan's TNC used 1%; other sources used 3% and 5%
Emissions per car	8 x 0.57 / 1.35 = 3.3 tons CO_2 per year	
Emissions factor of HV with medium-low carbon grid (50% gas, 50% RE)	0.42	McLaren et al. 2016
Emissions factor of HV with medium carbon grid (80% gas, 20% RE)	0.47	McLaren et al. 2016

Table B.1: Assumptions Used to Generate Figure 5.5
Note: HV = hybrid vehicles; RE = renewable energy ; TNC = third national communication.

Parameter	Value	Source/comment
EDL emission factor	0.667096	LMOE 2017
Diesel generators' emission factor	0.710861	LMOE 2017
Ratio of natural gas to HFO or diesel emission factors	0.72	EIA 2020
EDL power generation cost range in 2019 (low-high)	10.6 to 18.4 US$ cents	EDL
Average diesel generators' electricity cost	28 US$ cents	EDL
Total electricity demand	22 terawatt hours	Ahmad 2020a
Diesel generators' share of electricity	37%	Ahmad 2020a
EDL generation cost on shift to natural gas	8 cents per kilowatt hour (kWh)	Ahmad 2020b
Renewable energy cost (utility-scale solar photovoltaic)	6 cents per kWh	Ayoub and Boustany 2019

Table B.2: Assumptions Used to Generate Figure 6.4
Note: EDL = Lebanon's power utility; HFO = heavy fuel oil.

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