MAY 2021

SUSTAINABLE STATES

Environment, Governance, *and the* Future *of the* Middle East

AUTHORS

Jon B. Alterman
Natasha Hall
Will Todman

A Report of the
CSIS Middle East Program

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

MAY 2021

SUSTAINABLE STATES

Environment, Governance, *and the* Future *of the* Middle East

AUTHORS

Jon B. Alterman
Natasha Hall
Will Todman

A Report of the
CSIS Middle East Program

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

ROWMAN & LITTLEFIELD
Lanham • Boulder • New York • London

ABOUT CSIS

The Center for Strategic and International Studies (CSIS) is a bipartisan, nonprofit policy research organization dedicated to advancing practical ideas to address the world's greatest challenges.

Thomas J. Pritzker was named chairman of the CSIS Board of Trustees in 2015, succeeding former U.S. senator Sam Nunn (D-GA). Founded in 1962, CSIS is led by John J. Hamre, who has served as president and chief executive officer since 2000.

CSIS's purpose is to define the future of national security. We are guided by a distinct set of values—nonpartisanship, independent thought, innovative thinking, cross-disciplinary scholarship, integrity and professionalism, and talent development. CSIS's values work in concert toward the goal of making real-world impact.

CSIS scholars bring their policy expertise, judgment, and robust networks to their research, analysis, and recommendations. We organize conferences, publish, lecture, and make media appearances that aim to increase the knowledge, awareness, and salience of policy issues with relevant stakeholders and the interested public.

CSIS has impact when our research helps to inform the decisionmaking of key policymakers and the thinking of key influencers. We work toward a vision of a safer and more prosperous world.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

ISBN: 978-1-5381-4037-6 (pb); 978-1-5381-4038-3 (ebook)

Center for Strategic & International Studies
1616 Rhode Island Avenue, NW
Washington, DC 20036
202-887-0200 | www.csis.org

Rowman & Littlefield
4501 Forbes Boulevard
Lanham, MD 20706
301-459-3366 | www.rowman.com

ACKNOWLEDGMENTS

The authors would like to express their thanks to the many experts in Jordan, Lebanon, and Tunisia who shared their knowledge, insights, and experience with the authors. The authors are also grateful to two remarkable collections of scholars, engineers, and practitioners who helped shape this work.

The first is our project advisory board: HE Adnan Amin, Dr. Sami Atallah, Dr. Myriam Bincaille, Dr. Shantayanan Devarajan, Dr. Nadim Farajalla, Fida Geagea, Kishan Khoday, Roula Majdalani, Dr. Michael Mason, Dr. Claudia Sadoff, Dr. Jeannie Sowers, and Dr. Robert Springborg. Each brought many decades of research and experience, and their wisdom was as inspiring as it was daunting. We are grateful to them for their guidance and enthusiasm for the project, which grew palpably as the project took shape.

The second is our working group: Dr. Faten Attig-Bahar, Dr. Wassim Chaabane, Karim Elgendy, Dr. Annabelle Houdret, Annika Kramer, Jessica Obeid, Maisan Otoum, Mohammad Al-Saidi, Tessa Terpstra, Franziska Wehinger, and Salman Zafar. This very impressive group of practitioners are deeply rooted in the very processes and projects described in this paper, and we hope that our efforts will help contribute to the success of their own, as their efforts certainly did for ours.

The authors are also very grateful to the broader CSIS Middle East Program research team—McKinley Knoop, Danny Sharp, and Caleb Harper provided extensive support—and we are grateful for the research efforts of current and former interns Mahmoud Ghanem, Humzah Khan, Hannah Brown, Buthaina al-Zubair, Max Hamid, Sarah Thomas, and Lauren Fredericks.

The authors would also like to express their gratitude to the team at the CSIS iDeas Lab, whose production and design expertise has enriched the final product immeasurably.

Finally, the authors would like to express their thanks to Amb. Meshal bin Hamad Al Thani and the Embassy of the State of Qatar, which supported this project. The shape of this project, as well as the opinions, conclusions, and recommendations expressed in its findings are those of the authors alone, and they do not represent the views of the embassy or the government of Qatar, which neither reviewed the project's findings nor provided any input to them before publication.

CONTENTS

EXECUTIVE SUMMARY

The importance of environmentally sustainable public utilities in the Middle East is an improbable topic for a Washington think tank study.

Yet, many countries in the Middle East face serious challenges providing utilities in any manner to their populations, and the failure to do so is an increasing flash point for public dissatisfaction. This study finds that providing more environmen-

tally sustainable services in the Middle East would be an effective way to address many citizens' grievances which go beyond the reliability of those services. It would also help ameliorate deep dissatisfaction with the quality of governance and help build trust between citizens and their governments.

This study examines three sectors—power, water and sanitation, and solid waste—in Jordan, Lebanon, and Tunisia. While the three countries are different in many ways, each faces increasing challenges providing services to their citizens. Providing these services in an environmentally sustainable way would also crucially increase each country's resilience and diminish their vulnerability in a chronically unstable region.

Jordan has the most centralized system of providing these services. Efforts to ensure service provision have often locked the government into arrangements that are expensive and protect elite interests at the expense of sustainability. In the case of water, the issue is existential for the desert country.

Lebanon has a very decentralized system, but aspects of it have been captured by sectarian actors and business interests who prioritize maintaining their economic and political power.

Tunisia emerged from a revolution a decade ago with a keen interest in moving beyond the centralized control of the previous dictatorship. It has found, however, that fledgling institutions are often incapable of implementing durable change, especially when legacy institutions seek to guard their existing prerogatives.

All of the governments under study strain to provide services today, and while they have all expressed interest in environmentally sustainable solutions, each has also faced challenges in implementation. The vignettes in each chapter explore consequential experiments, many of which were successful and point the way for replication in individual countries and region-wide.

This study found that the provision of environmentally sustainable services would have a number of salutary effects: it would provide services economically, it would do so in ways that minimize pollution and conserve vital resources, and it would help empower local authorities that are closely connected to their citizenry. But perhaps even more importantly, providing local, environmentally sustainable services would address the yawning trust deficit between millions of citizens and their government. The halo effect of effective governance would, in the estimation of the study's authors, spread to many other aspects of public life.

The topic seems mundane, technical, and not worthy of high-level attention. Instead, it should be seen as the more persistent ways many citizens in the Middle East see their government. Success in this endeavor would not only preserve the environment for future generations but also contribute to lasting social peace as well.

INTRODUCTION

Water helped make the Fertile Crescent fertile, but the area is now among the most water-poor in the world.

Growing populations and increasingly intensive agriculture regularly outstrip the yields of rivers and rainfalls and deplete ancient aquifers.

The region's wealth and abundance were legendary in antiquity, but today, the Middle East faces similar pressures to those found throughout the developing world.

Growing urban populations strain infrastructure, create unprecedented amounts of waste, and consume growing amounts of electricity required for transportation, heating and cooling, industrial production, and more.

In fact, many Middle Eastern states are even worse off than many of their middle-income peers. Civil wars and insurgencies have interrupted efforts to build infrastructure and have driven high levels of displacement, inside and outside of national borders. Ongoing displacement has driven the construction of large swathes of informal housing, sometimes only belatedly connected to public utilities and often defying long-term planning efforts. Climate change adds another layer to the region's troubles by triggering deepening water shortages, increasing migration from the countryside, and driving high electrical consumption in the summer.

Despite frequent international support, governments often struggle to provide reliable power, water, and solid waste disposal. Adopted solutions are often costly, require extensive ongoing inputs, work intermittently, and are difficult to maintain and to scale upward. Since citizens come into daily contact with these basic services, it is no wonder that their poor quality has often become a common rallying cry in the Middle East.

New technology-based approaches provide opportunities for this vicious cycle to morph into a virtuous circle. Environmentally sustainable approaches to the provision of utilities are often more decentralized, are less technically complex, and generally have much lower operating costs. While there is no single definition of environmental sustainability, sustainability efforts focus on bringing processes into alignment with the regenerative processes of the ecosystem. For example, renewable energy reduces pollution and helps avert dramatic climate change, while water conservation and recycling reduce pressure on the water table. Twentieth century development often favored maximizing short-term human benefit, while twenty-first century approaches seek to align human benefit with the environment.

A shift toward more environmentally sustainable efforts to provide public utilities can address many of the grievances—and public health threats—that animate today's public debate. For both local and national governments, these initiatives create positive habits: local accountability, distributed technical expertise, and integrated planning and maintenance. Smaller-scale, sustainable, and more locally focused projects discourage monopolists and profiteers from sweeping in, and they encourage greater local participation and the development of local skills. They can enhance trust between central governments, localities, and the populations they serve, reversing some of the skepticism that often greets major projects. The widespread international interest in sustainability also gives local actors exposure to international financial institutions, NGOs, governments, big business interests, entrepreneurs—the same groups that could play a key role in promoting investment and creating jobs for the region's young

people. Orchestrating the resources, expertise, and stakeholders for sustainable environmental projects would create competencies that flow into other areas as well, creating a greater culture of experimentation and entrepreneurship to invigorate local economies.

Success in this realm would require more than technology and blueprints, however. The absence of trust is an enduring obstacle. The Middle East has some of the lowest prevailing levels of institutional trust of any region in the world. Skepticism that projects will bring positive change—often reinforced by experience—makes success harder and breeds more skepticism. Despair over prospects drives short-term thinking, diminishes long-term investment, and encourages short-term profit-taking. People in all areas of society withhold the information necessary to plan effectively, out of fear it will either be misused or corrupted in the pursuit of gain. Time after time, the powerful in the Middle East have added to their strength, while the weak have stiffened their resolve to resist it. The failure to reliably provide utilities has become both the symbol and cause of dysfunction. An enhanced ability to provide those services in an environmentally sustainable manner can contribute to a virtuous circle in which services improve, trust increases, sustainability is enhanced, economies grow, and public welfare rises.

In order to explore the roles that environmentally sustainable service provision can play in Arab societies, CSIS explored three countries in the Eastern Mediterranean basin: Jordan, Lebanon and Tunisia. The three countries have a great deal in common: they are all middle-income countries, they have similar demographics, and they enjoy a high degree of international interest and financing. They have young and growing populations, but they lose some of their best young talent to opportunities abroad, and they struggle to attract foreign direct investment. Subsidies strain the public budgets, and agricultural sectors are stressed.

A shift toward more environmentally sustainable efforts to provide public utilities can address many of the grievances—and public health threats—that animate today's public debate.

And yet, for all of their commonalities, the respective governments have taken markedly different approaches to governance. Lebanon's centrally managed patronage system aims to satisfy the country's 18 sectarian communities while ensuring that they remain divided. Maintaining the country's precarious political balance has often shaped the country's development plans and the organizations that implement them. Jordan has experienced little of Lebanon's political drama. The government is highly centralized, with authority and extensive technocratic expertise firmly based in the capital. Tunisia is a new experiment in the Arab world, as it seeks to build new systems as an escape from the country's authoritarian past. Often, Tunisia has been hampered by the persistence of old institutions and the relative weakness of new ones.

Throughout the report, the authors assessed three key sectors—power, water and sanitation, and solid waste. The study team explored governmental and private sector efforts to provide utilities, the obstacles they have encountered, and entrepreneurs' efforts to enter the sectors with sustainable solutions. The team also studied country-specific details, which often related to the political economies of states, as well as sector-specific details that might have relevance in different contexts. Interspersed in the study are brief vignettes that give examples of especially memorable successes and failures.

The study that follows draws broader lessons from the successes and failures of efforts to promote environmentally sustainable projects in the power, water and sanitation, and solid waste sectors in Jordan, Lebanon, and Tunisia. While there is a great amount of specificity in each case and in each country, the report pays specific attention to the twin challenges of sustainability and trust. The authors believe the two are related in compelling ways and believe the relationship is the same in all of the countries in this study.

Governments around the world should seek environmentally sustainable methods of providing services for a host of reasons. Similarly, governments should seek to promote trust for many reasons

The Middle East's environmental stresses put a special premium on environmental sustainability, and the region's enduring trust deficit puts a special premium on the trust.

as well. The authors are convinced that the Middle East's environmental stresses put a special premium on environmental sustainability, and the region's enduring trust deficit puts a special premium on the trust. Not only is success in both areas necessary for success in either, but success in both would also have positive effects that reach deeply into Middle Eastern societies.

Middle Eastern states have explored any number of paths in the last century to achieve prosperity and security. Most have struggled, sometimes serially, to secure lasting results. The challenges described here do not merely represent threats to the region's hopes. They also represent a route to realize many of the region's most enduring aspirations.

JORDAN

The Hashemite Kingdom of Jordan, a desert country with few energy resources and even less water, seems to have survived them all:

regional wars, lost territory, influxes of refugees which overwhelmed the local population, and a conflict with those refugees. Even during the Arab Spring, which swept through the region supplanting and shaking decades-old regimes, Jordan experienced waves of protests but no revolution.

The monarchy has skillfully consolidated power since Jordan's independence in 1947—in part by eliciting outside support from Western governments and regional governments alike. Appreciated by many as a vital state in a volatile neighborhood, Jordan has survived by drawing millions, and then billions, of dollars in external aid. By using the proceeds of that assistance to carefully appease powerful tribes and distribute a generous mix of subsidies and public sector jobs, the government has been able to withstand decades of latent discontent, but not without a cost. Relative to the size of its economy, the Jordanian government's spending is among the highest in the world.[1]

This generous external financing has had concrete benefits for service provision. The dispersed population is widely connected to electricity and water networks. The majority of wastewater is treated and reused. Still, Jordan must do better than average to survive. Jordan is the second-most water scarce country in the world. Climate change and population bursts have accelerated the problem. While it has the world's eighth-largest supply of oil shale, it has no oil reservoirs and little natural gas.[2] Consequently, Jordan has been dependent on outsiders for energy and development aid for decades. The 2008 global recession, gas supply interruptions, and wars rocked regional trade and infrastructure. Covid-related economic costs have catapulted Jordan's debt to over 100 percent of its GDP.[3]

Committing to environmentally sustainable solutions to service provision in the power sector, water and sanitation, and waste management are not just good for the environment, they are cost effective and necessary for meeting the needs of a population that is projected to increase by 20 percent in the next decade.[4]

GOVERNANCE OF SERVICE DELIVERY

The population of Jordan has grown immensely since the country was carved from the ruins of the Ottoman Empire after World War I. The royal family migrated from the Arabian Peninsula at that time, and while it did not have deep local roots, it proved skillful at balancing relations between the country's existing tribes and winning their allegiance. The British Mandate, which governed Jordan for the first two decades, always acknowledged Jordan's strategic importance. The United States and the United Kingdom in particular valued Jordan as a staunch ally and an important buffer for Israel. More than most countries, Jordan benefited from Western engineering support, and the influx of Palestinians—first in 1948 and then in 1967—provided a population that was increasingly cosmopolitan and eager for education.

The population of Jordan has swelled greatly since the country was founded, and most of Jordan's major cities are largely new. The capital, Amman, had perhaps 1,000 house-

holds a century ago and now hosts more than 4 million residents. The Hashemite monarchy that rules the kingdom consistently has placed a premium on deploying modernization and political balancing in equal measure. While it established authorities to provide utility services, the services are often delivered in a manner sensitive to political concerns. The government's political tasks have often dictated a strong hand from Amman, and in some cases, bred resentment between local populations and the central government.

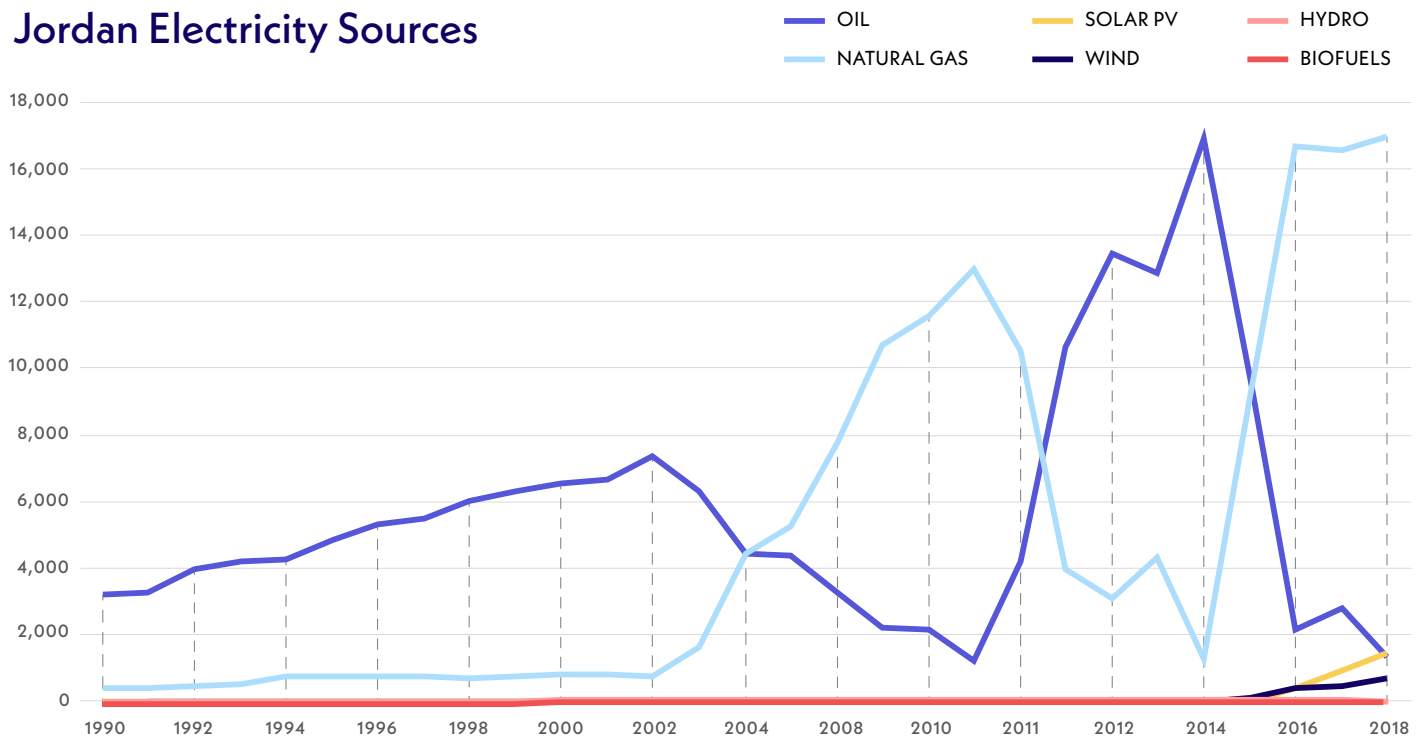
POWER

Thousands took to the streets in Jordan to protest rising prices—including fuel—in 1989, 1996, 2012, and 2018. Importing nearly 100 percent of its energy needs has meant that Jordan's leadership has been engaged in a delicate foreign policy dance to sustain cheap energy and electricity prices for its citizens.

However, the loss of regional largesse in recent decades meant that Jordan had to increasingly turn to the United States and international financial institutions and deal with mounting national debt through unpopular austerity measures. The power sector was considered a priority for such reforms.

The government gradually phased out energy subsidies and raised tariffs on some of its largest consumers (e.g., ICT companies and hotels). It privatized the generation and distribution of electricity while maintaining a state-owned monopoly—the National Electric Power Company (NEPCO)—to manage transmission, engage in power purchase agreements,

Jordan Electricity Sources



Source: International Energy Agency, "Total energy supply (TES) by source, Jordan 1990-2018," database (Jordan), 2020, https://www.iea.org/countries/jordan.

and purchase fuel for power generation companies.

Even so, regional turmoil still made Jordan vulnerable. As unrest swelled during the Arab Spring, terrorists attacked the gas pipeline from Egypt more than 24 times, jeopardizing vital supplies.[5] Forced to buy expensive fuel oil on an urgent basis, NEPCO's debt rose.[6] Bolstering a more resilient energy mix became a priority. Plans were developed to exploit Jordan's uranium for a nuclear plant and Jordan's oil shale reserves.[7] Yet, with large expanses of desert, more than 310 days of sun a year, and strong winds, renewables were a clear unexploited resource.

As early as 2012, as ideas for nuclear, oil shale, and new gas projects were still being developed, Jordan embarked on a new frontier in renewables. Parliament adopted the Renewable Energy and Energy Efficiency Law (REEEL) in 2012, to incentivize private sector investment in renewable energy, and created the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) to support individuals and small- and medium-sized enterprises. Jordan's government planned to boost electricity generation capacity from renewable sources to 1.8 gigawatts by 2020, and it attracted billions of dollars of investment to do so.[8] By 2018, Jordan was ranked first in the Middle East and North Africa in renewable and clean energy growth and third in the world, according to a Bloomberg report.[9] By 2019, Jordan had about 6,900 workers employed across the renewables sector.[10]

Yet, solutions agreed to in the urgent circumstances of the Arab Spring began to impinge on the growth of renewables. A $10 billion agreement with Noble Energy to import Israeli natural gas secured Jordan's gas supply, but it locked the government into high levels of consumption for 15 years, arguably at premium rates.[11] A 30-year power purchase agreement (PPA) to build the second-largest oil shale-fired plant in the world was signed, aiming to meet almost 15 percent of the country's power demand.[12] Pricing for that deal has also been controversial.[13]

At the same time, renewables were eating into NEPCO's bottom line. The company's biggest electricity consumers responded to higher NEPCO tariffs by building their own solar facilities. Jordan went from having too little electricity to having too much. Yet, because the gas purchase agreements and PPAs require NEPCO to purchase fixed quantities of electricity at fixed rates, NEPCO continues to buy electricity that Jordanians cannot use and cannot afford, with no way to export it. Today, NEPCO's debt stands at around $7.7 billion.[14] Servicing the debt costs over $100 million annually.

In 2019, the government capped renewables projects at one megawatt, shattering investor confidence and disrupting companies whose business model had been built off of Jordan's ambitious renewables strategy. When electricity peak load dramatically dropped early this year due to Covid-19, renewables were taken off the grid completely—without informing companies or consumers. The losses were tremendous, and many companies are looking outside Jordan for future business development. Some in the field

CLOUDING JORDAN'S RENEWABLES FUTURE

In early 2012, the Jordanian government and NEPCO increased the electricity rates on banks and telecom companies by 150 percent overnight in an attempt to keep costs low for individual consumers. The move dramatically increased costs for Jordan's three major telecom companies, Orange Jordan, Zain, and Umniah. By 2018, one of the companies was operating in the red, prompting executives to search for a way to cut energy costs. They found their solution in solar energy.

Orange Jordan partnered with Kawar Energy, a renewables company, to install a 37-megawatt photovoltaic (PV) farm, covering over 70 percent of the company's energy consumption. Zain and Umniah planned their own. The arrangement was good for the telecoms, but it created a crisis for NEPCO, which was relying on some of its largest customers to pay steep rates in order to subsidize individual consumers. NEPCO had gone deeply into debt to finance generation capacity, and it suddenly had both an income problem and a looming demand problem.

On January 9, 2019, the Jordanian government capped all new renewable projects at one megawatt, citing the need to assess grid capacity. Two years later, that cap on new development remains.

The cap on new, large-scale solar projects has decimated what was once a market for solar energy. Most solar companies have shrunk by 50 percent after the cap. Kawar Energy has half the employees it had in 2018, and a slew of projects have been put on hold.

With investor confidence shaken by the government's sudden move, it might be a long time until PV advocates in Jordan see the light at the end of this tunnel.

who have continued to develop projects under one megawatt do not believe that such scale can stimulate job growth at the same rate.[15] Now, promising young engineers in the country are asking if they should even study renewable energy.[16]

Those in the business argue that the government is so focused on debt that it has been making short-term economic decisions without accounting for how renewables could electrify the Jordanian economy over the long term. Experts point to the possibility of using the power to electrify cars, partially run desalination plants, or simply encourage industries to use more power. In the meantime, renewables companies are looking into storage capabilities, something that many experts said needed to be incorporated into planning years ago. The government has also signed a preliminary agreement to connect to Iraq to export electricity and stabilize the load during times when there is excess capacity. However, given the regional experience so far, Jordan will have to invest in alternative strategies.

Today, the country still imports around 94 percent of its energy, which represents approximately 10 percent of GDP, with annual domestic demand increasing 3 percent. Advancing the renewables industry is clearly Jordan's future if it is ever to achieve any level of energy independence and financial sustainability—necessary steps for any country, especially one with such high debt in a chaotic neighborhood.

There are a few necessary steps for Jordan to move forward with renewables. The Green Corridor project seeks to address grid capacity, and it is now awaiting the completion of an environmental impact assessment.[17] However, industry experts have recommended that distributors, who have very long-term contracts with the government, also need to be properly incentivized to deal with the variable nature of renewable energy.[18] In light of the existing one megawatt cap, the legal framework also needs to be revised to include individual consumption and storage capacity.[19]

Experts suggest enlarging the circle of decisionmaking and making it more transparent—particularly in PPAs—to find solutions and prevent problems in the sector before they begin. Fostering more transparency in decisionmaking—from the bidding process to implementation and operations—will also be necessary to re-instill confidence from investors, not to mention the country's businesses, people, and parliament. Such trust-building steps will also encourage young Jordanians to begin developing skills in various aspects of the renewables industry to meet the demands of tomorrow. Given solar farms' locations in desert areas where employment outside the public sector remains low, this could be a boon for workers if they believe that there is a future in developing such skills.

Renewables can help Jordan become more resilient, but the government needs to first make the sector more resilient to external challenges. Making those planning choices transparently is not just doable, it is mandatory to bring confidence back.

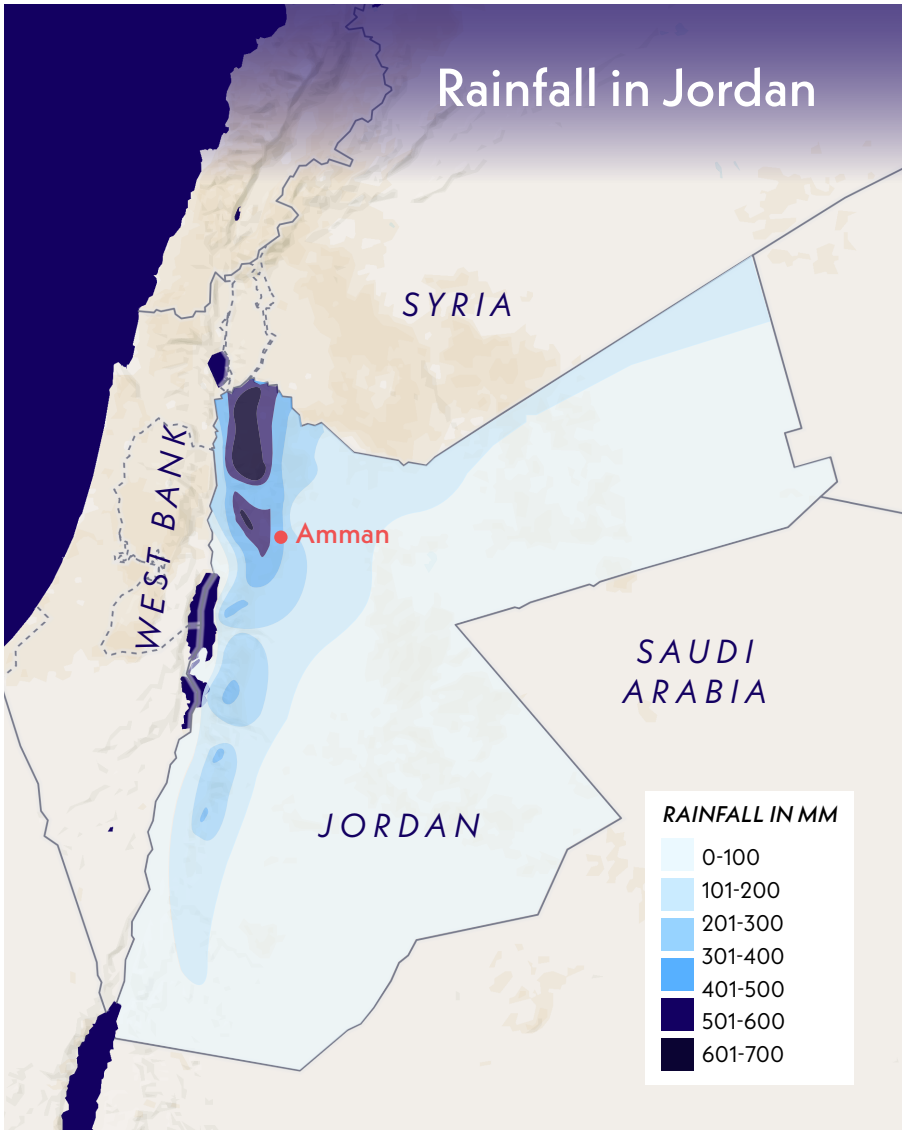
WATER AND SANITATION

Jordan did not have much of an Arab Spring, but it did have a parched Arab summer in 2012, igniting protests against water shortages and disruptions. Some demonstrators burned tires, while others carried empty plastic gallons in the street, clamoring for water to fill them.[20]

Jordan is in trouble. The country's per capita water supply is only 10 percent of the level that the United Nations defines as the boundary for water poverty. It amounts to less than 100 cubic meters annually. As one expert in the water sector said, "if Jordan does not start making drastic changes, my daughter will not have enough water to live here."[21]

The stresses of climate change, population pressures, and problematic transboundary water agreements add to water stress.[22] However, there are other immediate challenges. Agriculture consumes over 60 percent of water resources while contributing just over 4 percent to GDP. Non-revenue water (NRW), or water lost through leakage, under-registration, and theft, is approximately 51 percent.[23] While these are common figures throughout the world, Jordan is not typical. As the second-most water poor country on the planet, its margin for error is paper thin.[24]

To control water supply, Jordan's water and sanitation sector became increasingly centralized in the 1980s. Increasing the water supply was the priority. In order to deal with demand, the government manages the sector primarily through the Ministry of Water and Irrigation (MWI), with the Water Authority of Jordan (WAJ) and the Jordan Valley Authority



Source: Jawad Taleb Al-Bakri, Mohammad Ajlouni, and Mahfouz Abu-Zanat,"Incorporating Land Use Mapping and Participation in Jordan: An Approach to Sustainable Management of Two Mountainous Areas," *Mountain Research and Development* 28, No. 1 (February 2008): 50, https://bioone.org/journals/mountain-research-and-development/volume-28/issue-1/mrd.0863/Incorporating-Land-Use-Mapping-and-Participation-in-Jordan/10.1659/mrd.0863.full#i0276-4741-28-1-49-f01.

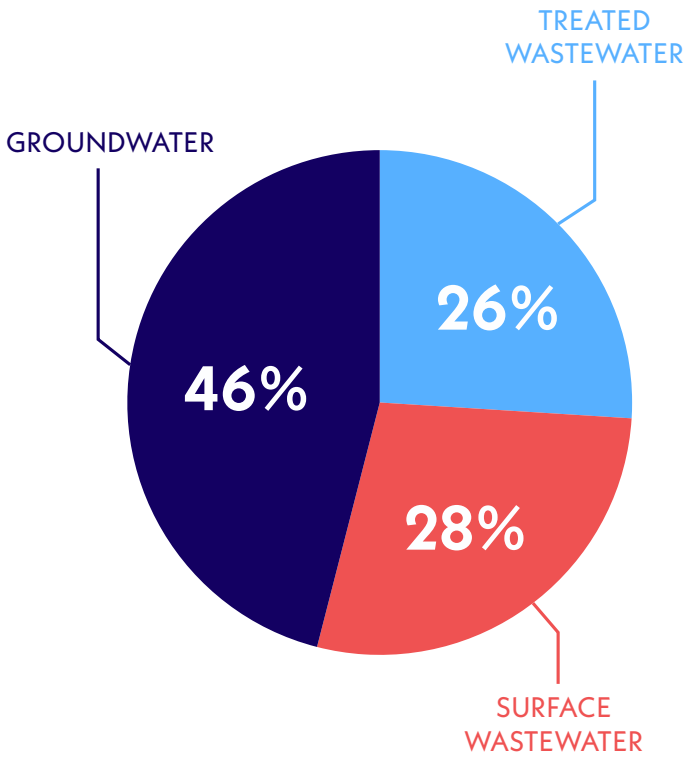
(JVA) underneath it. Together, these bodies plan, regulate, and provide services. The JVA is responsible specifically for water sector development and distribution of irrigation water in the Jordan Rift Valley. While the operation and management of water and sewage services has been opened to private sector participation since 1999, asset ownership has been fully retained by the public sector, and private sector involvement has been limited to a couple large infrastructure projects.

The centralized structure has had some benefits as infrastructure needed to quickly expand. Today, 95 percent of the population has access to an improved water source, albeit on an intermittent basis, and about 63 percent are connected to a public sewer system.[25] Two-thirds of wastewater is treated, and nearly 100 percent of that is reportedly reused. Al Samra Wastewater treatment plant is one of the unrivaled success stories of planning at scale. The plant has gone through several expansions and renovations in recent years to treat almost 70 percent of Jordan's treated wastewater. Through a mix of biogas and hydropower, the plant is able to meet 78 percent of its energy requirements.[26] The plant was the first co-financed private sector build-operate-transfer (BOT) project in Jordan.[27] However, aside from Al Samra and the $1.1 billion Disi conveyance project, which brings non-renewable fossil water to Amman and surrounding areas, the water sector has attracted limited private sector investment.

Even with these achievements to improve sanitation and supply, Jordan continues to use water at an unsustainable pace,

> **As one expert in the water sector said, "if Jordan does not start making drastic changes, my daughter will not have enough water to live here."**

Water Sources for Irrigation



Source: Maher Salman et al., *An assessment of policies, institutions and regulations for water harvesting, solar energy, and groundwater in Jordan* (Rome: Food and Agriculture Organization of the United Nations, 2018), 10, http://www.fao.org/3/i8601en/I8601EN.pdf.

PATCHING JORDAN'S WATER LEAKS

The Jordan Valley is the country's "vegetable basket," but one farmer's frustration captured the water challenge there succinctly: "Those banana plantations are owned by the big guys; there is water for them. . . . The water problem is for the small guys and the weak guys." The history of water management in the Jordan Valley is one of maximizing political stability, not water conservation. In this arid country, influential tribal members and landowners have steady access to water, while individual consumers and small farmers struggle.

In 2001, the German development agency Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) developed a set of Water User Associations (WUAs) in partnership with the Jordan Valley Authority (JVA), the government agency responsible for water distribution to the valley's farmers. The scheme sought to create a "sustainable participatory approach" to water management to address both inequities in access and the JVA's own resource constraints. In exchange for a yearly fee to the WUA, farmers were able to lobby the JVA collectively, get access to assistance that the under-resourced JVA was unable to provide, and win the right to repair their own leaks.

The presidents of WUAs were typically powerful tribal leaders. As a consequence, they hired workers to monitor pipes and open taps more often for the workers' connections than their technical skills. Many small farmers accepted the trade-off. They had joined WUAs mainly for entrée to powerful farmers who could lobby for water on their behalf.

The WUAs have increased solidarity among farmers. For example, many are now persuaded that stealing water from farmers' shared pumping stations is wrong. The goodwill does not flow to the Jordanian state or those outside the WUA, though. One farmer said he had no problem with farmers stealing water directly from the King Abdullah Canal. That is like stealing from the government, he explained, and that seems to be fine.

depending on underground aquifers for over 60 percent of its water needs and over-abstracting them by more than 160 percent.[28] Many are becoming brackish, with little to no recharge. While water sector experts agree that dramatic resupply efforts through desalination and water exchanges with neighboring countries will be necessary, many say that there must also be more pressure on limiting demand, theft, and wastage.

Jordan's National Water Strategy 2016–2025 recognized these issues and aimed to reduce NRW from 50 to 25 percent by addressing leakages, illegal pumping, and meter deficiencies. Donors worked with Jordan to update pipes and introduce smart metering and rapid leak detection; such investments saved millions of dollars and cubic meters of water.[29] To encourage water efficiency, the government introduced quotas and bulk tariff rates on water.[30] In addition, authorities announced that between 2013 and 2017, they prevented or stopped over 30,000 violations on water mains and resources and imposed stiff penalties for violations.[31] The MWI said that it had also gone after Jordan's business and political elite, sometimes at great personal risk to the minister and his staff.[32]

Despite spending on infrastructure, corporatization of utilities, and donor projects to improve efficiency, reductions in water usage have not been significant.[33] Water experts continue to be skeptical of the government's commitment when they see Jordan's most water-intensive agricultural enterprises in the southern desert and the northern highlands, where the water deficit is the most extreme. The tension between the water haves and have-nots has grown over the past decade, as small-scale farmers are struggling to survive, and residents are forced to spend large amounts of their income to supplement carefully rationed water from the state.

The struggle has become violent at times, with residents in the north blocking roads and taking infrastructure hostage to demand water.[34] In the meantime, many agricultural communities with access to wells have been able to maintain their water supply. Reports have also pointed to the difference between farmers. Some have argued that many smaller-scale farmers without political capital still struggle with water shortages even after shifting their water consumption habits, while powerful landowners continue to use groundwater and surface water to feed water intensive crops, further entrenching inequalities.[35] For example, while the government encourages using treated wastewater for irrigation, some wealthier farmers continue to use precious groundwater for low-value olive trees to boost land values.[36]

Reducing NRW, increasing water conservation through treated wastewater reuse and new technologies, and building up supply is necessary. New technologies such as hydroponic farming and drip irrigation could save 50 to 80 percent of the water used in traditional cultivation.[37] However, experts consistently cite the government's need to reform the agricultural sector through zoning regulations, lowering import tariffs on water intensive crops to encourage farmers to

grow less water-intensive crops, and allowing contracts for companies growing in unsustainable areas to expire. However, powerful interests have been able to lobby the government to hold off on such measures.[38] Increasing water prices may discourage agriculture, but powerful interests will continue to find ways around such pricing schemes.

Giving farmers at each end of the income spectrum alternatives may be the only option, and this will not be easy. Around 25 percent of the poor, including many Syrian refugees, rely on agriculture for their income, according to the government.[39] Absorbing these workers and small-scale farmers who can no longer make ends meet due to water shortages has already proven difficult. In some parts of the south, the state's security and civil defense departments have absorbed 90 percent of workers in order to maintain stability.[40] Confronting powerful vested interests will be even more politically challenging for the government.

Direct communication with farmers and landowners will be necessary to find the necessary mixture of incentives and regulations to encourage farmers to shift to higher value, water-efficient crops, or alternative employment or revenue generation such as eco-tourism or wind and solar farms.[41] Developing reliable and transparent water data will also be essential for technical experts and entrepreneurs to understand where the losses are coming from in order to mitigate them. This transparency will also allow civil society to have a bigger role in the solution through awareness among the local population on water scarcity.

In order for any of these solutions to work, the government must show commitment by enforcing the necessary policies to make environmentally sustainable water planning effective. Much like importing expensive fuel oil, growing bananas in the desert and exporting citrus cannot be part of Jordan's future if it wants to survive and thrive.

WASTE

In the past decade, Jordan could no longer deprioritize its waste management sector. In part due to urbanization, a refugee influx, and growing economy, the amount of solid waste from 19 of Jordan's 21 landfills doubled between 2012 and 2019.[42] In northern Jordan, the urgency is particularly acute with over a half a million refugees spilling across the border, straining municipalities' ability to deal with newly generated amounts of solid waste. Most of Jordan's landfills are still unsanitary, meaning they could threaten surface and groundwater—a precious rare commodity in the country.

International donors helped northern governorates respond to growing waste management needs due to the Syrian refugee influx but many municipalities outside the capital and touristic areas continue to struggle with a lack of resources. Amman, Aqaba, and the Petra region are managed by the Greater Amman Municipality (GAM),

REEDING BETWEEN THE LINES

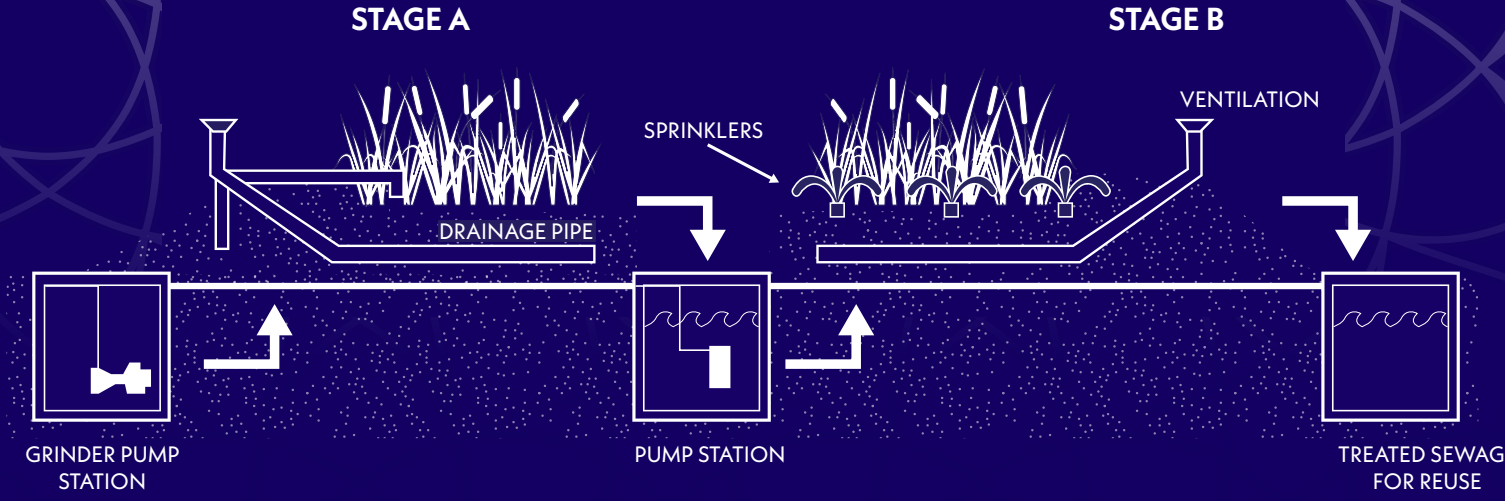
Azraq's oasis—wetlands in the middle of Jordan's arid desert landscape—has been famous for centuries. In recent decades, too much water has been pumped and too much untreated wastewater has been dumped, threatening the Azraq Wetland Reserve, groundwater wells, and local biodiversity. The answer to the threats is as simple as it is elegant: reeds.

When engineers plant reeds for the Innovative Sanitation Solutions and Reuse in Arid Regions (ISSRAR) project, they will be doing more than merely revitalizing the environment. The reeds will form the backbone of an innovative wastewater management system that helps a town near the Azraq oasis turn its sewage from refuse to resource. The "constructed wetlands" can filter and treat over 500 m^3 of raw sewage per day—more than enough for 12,000 residents.

Compared to a traditional wastewater treatment facility, the constructed wetlands require minimal electricity and few highly technical skills to maintain. As a bonus, the treated wastewater can irrigate crops, lessening the burden on dwindling groundwater resources.

The original concept was a hard sell to locals, though. Residents feared that the system would smell and devalue their land. They also did not want to become a dumping ground for other villages' waste. A six-month campaign sought the support of key stakeholders, while young volunteers went door-to-door to build grassroots support and answer residents' concerns.

The technology deployed in Azraq has been used in other places in the Middle East and around the world. In these projects, the reeds do most of the dirty work, and the people reap the benefits. For those in rural communities who often find themselves doing dirty work while others benefit, the project is a welcome change.



Source: Original analysis and creation based on "Raw Wastewater Treatment by Constructed Wetlands," Blumberg Engineers, 2019, https://www.blumberg-engineers.com/en/ecotechnologies/raw-wastewater-treatment.

the Aqaba Special Economic Zone Authority, and the Petra Development and Tourism Region Authority (PDTRA), respectively. They have legal, financial, and administrative authority over solid waste management in their areas. The rest of the country depends on the Ministry of Municipal Administration (MOMA), which often does not have the budget to effectively manage waste. Cost recovery is only 60 percent in the Greater Amman Municipality and no more than 30 percent in the other municipalities. Household contribution to solid waste management represents 0.11 percent of GDP per household, a much lower share than comparable countries.[43]

As a result, while waste management services are acceptable in large cities, those services are often poor or nonexistent in small towns and rural areas, as municipalities generally lack capacity.[44] However, the need to respond to an increase in waste—especially in northern governorates hosting tens of thousands of new refugees—prompted the government and donors to begin working on a strategy for the waste sector. In 2015, the government released its Solid Waste Management Strategy, which aims to achieve a recycling rate of 50 percent by 2034 and recommends the development of five major composting facilities by 2025.[45] Currently, the amount of waste recycled still does not exceed 7 percent of waste produced.

Young boys get heat from a burning rubbish bin as Syrian refugees go about their daily business in the Za'atari refugee camp on February 1, 2013, in Za'atari, Jordan.

Jeff J Mitchell/Getty Images

Most recycling activities in Jordan are still considered pilot projects and small-scale interventions. They are mostly initiated and supported by NGOs and other international organizations for relatively short funding schedules. The UN Development Program (UNDP), the French Development Agency (AFD), and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have all either completed or launched projects to develop sanitary landfills and sorting and composting facilities, aiming to employ refugees and Jordanians.

Formal private sector participation remains limited. The majority of recycling is still done by around 5,000 waste pickers in the country. Syrian refugees have entered the market in search of income opportunities, intensifying competition with Jordanians. Dozens of recycling companies, which waste pickers sell to, face tough competition as well. The recent rise in electricity prices has raised the costs of recycling to the point where raw materials and imported recycled products are cost-effective substitutes for Jordanian recycled products.

With greater awareness, integration of sectors, and inclusive planning, Jordan could create an opportunity out of crisis by using aid to develop long-term, financially sustainable models for waste management. There are currently low levels of awareness in communities regarding waste management. NGOs such as the Jordan Environment Society, which started its recycling program in the mid-1990s, developed awareness campaigns to teach residents how to sort at source. While the capacity of such programs has been limited, they could be expanded to reach greater numbers of people as recycling efforts expand. A 2019 Oxfam and GIZ country-wide survey showed that 75 percent of non-recyclers said they would be willing to recycle if proper facilities were made available to them.[46] Some projects also provide maps identifying where a limited number of recycling companies are located for those willing to bring their materials to those locations. While these efforts alone are unlikely to greatly expand sustainable waste management, they could help with future planning and building awareness with local communities.

Due to high electricity costs, making recycling financially feasible is challenging. However, if a more integrated approach is developed, sustainable solid waste management could make use of renewable energy, including waste-to-energy solutions, to mitigate the costs and reduce methane gas emissions from landfills. Al-Ghabawi landfill near Amman has already taken advantage of this technology and now has an installed capacity of 4.68 megawatts, only using 4.5 percent of the generated energy for the plant's operations.[47] Some projects are also working with the 200 recycling companies in Jordan and the government to enable and incentivize commercial waste generators to use recycling services by reducing their overall solid waste management costs.[48] Since the commercial sector in Amman generates at least 40 percent of waste produced, this could be a significant step.[49] Additionally, composting could also create soil conditioner or fertilizer for struggling farmers, since more

AWAD AWAD/AFP/Getty Images

Garbage and water waste are seen on the shores of the Jordanian side of the Dead Sea, near Shuneh on April 16, 2008.

than half of waste produced is organic. By improving cost recovery mechanisms, the government could better reach areas on the periphery.

Many of the existing efforts are either large-scale government efforts for major cities or NGO-led projects. While NGOs, in particular, have been able to develop income opportunities for Jordanians and Syrian refugees in the sector, further expanding sustainable solid waste management practices could provide 1,000s of formal jobs for women and men. In Jordan, a fourth of waste pickers formally working on dumpsites are women.[50] But as open dumpsites close down and the sector is more formalized, many waste pickers may be left out. Some efforts to employ informal waste pickers have already backfired when companies paid them less than they would make on their own. Understanding how formalizing the sector could impact local economies and job competition must also be better understood to assess the long-term costs and benefits of scaling up sustainable waste management practices.

By attracting private sector participation at a larger scale and investing in the skills development needed for this strategy, thousands of jobs could be created in sustainable waste management. A participatory and inclusive approach will ensure that benefits outweigh the costs.

ANALYSIS

In an effort to maintain stability and mitigate costs, Jordan has had to move slowly—too slowly some experts say—toward policies that would make basic service provision more resilient and sustainable. For Jordan, a country with limited energy and water resources in an unstable region, environmental sustainability is existential. A growing number of youth will expect jobs in their future, something that the public sector and agriculture simply cannot continue to absorb.

While connectivity throughout the region will hopefully be the way of the future, Jordan cannot depend on outsiders for energy, water, or aid. With guaranteed debt and advances of NEPCO and WAJ reaching 22 percent of GDP in 2016, financial feasibility will be paramount.[51] Pursuing environmental sustainability in service provision has the potential to decrease deficits and vulnerability. Integrated and transparent participatory planning could minimize the growing pains during this transition and create thousands of new jobs for a country whose cost of living has skyrocketed.

LEBANON

In the rush to stanch the bloodshed and rebuild Lebanon after a destructive 15-year civil war, the 1989 Taif Agreement maintained Lebanon's confessional system,

dividing political and economic power between the country's 18 recognized sects. The agreement had the effect of empowering warlords and transforming them into political leaders. When utilities were rebuilt in the post-war period, the country's sectarian parties

became shareholders in reconstruction, and transparency and accountability were deferred. Lebanese have been paying the costs ever since.

Early in the civil war, the government created the Council for Development and Reconstruction (CDR) to allocate aid for infrastructure reconstruction. In the years since, it has become one of the country's most powerful economic actors, spending billions of dollars in close collaboration with Lebanon's prime minister. The quality of service provision has often lagged, but the CDR has served its purpose as a political lubricant, rewarding politicians' families and sectarian parties that advanced their members' narrow interests.[52] Political peace was maintained at the cost of effective and efficient services.

While Lebanon's political and economic power is intentionally fragmented, at its core is a centralized system that distributes patronage. Localities depend on the central government for services and revenue, and they lack the resources to develop their own solutions to the central government's failings. Those failings are legion. The World Bank says Lebanon's electricity shortages are the fourth worst in the world, and the public hails as "electricity martyrs" those who die while illegally tapping into electrical supplies.[53] Only 48 percent of the population has access to safely managed water.[54] The seas off much of Lebanon's beautiful coastline have 100 times the bacterial concentration than authorities would cite to close a New York beach.[55] Lebanese pay one of the highest rates in the world for solid waste management, yet 77 percent of the country's waste is either openly dumped or tossed into a landfill.[56] In response, popular protest movements have arisen, and governments have fallen.

Today, the country is in crisis. Failures in basic service provision are at the epicenter, creating widespread economic, environmental, health, and political consequences. Lebanon's intentional-

When utilities were rebuilt in the post-war period, the country's sectarian parties became shareholders in reconstruction, and transparency and accountability were deferred. Lebanese have been paying the costs ever since.

ly fractured, heavily managed approach to public services produces poor results and starves stakeholders on the periphery from the resources that would allow them to provide those services more efficiently, effectively, or sustainably.

GOVERNANCE OF SERVICE DELIVERY

While much of Europe's nineteenth century history was about the homogenization of nation states, Lebanon was carved from Greater Syria in order to protect Christian minorities on Mount Lebanon. However, as a national identity formed in the twentieth century, it emerged in tandem with Lebanon's primordial identities—the country's 18 official sects. Lebanon's uneasy sectarian balance burst apart in a civil war that erupted in 1975 and lasted a decade and a half. When peace was made and the country patched together, former sectarian warlords became politicians and businessmen. The result was a set of often strained political relationships that had economic implications and economic relationships that had political implications.

The country has few robust and genuinely national institutions. Instead, individual sects have captured many institutions in the country, leading both to the replication of efforts and the limited authority of national organizations. The Lebanese system sometimes seems better at checking political power than executing it, and this has proven a problem as the country has been forced to rebuild from warfare multiple times in the last half century. Volatile politics and the periodic eruption of war have discouraged long-term investments, and Lebanese coping strategies—often borne out of war—have tended to favor minimally adequate fixes rather than comprehensive reform.

POWER

Lebanon has long faced electricity shortages. Today, the effective capacity of Lebanon's electric system is less than two-thirds of peak demand, leaving a gap of 1.5 gigawatts.[57] Some parts of the country get only four hours of power per day.[58] As a result, many of Lebanon's residents have fallen back on old wartime habits, relying on inefficient, smoke-belching diesel generators. State-subsidized electricity is almost comically cheap, with rates that have not changed since 1994, but the costs of supplementing intermittent supply with costly diesel generators busts the budgets of many Lebanese.

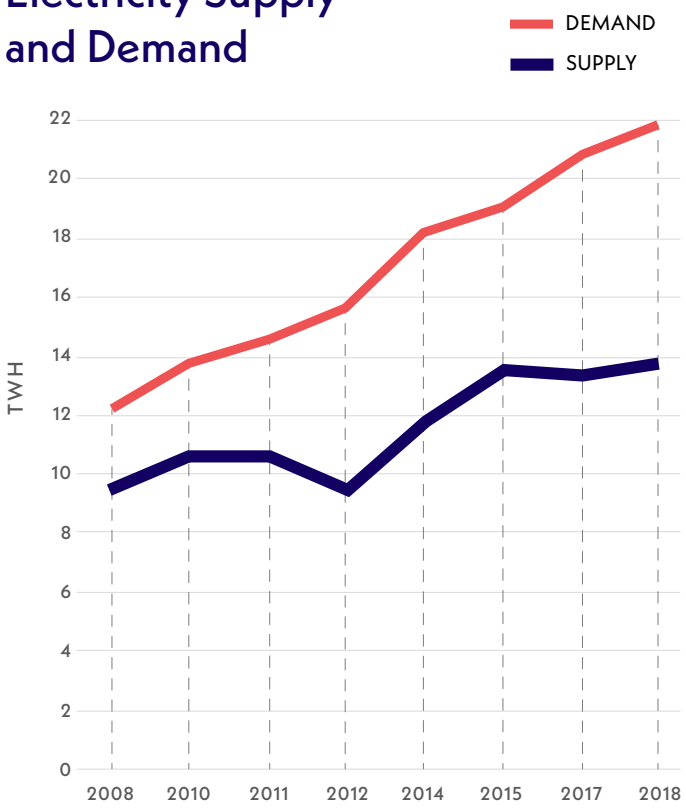
Power sector reforms would rebound through Lebanon's entire economy. The state-owned Électricité du Liban (EDL)

company holds a monopoly on power generation, transmission, and distribution in Lebanon; its losses account for 40 percent of Lebanon's national debt. In recent years, international donors and financial institutions have focused attention on reforming the power sector, to no avail. Specifically, the International Monetary Fund has repeatedly asked the government to (1) reduce technical and non-technical losses since only 57 percent of electricity produced is transmitted, billed, and collected; (2) increase capacity by building new power plants; and (3) increase electricity tariffs.[59]

The Lebanese parliament has tried, too. Almost 20 years ago, parliament passed Law 462/2002. The law envisioned that a new and independent electricity regulation authority would monitor the process and grant licenses for power generation, but the government has repeatedly postponed the creation of the authority.[60] Instead of implementing the law, parliament awarded the Lebanese cabinet sole authority to grant licenses and tenders for large-scale power generation, based on recommendations by the Ministry of Energy and Water (MEW) and the Ministry of Finance (MOF). What was to be a formal process with rules, transparency, and accountability became an informal one with no clear criteria for selecting bids.[61]

Despite its failure to implement the 2002 law, the government has continued to make myriad promises to supply 24 hours of power daily. It floats plans to build six new power plants, rehabilitate or close aging plants, switch to cleaner and more cost-efficient natural gas, invest in renewables, increase collections on payments, and increase electrical fees to reduce deficits. Yet, the improvements have been slow to come. Instead, starting in 2013, Turkish power barges running on diesel and fuel oil—rather than natural gas as was proposed—have anchored off the Lebanese coast.[62] There are now three, and they account for a quarter of the country's power generation capacity.[63] They are more expensive than generation on land, and the exhaust is a menace to the populations nearby.[64] Intended as a short-term fix until longer-term, more sustainable and affordable solutions could be implemented, they have become a durable feature of the Lebanese coastline.[65]

Electricity Supply and Demand



Source: "Lebanon's electricity supply and demand balance (Sources: data was obtained from EDL, Projections are based on team's analysis)," in Ali Ahmad, *Distributed Power Generation for Lebanon* (Washington, DC: IBRD/World Bank, May 2020), 12, http://documents1.worldbank.org/curated/en/353531589865018948/pdf/Distributed-Power-Generation-for-Lebanon-Market-Assessment-and-Policy-Pathways.pdf.

TAKING THE POWER BACK

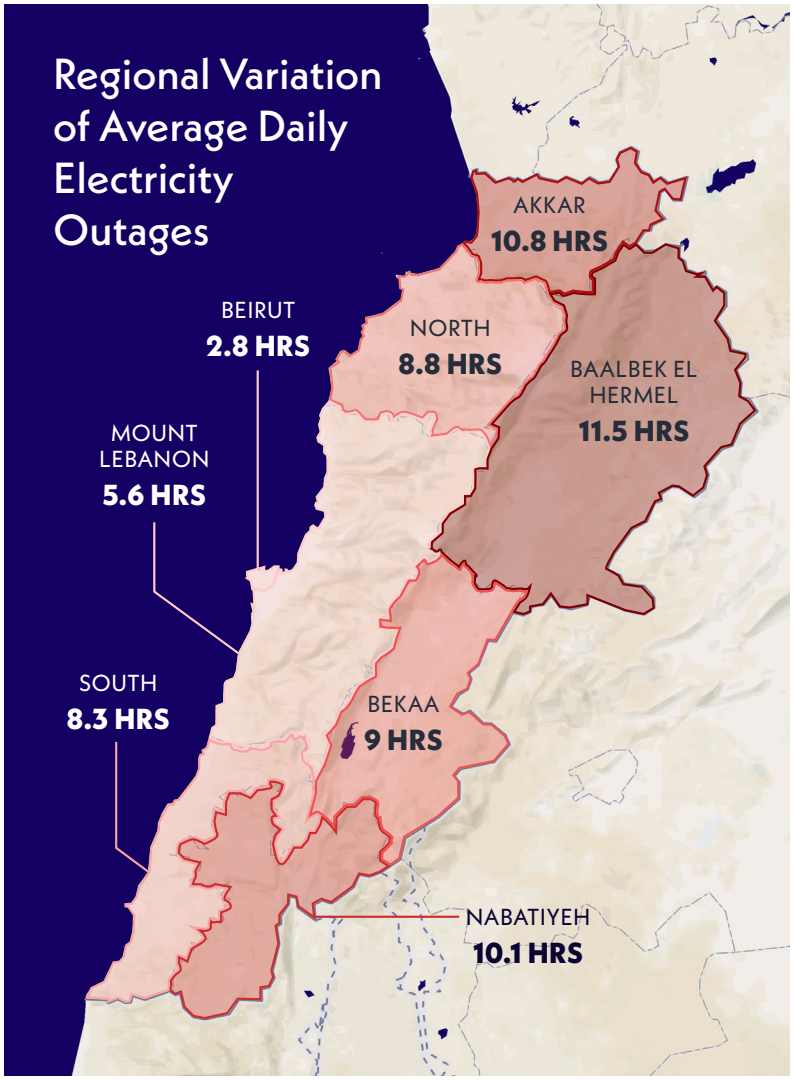
When residents in the small village of Qabrikha in southern Lebanon pay their electric bill, they pay twice—once for energy supplied by Lebanon's energy monopoly, Electricité du Liban (EDL), and once to fuel diesel generators during the EDL blackouts that are a daily occurrence in southern Lebanon. Recently, they started paying a third bill: for energy from a photovoltaic solar farm that the municipality built. With the third bill, overall costs have plummeted.

According to one resident, connecting to the solar system cut electricity costs by 30 percent and ended daytime blackouts. Villagers like the system so much that when it went down due to a technical glitch last February, villagers and the municipality implored the UN Development Program (UNDP)—which launched the Qabrikha project—to get it back online as soon as possible. The savings have allowed the village to invest in grid improvements and offer power to residents for longer periods for less cost.

Still, the project has had challenges. While UNDP and EDL reached an agreement more than two years ago for the solar farm to sell excess electricity to the utility, EDL has yet to sign the contract or attach the necessary bidirectional meter. For now, customers have to pay multiple electric bills.

Despite the challenges, Qabrikha demonstrates that there is a demand for sustainable electricity in areas of Lebanon that have been historically cut off from electrical resources, for both economic and environmental reasons. Renewables keep the lights on in Qabrikha, even if residents still have to pay twice.

It is difficult to explain Lebanon's failure to pursue more sustainable power production through natural gas and the construction of desperately needed new power plants. Some experts argue that vested interests in the shale and diesel industry are part of the calculus of failing to pursue the use of cleaner natural gas or renewables.[66] Sectarian politics have also come into play when the construction of a new power plant was halted when politicians insisted that the plant be built in their sect's area, disregarding the infeasibility of that location.[67]



Source: "Lebanon's electricity supply and demand balance (Sources: data was obtained from EDL, Projections are based on team's analysis)," in Ali Ahmad, *Distributed Power Generation for Lebanon* (Washington, DC: IBRD/World Bank, May 2020), 13, http://documents1.worldbank.org/curated/en/353531589865018948/pdf/Distributed-Power-Generation-for-Lebanon-Market-Assessment-and-Policy-Pathways.pdf.

Many consumers have been looking to renewables to fill the gap. In collaboration with the Central Bank of Lebanon, and with the help of international donors, the Lebanese Center for Electricity Conservation, a branch of the MEW, began offering long-term, low-interest loans in 2012.[68] The loans were intended for individual consumption, but some larger-scale entrepreneurs saw an opportunity. Increasingly inexpensive solar panels, when combined with subsidized loans, could provide economical and sustainable solutions for small towns. The town of Jabboule, in the Bekaa valley, developed a project that combined PV panels with battery storage to supply 200 homes, a factory, and a school.[69] Other towns developed renewables as well, using hybrid systems incorporating generators and solar.[70]

While the benefits of incorporating renewables in the energy mix are clear, there are numerous challenges due to a dearth of human resources at EDL and electricity capacity. While EDL provided a simple online application for customers that both generated and consumed electricity to acquire a bidirectional meter, they did not have the capacity to respond to applications in a timely way.[71] And since EDL does not provide 24/7 electricity, solar producers were also forced to negotiate with numerous diesel generator operators to develop a hybrid

system, creating another hurdle.[72] Still, some municipalities and individual consumers needed the alternative and were willing to work around the obstacles. But by 2018, Lebanon's growing financial crisis dried up most of the bank financing used to provide long-term, low-interest loans.[73]

Developing larger-scale renewables is even more difficult. Prior to the current crisis, there was a MEW initiative to award a limited number of large-scale contracts for solar and wind-generated power.[74] However, since these PPAs do not require any capital investment by the government, the investor takes on all the financial and technical risks of working in Lebanon; risks which translate to higher wind energy and solar PV costs in in the PPA.[75] For example, a wind farm in Akkar is charging 10.75 cents per KwH for wind power, when the levelized cost of electricity is 7.8 cents.[76] The margin of profit will allow the company to recover its initial investment. Even with this additional cost, it is still cheaper than EDL's average cost of production at 17.14 cents per KwH.[77]

Renewables seem like an obvious solution for Lebanon's persistent power problems. With over 300 days of sun per year and a potential of 6.1 gigawatts of wind energy, Lebanon is well-suited for renewables.[78] Given the current grid capacity, investments may have to start small or be disconnected from the grid. Entrepreneurs in the renewables sector are ready, and the assessments for capacity have been done. What is missing is capital and an appropriate regulatory framework.

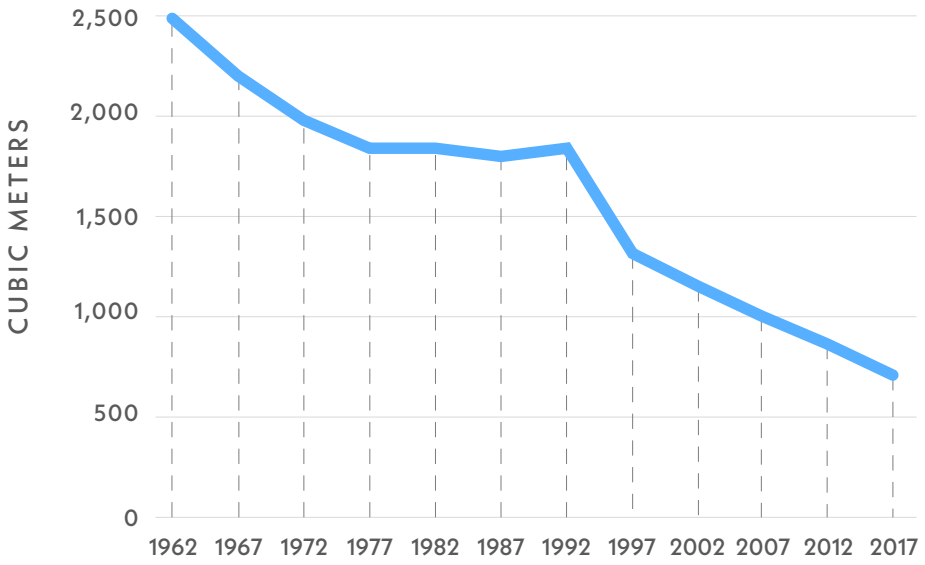
WATER AND SANITATION

Thirty years after the end of the civil war, getting access to clean running water remains a challenge in many parts of Lebanon. Water providers have become indispensable; key to Hezbollah's rise in the 1980s was the provision of free water in underserved neighborhoods.[79] Lebanon, once water-rich compared to its neighbors, now suffers from water scarcity. Its sea fronts, lakes, and rivers are dangerously polluted with raw sewage, often visible as grey blotches on satellite imagery.

Many neighborhoods have experienced hours of daily water cuts since the civil war. Much like electricity, poorer neighborhoods in the Greater Beirut area and southern and northern Lebanon suffer the most. Trucked water can fill much of the gap, but it can cut deeply into lower- and middle-class families' incomes. Bottled water can supplement, as well, but it is even more costly and adds to the country's solid waste crisis.

There are many factors contributing to the steep decline in water availability. Underinvestment, conflict, informal property development, and planning splintered by regional and sectarian tensions have hurt water and sanitation utilities. The influx of 1.5 million Syrian refugees has increased the demand on water services by almost 30 percent.[80] Today, Lebanon claims less than 1,000 cubic meters per capita of annual renewable water resources, the definition of water scarcity. Along with naturally increasing demand, climate change could further reduce Lebanon's water availability by as much as 16 percent.

Renewable Water Sources per Capita



Source: The World Bank, "Renewable internal freshwater resources per capita (cubic meters) – Lebanon," Database, https://data.worldbank.org/indicator/ER.H2O.INTR.PC?end=2017&locations=LB&start=1962&view=chart.

The problems of Lebanon's water sector are, in some ways, even more challenging than the challenges of the electricity sector. Water is a shared resource, but it is not one that is shared equally. Today, an estimated 20,000 boreholes in Greater Beirut and Mount Lebanon—many of which are illegal—provide water to households across the income spectrum, exacerbating water scarcity and corrupting the data necessary to inform planning decisions.[81] As in the electricity sector, propositions have been robust, but execution has been paltry. Of 18 dams proposed as part of the National Water Sector Strategy for 2000 to 2010, only a single one was built.[82]

While there has been significant investment in wastewater infrastructure, the benefits have not matched the spending. In the decade after the civil war, the CDR awarded 122 contracts in the wastewater sector; 42 small treatment plants were built between 2001 and 2004.[83] Many of the wastewater treatment plants were built without the energy to function, the workers to operate and maintain them, or connection to sewage networks. By 2007, the country had only one operational wastewater treatment plant, which did not adequately remove contaminants, and only 66 percent of the population was connected to an improved sewer network—mostly along the coast and in major cities.[84] Today, only 3 to 7 percent of wastewater is treated. Most of Lebanon's sewage, industrial, and agricultural waste is still habitually dumped into the sea or the country's water ways.[85] The seepage into groundwater and use of polluted water for agriculture is endemic, damaging public health.

Like the electricity sector, parliament sought to reorganize the water sector about two decades ago. Parliament designated the MEW as the lead policy actor in the water sector, and it consolidated numerous water establishments into just four regional ones under the ministry to build and operate drinking, irrigation, and wastewater treatment. Yet, the regional water establishments never got the necessary resources to fulfill their mandate, and overlapping responsibilities of different government institutions and local stakeholders impeded progress. At least 48 percent of supply is still lost to leakage and theft.[86] Many Lebanese simply do not pay their water bills, and even metering

IT TAKES A VILLAGE TO PROTECT A RIVER

In 2018, the Lebanese Transparency Association released a dramatic video taking viewers on an aerial journey of the Litani River. The Litani is Lebanon's longest river, and its basin covers a fifth of the country. But this was no tourism video. It showed a waterway choked with waste from municipalities, farms, and industry, along with proof that farms use the contaminated water for irrigation. The video and subsequent reports cite rising cancer rates as evidence for the health consequences of the pollution.

For decades, Lebanese governments have lacked either the will or capacity to combat pollution of the Litani. But in 2018, Sami Alawieh became the head of the Litani River Authority (LRA), the governmental institution responsible for the Litani River. A lawyer by training, Alawieh rallied strong political backing to wage a war against pollution. Lacking a mandate either to manage sanitation infrastructure or shut down violators, Alawieh had to think creatively.

The LRA began recruiting a wide range of partners. Experts at the Lebanese University helped to measure pollution levels, and teams from the Faculty of Agricultural and Food Sciences at the American University of Beirut assisted in documenting violations. The LRA website asked citizens to submit evidence of pollution and polluters through LRA social media channels, and Alawieh posted videos of polluters dumping into the river on social media, engaging the community. The Lebanese Bar Association signed a cooperation agreement with the LRA to provide legal support on environmental matters, and after just one year, the LRA had issued more than 200 violation notices over the discharge of waste into the river. Activists then launched campaigns to boycott the companies and factories while enforcement was pending. Alawieh was labeled a hero for his campaign to save the Litani.

The LRA's campaign has caused its share of disturbance. The campaign displaced hundreds of refugees, and it sued 17 local and international NGOs assisting them for failing to properly manage the latrines servicing the settlements. Litigation also shut down more than 70 unlicensed factories, putting people out of work in an already strained economy.

There will be limits to punishing violators without viable options for cost-effective wastewater treatment in the country. However, the LRA's campaign is an example of civil society, academia, and the judiciary joining together to do what the government alone cannot.

remains an innovation in many parts of the country. Starved for cash, handcuffed by a public sector hiring freeze, unable to afford regular maintenance, and facing an unreliable electricity supply to operate its pumping operations, the regional water establishments struggle to deliver services.[87] To this day, only the Beirut and Mount Lebanon Water Establishment (BMLWE) covers its own maintenance and operations costs.[88]

Local stakeholders have emerged to fill in gaps. Despite the MEW's consolidation of authority 20 years ago, more than 200 local water committees continue to operate independently of the ministry and the system it established.[89] The municipalities also have long records of involvement in local water matters, but their principal governmental contact is the Ministry of the Interior and Municipalities (MOIM), which has a weak record of cooperation with the MEW.[90] In addition, some of the municipalities have their own records of tensions, which can complicate disputes over water. In the words of one water expert in Lebanon, "the government pretended that they were operating on a blank page, but the social dimensions were very complex, involving many communities with different ways of functioning together. Tensions between some communities were not taken into account."[91]

Overlapping authorities impede effective

HASSAN AMMAR/AFP via Getty Images

A Lebanese boy fills his palms with water to drink from a mineral water tanker that says "Hezbollah" on it in the southern Lebanese village of Frun on November 2, 2006.

service delivery and accountability at the center as well. Lebanese complain that the CDR and the MEW share responsibility to plan, fund, and implement large-scale water infrastructure, but they do not coordinate.[92] In light of these ongoing governance issues, cheating has become widespread because regulations are rarely enforced.

With this lack of accountability, the Lebanese public has grown especially skeptical of large infrastructure projects, which are susceptible to corruption. The recent campaign to stop the construction of the Bisri Dam to augment water supply is emblematic of this mistrust.[93]

However, there have been exceptional individuals that have made positive change in this complex environment. In Ablah, about 20 miles southwest of Baalbek, the mayor played a major role in ensuring that a small wastewater treatment plant continued to function by collecting yearly fees from residents and hiring a competent engineer to manage the project.[94] In spite of some challenges, the project was able to better treat the wastewater and irrigate farms, limiting the usage of groundwater.[95] Further south in Saida, the South Lebanon Water Establishment (SLWE) hired 45 new engineers and fired more than 60 inefficient contract employees to allow the institution to function.[96] The SLWE was not the only governmental institution shaking things up. In 2018, the new director of the Litani River Authority (LRA), the government institution established in 1954 to manage Lebanon's rivers and irrigation and hydropower projects along Lebanon's longest river, began cracking down on polluters—taking big industries, municipalities, and even NGOs to court.[97] However, many of these examples were successful in spite of the system, rather than because of it. They also required some level of political backing or, at least, acquiescence, which is not always forthcoming.

The checkered record of incomplete or failed water projects has also damaged the reputation of international development agencies, NGOs, and international financial institutions working in Lebanon. However, some implementers are learning how to work in the Lebanese context. In order to ensure that water and sanitation services are more equitably distributed, some implementers have shifted from unsuitable infrastructure to focusing on realistic inputs, communication, and coordination. Low-cost and low-energy wastewater treatment projects have been proposed and developed, such as constructing wetlands to naturally filter toxins.

Decentralized wastewater treatment companies could be a promising alternative to large plants that require energy and resources that Lebanon does not possess. A creative initiative by the AFD linked French municipalities with Lebanese ones and used the framework to build relations between the regional water establishments, municipalities, and sometimes the CDR.[98] USAID began working directly with local NGOs, agricultural cooperatives, and municipalities to install drip irrigation, cutting water demand considerably.[99] Now, donors are working with the government to improve its recovery costs; this is vital for continued maintenance and operations.

Lebanon's waterways are in crisis, but the country has the technical experts and entrepreneurs to develop solutions to the country's water supply and sanitation is-

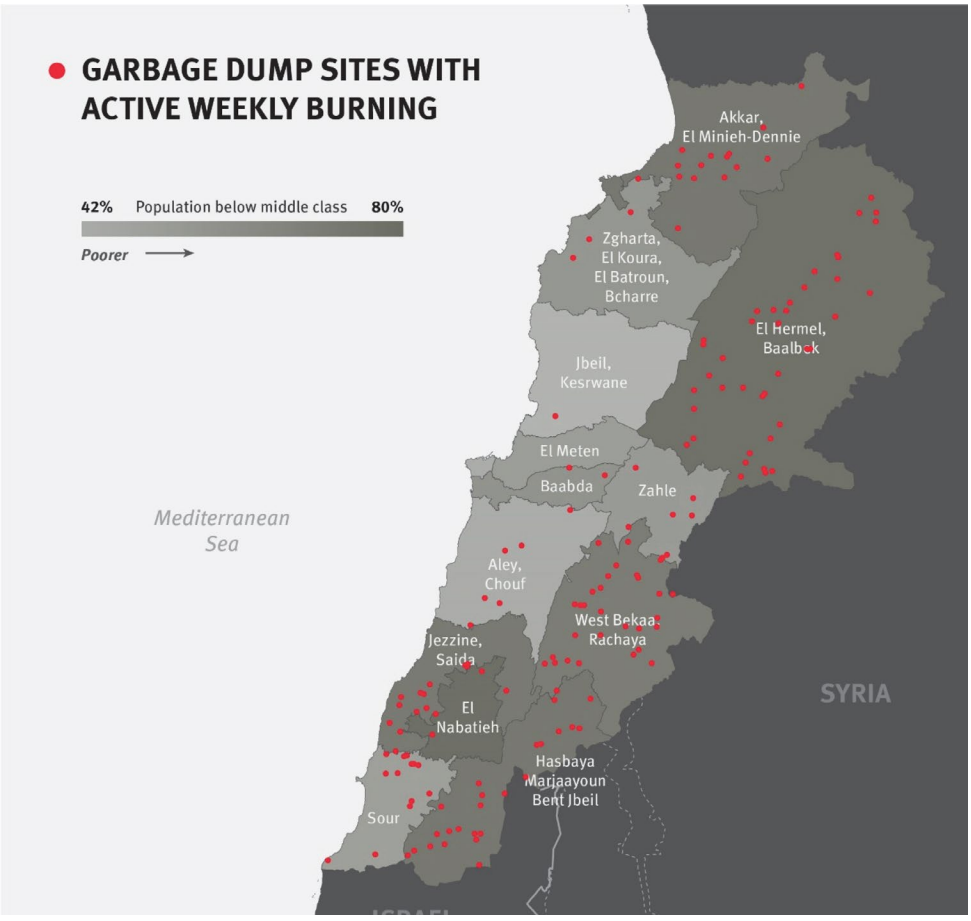
sues. Adopting these cost and energy efficient solutions, coordinating with local stakeholders, and equitably enforcing regulations will not radically fix Lebanon's problems overnight, but it will help reinstate the trust needed to ensure water is a public good for all.

WASTE

When refuse began spilling into the streets of Beirut after the closure of the Naameh landfill in July 2015, it ignited waves of protests. Citizens' discontent at the central government's failure to provide waste collection and treatment birthed dozens of civil society movements including Beirut Madinati (Beirut, My City) many of whom rallied under the slogan, tal 'it rihatkum, or "You Stink." But 2015 was not the start of Lebanon's garbage crisis, it was only the year that the crisis reached the richer parts of the country. Lebanese have burned waste and used open landfills for years, harming their health and the environment.[100]

These problems emerged in spite of the country paying some of the highest rates for solid waste collection in the world. The company with a monopoly on waste collection and street cleaning in Beirut reportedly receives $140 per ton of waste.[101] By comparison, Algeria spends around $7.22 and Jordan $22.80.[102] Only 6 percent of solid waste is recycled, and most is merely disposed of in unsanitary landfills. Entrepreneurs have been eager to gain entry to the waste sector but have found it difficult to break the monopolies dominating waste collection.

At the national level, the Waste Management Board oversees developing waste



Source: Human Rights, Watch, *"As If You're Inhaling Your Death": The Health Risks of Burning Waste in Lebanon* (Human Rights Watch, November 2017), 46, https://www.hrw.org/sites/default/files/report_pdf/lebanon1117_web_1.pdf.

GOLD FROM GARBAGE

When the mayor of Manara, Hassan Ayoub, does his daily lap through the streets of his small municipality in Lebanon's Bekaa, he looks for one thing: small bins outside of residents' homes that indicate they are sorting their waste.

Manara is one of a few Lebanese municipalities that have teamed up with Compost Baladi, a startup promoting low-tech, low-cost composting solutions for municipalities, individuals, and the private sector. The company's founder recognized an opportunity to significantly decrease the amount of organic waste dumped or landfilled—over 50 percent of the total amount of waste produced—through composting. Through the partnership, and the mayor's watchful eye, over 80 percent of Manara households regularly sort their waste. Compost Baladi works with the municipality to gather, dispose, and transform organic material into compost that can be sold to consumers and recover costs.

It was a long road to the Manara model. Past experiences had made municipalities wary of private sector initiatives on waste. To demonstrate that their model worked, Compost Baladi began small, working with groceries and then residences on domestic sorting and composting. After demonstrating their proof-of-concept—and demonstrating that they were not just creating another problem—they were able to scale up.

Local as it is, Compost Baladi's municipal interventions were only made possible because international donors, such as the Dutch VNG International in Manara's case, made significant investments covering the cost of infrastructure.

The economic crisis has limited imported products and opened new opportunities for the locally made compost. But since most of the machinery and equipment used in a composting facility are paid for in dollars and the compost it produces is paid for in Lebanese liras, the sharp drop in the value of the lira has created problems for investors. While Compost Baladi is committed to working in Lebanon, its next expansion may be elsewhere.

strategies and authorizing a solid waste management plan. Like in the water field, authority is shared between the CDR and different ministries such as the Ministry of the Environment and the Ministry of Interior and Municipalities.[103]

While municipalities are responsible for solid waste management, legislation in 2001 effectively allowed the central government to siphon the Independent Municipalities Fund—money designated for all municipalities—to fund waste management contracts in the Greater Beirut area. The effect was not only to force all Lebanese to subsidize waste collection in Beirut, but also to starve local governments of the resources they needed for solid waste management.[104]

The 2015 crisis forced the government to respond. The government expanded landfill capacity and delegated increased authority to local governments for waste management. However, the central government continued to prioritize its own projects, and municipalities continued to lack the resources necessary to properly assess waste management projects, making them vulnerable to the destabilizing role of politically connected private companies managing municipal solid waste. Ambitious but ultimately failing projects included highly complex inputs not suitable to the current environment.

The effects of these failures went beyond the individual projects by making it difficult for entrepreneurs interested in promoting environmentally and financially sustainable alternatives to win the trust of residents and municipalities. Given the lack of regulation and resources, municipalities may also prefer the cheapest immediate option, rather than the sustainable one.

Before the economic crisis, there were many challenges, but motivated entrepreneurs were gaining ground—adapting their business model for recycling and composting organic material to the Lebanese context. To build trust, some had to start small, working with grocery stores and convincing municipalities that their solution would not backfire or cost them anything at the outset.[105] Ziad Abichaker, who developed the first zero-waste landfill in Beit Miri, switched from a build and transfer model to a build and operate model when it became clear that some municipalities did not have the capacity to manage the waste. Since few residents would sort their waste for recycling at home, he asked waste collectors to pick up the trash without compacting it so it could be properly sorted later on. These success stories spoke for themselves; municipalities began inviting these entrepreneurs to work with them, but then the government went bankrupt.

Today, entrepreneurs say that donors can provide the upfront costs and, in time, when they are ready, municipalities can assume management. In the meantime, creation of an enforced and detailed regulatory framework for participation in the sector, along with a realistic recovery cost mechanism, is needed.[106] What is clear is that if nothing is done in the short term outside of the central government structure, the waste crisis will reach unprecedented levels.

JOSEPH EID/AFP via Getty Images

Garbage lie at Dbayeh's seaside shore north of Beirut on November 28, 2017, after it was washed away by the sea from the nearby seaside garbage dump of Karanatina.

ANALYSIS

Lebanon's current troubles should not surprise those who have been paying attention to basic service provision. However, in crisis lies opportunity. The country has the chance to rebuild in a way that it never did after the civil war. By leading with environmental sustainability, transparency, and cooperation, Lebanon can finally have inclusive reconstruction and renewed pride in their public goods.

Companies, NGOs, and development agencies are learning that working within the existing landscape to build trust and cooperation with stakeholders is more challenging but ultimately more rewarding than simply building infrastructure unsuitable to the context. Lebanon has the talented entrepreneurs, technical experts, and motivated civil society to do this work, but they need to be empowered to work constructively with their government and communities or they will eventually look elsewhere like so many millions of their compatriots during the war.

TUNISIA

In December 2020, authorities in Sidi Bouzid planned a ceremony to commemorate the 10-year anniversary of Mohammed Bouazizi's self-immolation.

The fruit vendor's protest against harassment from local officials had ignited nationwide protests which swept Tunisia's aging dictator from power and catalyzed protests from Morocco to Bahrain. A decade later, Tunisia's democratic revolution is considered the only success story of the Arab Spring.

But when crowds marched through the streets of Sidi Bouzid last December, they were not celebrating the success of the revolution. Instead, they chanted and shouted, railing against unemployment, poor services, and the lack of local development.[107] After a decade of failed promises, the people of Sidi Bouzid returned to the street to call for a new revolution. At the last minute, local authorities were forced to cancel the commemoration.

Tunisia's 2011 revolution created an opportunity for the government to remake the social contract through improved service delivery, but the government has fallen short of Tunisians' expectations. As part of its effort to build government accountability, Tunisia has embarked upon a broad strategy of decentralization. However, the decentralization process has been slow and uneven, and the central government has not provided local authorities with sufficient support to improve basic services of electricity, water and sanitation, and solid waste management.

Many Tunisians have now become disillusioned about prospects for positive change. Despite lockdown measures for the Covid-19 pandemic, violent protests spread across multiple governorates on the tenth anniversary of the revolution in January 2021. There is increasing urgency for the government to deliver sustainable and reliable utilities to its people.

GOVERNANCE OF SERVICE DELIVERY

The Tunisian government rapidly increased the provision of utilities in the last half-century, but regional disparities endure. The state sought to expand its authority in Tunisia in the second half of the twentieth century and extended utilities services to rural areas as part of the strategy. However, development was unequal and exacerbated interregional disparities. The state simultaneously dismantled mediating institutions—including tribes—and decisionmaking became highly centralized.[108] The government concentrated resources on several large cities on the coast, believing that was critical to Tunisia's development, and neglected the poorer regions of the interior and the south. These disparities exacerbated growing perceptions of marginalization which reached a crescendo in 2011.

Tunisians had high hopes that their living conditions would improve after the 2011 revolution. But the government has struggled to contend with rising demand for services and stresses on supply. As Tunisia's population has grown and become increasingly urban, the pressure on Tunisia's utilities has become more acute. Between 2010 and 2019, Tunisia's population grew by roughly 1 million, the vast majority of whom live in urban areas.[109] Tunisia is also grappling with the effects of climate change. Summers are hotter and drier, and winters are wetter, with less predictable rainfall. Meanwhile, political turmoil, endemic corruption, and

financial constraints have stymied the government's ability to make progress on its ambitious nationwide plans to improve the provision of utilities.

POWER

When a map from a German student's 2005 diploma thesis went viral on social media, it captured the excitement of engineers, environmentalists, and businesspeople alike.[110] The map was of North Africa and superimposed a red square over a small section of the Sahara Desert. If you just filled that area with solar panels, the caption stated, you could generate enough energy to power the entire Earth.[111]

The most prominent attempt to harness the potential of solar power in the Maghreb was Desertec. The Desertec Industrial Initiative was a consortium of mainly European companies that planned to invest $472 billion in solar megaprojects in the Maghreb and then pipe energy through a super-grid to Europe.[112] However, the consortium fell apart and the dream never materialized when the price of renewable energy technologies decreased to the extent that investors believed Europe could meet its energy needs domestically.

Even before its demise, the Desertec megaproject had been met with skepticism in Tunisia. Tunisian trade unionist Mansour Cherni summarized local concerns at a conference in 2013: "Where will the energy produced here be used? Where will the water come from that will cool the solar power plants? And what do the locals get from it all?"[113]

Source: Nadine May, "Eco-balance of a Solar Electricity Transmission from North Africa to Europe," Diploma thesis (Technical University of Braunschweig, August 7, 2005), https://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/projects/Ecobalance_of_a_Solar_Electricity_Transmission.pdf.

BRIGHT SKIES, BRIGHT FUTURE

Ahmed Ernez was amazed at Germany's success despite its cloudy skies. The Tunisian electrical engineer had moved to Berlin to work in Germany's innovative solar energy industry and was convinced his perpetually sunny homeland held even more potential. But the German technology was too expensive for the Tunisian market. Instead of exporting it to Tunisia, he founded his own company, Biome Solar Industry (BSI), and manufactured affordable solar water heaters in Tunisia for Tunisians.

BSI worked within the government's PROSOL mechanism. Under PROSOL, Tunisia's national electricity utility vets the financial viability of potential clients and then provides them with subsidized credit and a loan that is repayable through their electricity bill, ensuring the manufacturer gets paid and removing customers' upfront investment costs. A combination of PROSOL financing and a growing team of highly trained technicians have allowed BSI to thrive. It now exports its products internationally.

Despite being established in the Tunisian renewables market, a lack of public awareness about solar technology remains an issue. BSI has taken to social media to educate Tunisians on the myriad benefits of solar water heaters. One recent Facebook post says taking a hot shower before bed improves sleep quality, while another states that hot washing machine cycles cost less and conserve water.

Rising gas prices, increasingly affordable technology, and vocational programs mean the Tunisian solar industry is also creating jobs. With help from the German government, BSI opened a training center in 2016 to facilitate installations and services in Tunisia's solar market. Trainees graduate with a nationally recognized "Qualisol" certificate and have gone on to found more than 60 microenterprises which operate across the country. However, entrepreneurs without Ernez's decades of technical experience and international contacts may struggle to replicate his success. Entering Tunisia's solar industry takes more than just a sunny disposition.

Although Tunisia has significant potential for renewables and the government has ambitious plans to transition to clean energy, the large-scale projects it has championed have often been met with local hostility. Opponents to these plans argue that the government prioritizes international companies over local initiatives, refuses to relinquish its monopoly on electricity generation, and fails to provide local communities with any of the benefits.

Tunisia's domestic energy situation worsens every year. Growing demand forced Tunisia to become an energy importer for the first time in 2000, and its energy dependency has grown progressively more pronounced since 2010. Tunisia relies heavily on fossil fuels and imports natural gas from neighboring Algeria. In 2017, natural gas and oil represented 94 percent of Tunisia's energy mix.[114] Although nearly 100 percent of Tunisians have access to the national grid, shortages in supplies mean that electricity outages are common in many parts of the country.

Tunisia's energy sector is highly centralized. The national electricity utility, the Tunisian Company for Electricity and Gas (STEG), dominates the generation, transmission, and distribution of electricity. STEG generates 81 percent of Tunisia's electricity, distributes all energy generated in Tunisia, and exercises effective control over the strategic evolution of the sector.[115] In a sign of its power, STEG has thus far resisted government attempts to establish an impartial regulation authority for the electricity sector.[116]

Despite its continued reliance on fossil fuels, the Tunisian government began to integrate climate change concerns into its energy sector development processes as early as 1992.[117] One of its early programs to promote renewable energy is the Tunisian Solar Programme (PROSOL), which was launched in 2005. PROSOL is a funding mechanism to develop solar water heaters as a way of managing energy demand. In 2009, PROSOL-Elec was launched, which authorized the self-production of energy and the right to sell electricity to STEG. However, strong interests have fought the introduction of renewable energy into the electricity sector. In addition to STEG, the

> **"Where will the energy produced here be used? Where will the water come from that will cool the solar power plants? And what do the locals get from it all?"**
>
> *TUNISIAN TRADE UNIONIST MANSOUR CHERNI*

powerful electrical union has regularly gone on strike to protest the development of the renewable sector, which it equates with dangerous privatization.[118]

After the revolution, new voices in Tunisia began to challenge STEG's dominance. Private sector actors and civil society groups have tried to chip away at STEG's monopoly on the electricity sector and push for a renewable transition, although STEG still retains a preeminent position.[119] Responding to growing pressures to deliver sustainable services, the government updated the regulatory framework for renewable sources in 2015, seeking to boost private sector investments and liberalize regulations. It set an ambitious target of increasing the share of renewable energy in Tunisia's mix to 30 percent by 2030. These moves have had some success. In 2017, STEG's opposition to renewable sources began to soften as it came out in support for some public-private partnerships. However, STEG's strong preference for large projects that are connected to the central grid means a top-down approach continues to dominate and smaller projects struggle.[120]

International donors have attempted to challenge STEG's domination by promoting private sector activity in the electricity sector, but they too have achieved little success. The World Bank criticized STEG for failing to meet the government's annual targets for renewable energy generation, network expansion, and the reduction of technical and commercial losses.[121] The bank argued that STEG needed to accept that its former role in the electricity sector was no longer viable in the new context.[122] The European Bank for Reconstruction and Development has similarly criticized Tunisia's authorization regime, arguing that STEG's contracts disadvantage developers.[123]

In this highly centralized environment, local authorities and entrepreneurs have struggled to play a significant role. Businesses must overcome financial, social, and political obstacles to succeed in the electricity sector. The PROSOL initiative remains active, and financing processes have been optimized to facilitate the expansion of the solar water heater market. The head of one company, Biome Solar Industry (BSI), said PROSOL was critical to his success. In addition to exporting products across Africa, Europe, and the Americas, BSI set up a training center for the installation of solar water heaters and has created 62 micro-enterprises across Tunisia.[124] However, foreign investors are cautious to fund these projects, given Tunisia's political instability and limited resources from local banks.

Entrepreneurs often struggle to convince local communities of the benefits of renewables. Perceptions persist that renewable energy at the household level is only for the rich, while the potential benefits for local communities—including food security, water, and sanitation—are often poorly communicated.[125] Tunisians' perception of energy as a right, and the substantial subsidies they enjoy from the government, further diminishes their interest in renewable technologies. Tunisia spends 5 percent of its GDP on fuel subsidies. Although the government has embarked on a program to reduce these

FATHI NASRI/AFP via Getty Images

Tunisian protesters pose for a picture while standing on a tank at the oil and gas plant in el-Kamour in Tunisia's southern state of Tataouine on July 16, 2020.

subsidies gradually, the volatile social environment makes it difficult to implement the strategy without prompting large protests.

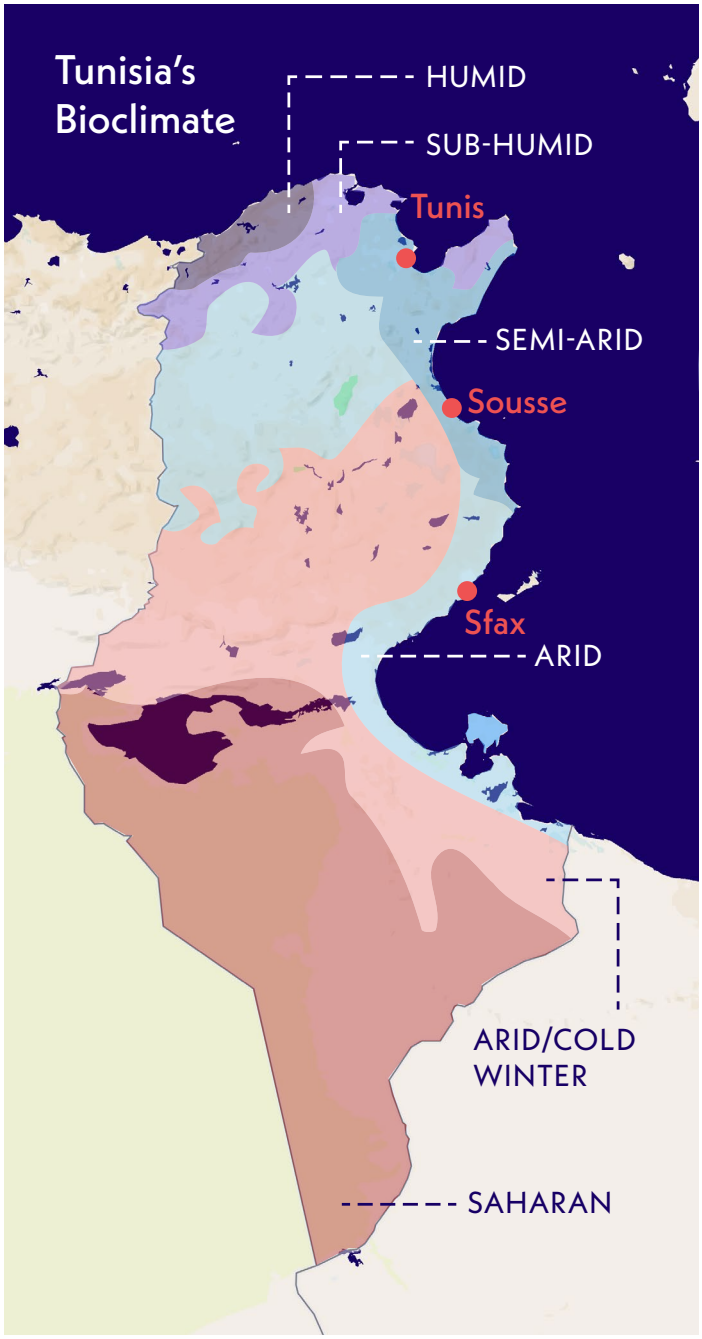
Tunisia has not yet been able to realize the dream of fueling the world's energy needs from its desert, and it has failed to even meet its own needs. The government has embarked on an ambitious plan to transition to renewable energy and has significantly improved the regulatory environment to achieve it. Experts predict that although Tunisia will miss the target of 30 percent renewable energy by 2030, it will have made important strides toward that goal.[126] However, Tunisia will not realize its potential to transition to a more sustainable energy strategy as long as strong interests resist any initiatives that challenge the state utility's monopoly on the market, political instability and subsidies deter private sector investment, and authorities fail to change mindsets by clearly articulating the benefits of renewable technologies to local communities.

WATER AND SANITATION

In March 2021, a national crisis in Tunisia prompted the Ministry of Religious Affairs to issue a call for the faithful to unite in prayer. It cautioned Tunisians to respect social distancing guidelines for Covid-19, but the crisis it referenced was not the pandemic. The government urged Tunisians across the country to pray for rain.[127]

Tunisia is one of the driest countries in North Africa. Two-thirds of the country is arid or semi-arid, and it is on the verge of water scarcity. The water resources Tunisia does have are distributed unevenly across the country and are heavily concentrated in the northwest. The areas on the coast that need the most water have the fewest resources. To make matters worse, climate change is causing fluctuations in rainfall, which is decreasing overall and becoming less predictable. As a result, droughts are becoming more common.[128]

Tunisia's growing population and economy increase demand for water year over year. The government has worked to extend water and sanitation services to the population and has achieved above average rates for the region. In 2016, the rate of drinking water coverage reached 97.7 percent at the national level, and between 2004 and 2015, the percentage of households connected to the public sanitation network increased from just under 74 percent to almost 90 percent.[129] However, Tunisia has a high level of water mobilization at 95 percent, meaning it has few options to increase supply.[130] Tunisia uses 83 percent of its mobilized water for agricultural irrigation, but the share used in the tourism sector is increasing, forcing two key sectors of the economy to compete for the dwindling resources. The water network is plagued by deteriorating infrastructure. Between 2010 and 2016, the system had an average efficiency of just 59 percent due to physical losses such as leaks, water theft, and insuf-



Source: Hana You et al., "Plant Diversity in Different Bioclimatic Zones in Tunisia," *Journal of Asia-Pacific Biodiversity* 9, Issue 1 (March 2016): 56–62, doi:10.1016/j.japb.2016.01.002; Dorte Verner et al., *Climate Variability, Drought, and Drought Management in Tunisia's Agricultural Sector* (Washington, DC: World Bank, October, 2018), 24, https://openknowledge.worldbank.org/handle/10986/30604.

THIRST ALONGSIDE A RESERVOIR

A group of women in the remote village of Erroui in northwestern Tunisia staged a sit-in by a reservoir. "We are dying of thirst!" they shouted, gesticulating at the reservoir full of drinking water two miles from their homes. Despite being in Tunisia's most water-rich region, their homes and the school in Erroui are not connected to the state water utility's network, and the women must walk for more than four hours a day for water.

The Tunisian government delegates responsibility for water provision in rural areas such as Erroui to volunteer-run associations called Agricultural Development Groups (GDAs). GDAs were designed to be democratic and financially sustainable entities, based on a model trialed in Germany. Rural populations elect directors to run their local GDA, and the group funds itself by charging consumers for water.

Until the Tunisian revolution in 2011, the system worked relatively well. A government-assigned representative in each GDA monitored its functioning and ensured consumers paid their bills. These representatives were often feared, so compliance was high.

However, the government has retreated further from water management in rural areas in the decade since the revolution. Corruption has increased, and some consumers extract more than their fair share of water. As service deteriorates, fewer consumers are willing to pay GDAs for their bills. In turn, GDAs have fallen behind on paying for electricity to run the water pumps, and the state electrical utility has cut their electricity.

GDA directors say they are trapped. They lack the authority to enforce payment and regulations, and they lack an independent body to investigate corruption. The GDA in Erroui, like many others, has fallen into debt. Of the estimated 2,500 GDAs across Tunisia, as many as 1,400 have stopped operating entirely.

Parliament's instinct is to get less involved rather than more so. A new water code would add wastewater management to GDA responsibilities. When civil society groups pushed back, the government argued that it is Tunisians' responsibility to elect effective representatives to GDAs. Whether they have effective representatives or weak ones, rural Tunisians may be walking hours a day for water for some time to come.

ficient registration of water meters.[131] The World Bank predicts water shortages in the Greater Tunis area by 2022 if supply capacity does not increase.[132]

Before the revolution, the water sector was characterized by highly centralized decisionmaking with limited stakeholder participation or consultation. The water code of 1975 defined water resources as a public good, banning private water ownership and centralizing water management under the Ministry of Agriculture, Water Resources, and Fisheries (MARHP).[133] Water was seen as critical to Tunisia's development, and the state invested in costly infrastructure to mobilize resources from the interior toward industrial cities on the coast.

Toward the end of the twentieth century, Tunisia embarked on a gradual shift from a supply management policy to a policy of managing demand. The government introduced water saving programs and sought to correlate water pricing more closely with operating costs. Although water management in most of Tunisia remained highly centralized, the government decentralized groundwater governance in rural areas. From 1987, the state began to implement reforms to decentralize agricultural development and progressively withdrew from local water management in agricultural communities. The result was the creation of water user associations (GDAs) in 2004. GDAs are non-profit associations that manage collective irrigation schemes or rural drinking water supplies on behalf of their members.[134] The structure aimed to increase technical expertise in decisionmaking, reduce resource management, and encourage direct public participation. However, members struggled to collect fees from their members, and many groups lacked the administrative, technical, and managerial skills to function effectively.

After the revolution, the government professed an aim to decentralize the water sector but made little progress in that regard. Water policy remains largely in the control of the same stakeholders as before the revolution. The national water strategies—Eau 2020, Eau 2030, and Eau 2050—were mainly conceived by the same government experts through non-participatory processes.[135] In 2014, civil society pressure resulted in Tunisia's constitution recognizing water as a right. The government tried to introduce a new public water code in 2015 which factored in climate change, but the powerful Tunisian General Labor Union (UGTT) opposed it due to fears of the privatization of the sector.[136] A compromise was agreed in 2019 and sent to parliament.

The changing relationship between the government and the people has manifested in increased tensions in the water sphere since the revolution. Protesters in the interior have decried the government's strategy of transporting water to richer areas on the coast. "How can you explain that the Jendouba region, which has large reservoirs, is suffering from thirst?" one man demanded in 2016.[137] Following pressure from the World Bank, the government pledged to increase the price of water in 2018, but frequent protests have delayed the process. The number of Tunisians refusing to pay their wa-

A rural woman walks with her donkey after collecting water in the northern Tunisian countryside of Mateur on March 14, 2019.

FETHI BELAID/AFP via Getty Images

ter bills in protest at service outages has also increased.

Decreasing rates of bill paying since the revolution have also undermined the effectiveness of decentralized water management bodies. GDAs' revenues come from selling water but collect just 40 percent of bills.[138] The groups lack the means to sanction farmers who over-pump groundwater, and so have no way to impose sustainable management of their resources. As a result of their financial difficulties, more than half of the 2,500 GDAs in Tunisia are estimated to be inactive.[139]

The Tunisian government is simultaneously grappling with growing demand for water, decreasing supplies, and an increasingly angry public. Repairing water infrastructure to mitigate losses is vital but will be costly and take time. Increasing water rates as a means of managing demand is necessary but should be implemented in a progressive manner to ensure that the most vulnerable are protected. The government must also integrate stakeholder participation and consultation in its strategic planning. Better understanding the needs and concerns of water users should enable the

government to provide incentives to reduce water usage. For example, farmers should be incentivized to transition to less water-intensive crops.

WASTE

In July 2020, Tunisian customs officers discovered hundreds of containers of suspicious cargo in the port city of Sousse. The containers were listed as storing plastic scraps for recycling but contained something else entirely. Not drugs, weapons, or cigarettes, but tons of putrid household and hospital waste from Italy.[140] The discovery shocked Tunisians, who demanded to know why Tunisia would import another country's garbage when it fails to manage its own waste effectively. The answer was money. Despite Tunisia's ban on importing foreign waste, the incident was evidence of a murky global trade in which industrialized countries pay developing countries to take care of their waste. The investigation into the scandal resulted in the sacking of Tunisia's environment minister, who was subsequently arrested in November 2020 alongside customs officials, a Tunisian diplomat in Naples, and national waste management agency officials.

Even without importing other countries' garbage, Tunisia's solid waste management crisis worsens year on year. Growing urban populations and changing lifestyles have caused dramatic increases in municipal waste. The annual quantity of municipal solid waste produced in Tunisia increased from 1.8 million tons in 2002 to 2.8 million tons in 2017, and it is projected to almost double again to 5 million tons by 2036.[141] The increase in solid waste increases pollution, poses serious public health risks, and strains underfunded management systems. It also carries economic costs. Several European tourism companies stopped offering tours to Tunisia, citing complaints about trash on the beaches.[142]

Tunisia adopted a relatively forward-looking, but highly centralized national solid waste management program in 1993. The new National Waste Management Agency (ANGeD) was tasked with rehabilitating illegal landfills and creating controlled landfills.[143] The government also established a decent legal framework for solid waste management, which defined different types of waste and the roles of the institutions that are responsible for managing different parts of the process. However, municipalities were responsible for waste collection but were not able to achieve financial or administrative autonomy, and some rural areas were not covered by any municipalities, meaning no one was responsible for waste collection.

Tunisia began to implement the first system of managing packaging waste in the MENA region—ECO-LEF—in 2001. ECO-LEF is a public-private partnership to collect, sort, and resell plastic waste to recyclers. The system is primarily funded by a 5 percent "eco-tax" on imports of raw materials and packaging made of certain materials, including plastic.[144] The government is supposed to operate a "pollut-

VOLUNTEER TRASH COLLECTORS

Tunisia's revolution in 2011 improved many things, but the odors of Tunis was not one of them. Trash collectors went on strike for almost half a year after the revolution to demand better salaries, and waste collection systems broke down. Garbage piled up and rotted in the streets.

The situation motivated some Tunisians to take matters into their own hands. A sound engineer, a software developer, and a French expatriate in the northern suburbs of Tunis founded an initiative "Tunisie Propre" to organize beach clean-ups and public awareness campaigns on littering. The three volunteers realized they could sell some of the waste they collected to recyclers if they sorted it. They saw an opportunity to use the limited revenues to increase the environmental impact of their efforts. They devised a plan to collect garbage directly from homes and businesses.

Tunisie Recyclage was born, a volunteer-run non-profit association that collects and sorts waste from members, who pay a subscription fee. The association attracted the attention of foreign embassies and international organizations in Tunis and secured funding to expand their work. By 2018, more than 1,200 households and 30 companies had subscribed, and they were able to hire three paid permanent staff.

However, the system relied on volunteers and an old truck that kept breaking down. Multiple times, they were forced to cancel their service at the last minute, and many of their members grew frustrated and stopped paying. Although they bought a new truck in 2020 through crowd-funding and resumed reliable service, they are still working to win back members' trust.

Because Tunisie Recyclage continues to rely on volunteers and donations, the initiative may be difficult to replicate elsewhere in Tunisia. Still, the organizers are keen to collaborate with municipalities and other similar organizations to expand their impact and encourage others to copy their model. They recently joined a consortium of 30 stakeholders working on fighting pollution. They believe that such partnerships may enable them to influence government strategies in the long term. However, Tunisia's political turmoil has made establishing relationships with the right authorities a challenge: in the 10 years since the revolution, Tunisia's government has changed seven times.

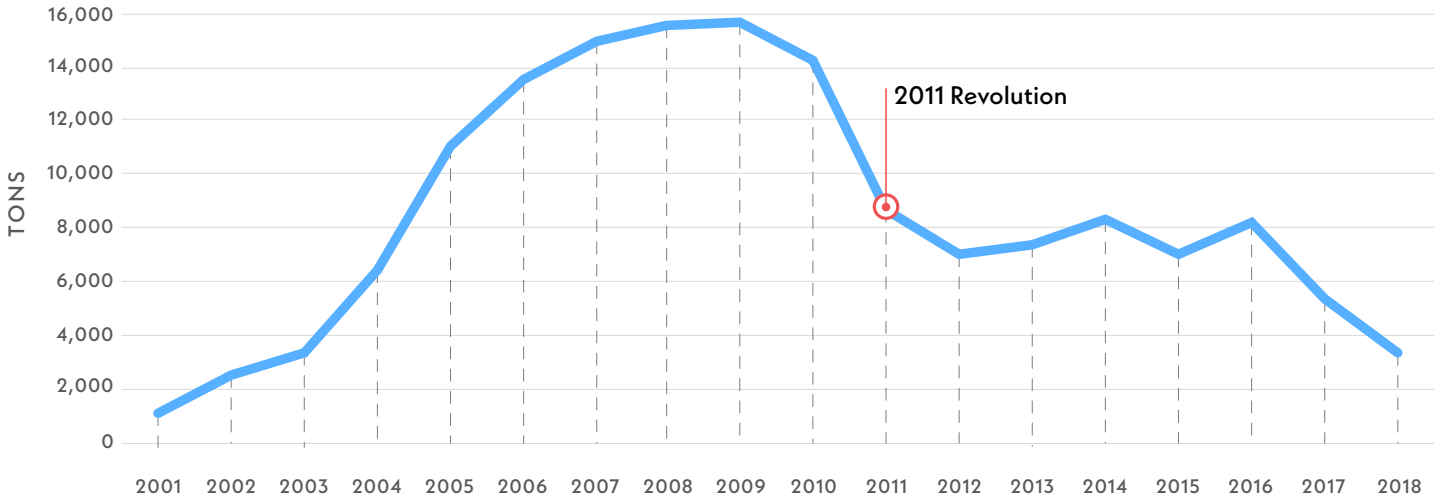
er pays" scheme for industrial waste, but the system is enforced unevenly and some powerful businesses evade it.[145]

Immediately after the revolution, waste management deteriorated in both rural and urban areas. Systems of waste collection and recycling were disrupted.[146] More than 70 percent of waste went to landfills, and 21 percent was dumped in uncontrolled landfills which proliferated across the country.[147] As one manifestation of the government's struggles with waste management since the revolution, the quantity of waste collected under ECO-LEF and the number of members of the system have both decreased dramatically since 2009.[148]

Waste management is an important aspect of the new government's commitment to decentralization. In 2014, the government issued a law which enabled municipalities to achieve financial and administrative autonomy, which is critical for their ability to perform their responsibilities in waste management.[149] When municipal elections were held for the first time in May 2018, local elected authorities gained increased powers and became important decisionmakers in waste management. For the first time, the authorities responsible for solid waste management were clear across Tunisia, as every inch of territory was part of a municipality. The decentralization process therefore created new opportunities for accountability in the waste management sector.

However, several factors have undermined local authorities' ability to manage waste effectively. There was little time between the creation of the new municipalities and local elections, meaning many local authorities came to power without knowing what their authorities or responsibilities were.[150] Because of weak revenue collection—just 27 percent of Tunisians pay municipal taxes—municipalities were overstretched and under-resourced.[151] Municipalities also lack data to inform their strategies of waste man-

Recyclable Materials Collected under the ECO-LEF Scheme



Source: Wassim Chaabane et al., "Shifting Towards Sustainable Tourism: Organizational and Financial Scenarios for Solid Waste Management in Tourism Destinations in Tunisia," *Sustainability* 11, No. 13 (June 2019): 3591, https://www.researchgate.net/publication/334137982_Shifting_Towards_Sustainable_Tourism_Organizational_and_Financial_Scenarios_for_Solid_Waste_Management_in_Tourism_Destinations_in_Tunisia.

agement. For example, without knowing where people live, how much trash is generated, and what type of trash is generated, municipalities stand little chance of optimizing collection processes.[152] These challenges caused a number of mayors to resign—in the first two years, almost 1 in 10 mayors across Tunisia resigned.[153]

Various international actors have attempted to support the development of Tunisia's solid waste management systems, but they have enjoyed limited success. The World Bank financed a $22 million project to support sustainable municipal solid waste management from 2007 to 2014, which was intended to provide institutional support, build infrastructure, manage and monitor projects, and build capacity.[154] However, an independent evaluation in 2015 found the project to have been "highly unsatisfactory."[155] The revolution disrupted the project, but the evaluation pointed to various other shortcomings. It failed to appreciate the political economy, relied too much on top-down interventions, and failed to develop a communications strategy with local communities, which led to opposition to new landfills and the proliferation of illegal dump sites.[156]

Donors have supported various local initiatives in the solid waste management space. The German government supported the creation of SWEEP-Net, a regional solid waste exchange of information and expertise in the MENA region in 2009. The platform aimed to serve as a network for municipalities to share best practices, but it collapsed when German financing expired in 2015. Local experts say that more than ten local waste management projects have collapsed as they failed to develop sustainable systems and international financing ran out.[157]

Local groups and entrepreneurs must overcome various challenges to engage in the solid waste management sector, including incomplete legal frameworks, negligible government support, and a lack of private sector investment. The constant political turmoil since the revolution, terrorist attacks, and now the Covid-19 pandemic have all undermined investor confidence in Tunisia's private sector, limiting entrepreneurs' ability to develop sustainable financing for their initiatives. Three volunteers founded Tunisie Recyclage in northern Tunis in 2012 as a response to the worsening waste situation after the revolution. What began as a campaign to raise awareness about pollution evolved into an association that collected waste from more than 1,000 houses and enterprises. The group attracted funding from various embassies and other international actors but remains small-scale and has received no real support from the Tunisian government.[158] Without a sustainable financing mechanism, it will struggle to expand beyond the northern suburbs of Tunis.

One international project sought to tackle the issue of informal waste collectors, but funding expired in 2020. Roughly 10,000 workers in the informal sector, known as barbechas, collect waste in Tunisia. They are not permitted to contribute directly to the ECO-LEF scheme and instead must sell their waste to middlemen who then sell it to private recycling factories or

ANGeD.[159] Several international donors and NGOs have attempted to integrate barbechas into the formal sector, but the waste pickers are often very sensitive to discussions about their status and little progress has been made.[160] One prominent British-funded project ended in 2020. A positive development came in 2020 when parliament passed a "social and solidarity economy" law which supports collectives and self-governed businesses that make a profit and serve a social objective. This law should give barbechas better protection from health risks and exploitation but will still not integrate them fully in the formal waste management sector.[161]

The Tunisian government has several good systems in place for solid waste management and has worked to improve the regulatory environment in recent years. However, although the government has shown interest in expensive technological solutions to manage waste—such as mechanical biological treatment plants—it has failed to put sufficient effort into establishing the foundations of basic governance in the sector. For example, the process for decentralization holds promise for waste management, but many of the necessary codes have yet to be issued.

Although the challenges to waste management have grown since the revolution, the new political environment has resulted in some important developments in the space. Corruption remains a scourge—as seen from the scandal of the contraband waste from Italy—but now the media is able to highlight it and the responsible parties were held accountable. Tunisians now elect local officials who are responsible for waste management in their areas and who can be held accountable. However, as long as municipalities are over-stretched and under-resourced, they will bear the brunt of public discontent for unsatisfactory performance in waste management.

ANALYSIS

Tunisia's revolution—arguably the only successful revolution of the Arab Spring—provided the backdrop for a similar revolution in service provision. The organs of the authoritarian state of Bourguiba and Ben Ali were weakened, and the public interest could take center stage in policymaking. Yet, Tunisia also stands as a reminder that even when existing structures shudder, replacing them with something more resilient is still a daunting task. New political leaders often lack either the expertise or experience to engender organizational change, and enduring institutions have incentives to redouble their efforts to protect or even advance the interest of those they represent. Tunisia has not failed at the task of adopting a more environmentally sustainable path toward service delivery, but neither has it succeeded. Instead, Tunisia warrants an "incomplete" as it continues to navigate the post-revolutionary period and find a new model of governance that meets the needs and demands of a public that has been underserved by its leaders.

COMMONALITIES

Failures in service provision are an increasing environmental, economic, and political threat to Jordan, Lebanon, and Tunisia.

Demand for increased services from growing populations and economies is not the only source of the problem. Climate change and forced displacement, both of which are beyond governments' control, compound the pressures. These governments strain to increase supplies of electricity and water and to dispose of waste, but they are often forced to resort to short-term fixes that are environmentally and economically unsustainable. Since service delivery already consumes a huge percentage of their budgets, further increases in spending

on services are difficult. As a result, services are increasingly patchy—causing diminished economic growth, cumbersome workarounds, and rising public anger that often drives thousands to the streets in protest.

These countries' mid-twentieth century experience was different. Then, the expansion of public utilities often seemed like a miracle, bringing improved health and an invigorated economy even to remote and rural areas. Combined with universal education and expanded transportation options, utilities were an integral part of the nation-building process for Middle Eastern states. In the countries under study, utilities helped millions shift their focus from mere survival, lifted an even larger number out of poverty, and created opportunities for leisure that were previously unimaginable.

And yet, the increasing unreliability of those very same services has become a liability. Mere survival has once again become a preoccupation for a growing number of citizens. Poor services contribute to desperation and disease among vulnerable populations who cannot afford to pay for supplements to public utilities. The poor are more likely to suffer from the effects of pollutants on air, soil, and water, watching as environmental degradation shrinks their children's opportunities.

Establishing more sustainable systems is not only critical for the environment and public health. It can boost local job creation, especially among young technical graduates who are struggling to establish their careers, and make businesses more competitive and efficient.

The transition to sustainable models of service provision will require changes in behavior. Citizens will have to get used to recycling, farmers will need to grow less water-intensive crops, and homes and businesses will need to pursue greater energy efficiency. Some of these changes will face resistance, but the transition need not be painful. Incorporating affected stakeholders in strategic planning and providing them with appropriate incentives allows the transition to create new virtuous cycles for society and the economy.

In all of the sectors in the countries under study—power, water and sanitation, and solid waste—there are differences: in the ways utilities are organized, in the actors involved, and in the strategies governments pursue. Still, there are striking commonalities among them. This investigation of pathways to sustainability has revealed a surprising number of common pathologies that cut across sectors and countries.

OBSTACLES TO THE TRANSITION TO SUSTAINABILITY

NATIONAL STRATEGIES

Governments have ambitious and relatively forward-looking national plans for service delivery. Tunisia incorporated climate change into its service delivery

strategies as early as the 1990s, and it has set an impressive target of reaching 30 percent renewables in its energy mix by 2030. Jordan has made unprecedented investments in renewables, making it a leader in the region. These plans indicate that the governments appreciate the importance of acting to usher in greater sustainability in service provision.

However, shortcomings in the formulation of these strategies undermine their potential and will hamper implementation. First, national plans have often prioritized large infrastructure projects, and those mega-projects have become the target of local anger. For example, protestors closed state oil facilities in southern Tunisia, activists and industrialists stalled the Red-Dead project in Jordan, and civil society groups persuaded the World Bank to abandon the controversial Bisri Dam project in Lebanon after they led a sustained campaign. In all three countries, citizens believed that the mega-projects sought to advance narrow (and often private) interests in capital cities at the expense of local stakeholders.

Second, planning often ignores significant populations affected by both the provision of services and their absence. In Lebanon, for example, government planning systematically ignores the country's refugee population, despite their constituting as much as a quarter of the country's inhabitants. Tunisia's national waste management strategy excludes more than 10,000 barbechas, informal waste collectors who collect most of the plastic that is recycled in the country. Repeated civil society attempts to formalize these workers' roles have failed, deepening barbechas' distrust of the government. Government strategies cannot succeed if they fail to consider significant numbers of consumers or large populations whose livelihoods the strategies threaten. In fact, these failings both jeopardize the strategies' success and further marginalize large and vulnerable communities, contributing to domestic strife.

A third common failing is inadequate intragovernmental coordination. The three sectors of power, water and sanitation, and solid waste management are intimately intertwined, and yet in all of the countries under study, the ministries and agencies that manage them exist in silos. A nexus approach in national service delivery, which is currently lacking in all three countries, would make all of them more efficient.

Finally, national plans are characterized by top-down planning, with inadequate stakeholder consultation and participation across the board. For example, the Tunisian government has articulated a commitment to decentralization in the country's water strategy, yet the government conducted only negligible consultations with affected parties. The issue is not merely political inclusion—although such inclusion would go a long way toward building trust with affected parties. There is also the need for more engagement with local communities, which would help ensure that projects built are appropriate to local needs, contributing to their ultimate success.

Government strategies cannot succeed if they fail to consider significant numbers of consumers or large populations whose livelihoods the strategies threaten.

TRANSPARENCY AND AWARENESS

Utility provision is an especially opaque process in these countries, and populations in each country complain that they have little insight into what governments do in this field and why. For example, pricing is generally wholly divorced from the cost of providing utilities, and the public has no idea what those costs are (and would not trust a government estimate of them). In addition, broad sectors of the population have, over time, grown to consider cheap utilities as an entitlement.

Governments must do several things simultaneously: connect pricing to costs, protect the most vulnerable, and address stakeholders' concerns. Greater transparency and inclusion of end users in planning processes would provide additional benefits to governments. For example, effectively engaging farmers would help inform government efforts to provide incentives and to vary cost structures with the goal of persuading farmers to farm less water-intensive crops. Doing so contributes to government goals of reducing consumption while also broadening political inclusion.

Poor public awareness of the importance of sustainable development has complicated governments' already difficult jobs. When governments insufficiently explain sustainable initiatives to local communities, those communities resist change. For example, an electricity expert in Tunisia noted that rural communities are generally unaware of the direct and indirect benefits of renewable energy and express no interest in pursuing it. More explicitly aligning governments with the goals of improving food security, water access, and sanitation systems—and explaining the ways that renewable technology advances those goals—would increase its acceptance.

REGULATIONS, ENFORCEMENT, AND ACCOUNTABILITY

A widespread sense of pervasive favoritism marks criticisms of governance in Jordan, Lebanon, and Tunisia. Incomplete

regulations, uneven enforcement, and limited accountability define all three service sectors in all three countries to varying degrees. In Lebanon, for example, laws for service provision are incomplete, outdated, and sometimes contradictory. Even worse, the regulations that do exist are unevenly enforced, and entrenched confessional patronage systems shape every sector of service distribution. Without independent regulatory bodies for service provision, corruption—and perceptions of corruption—festers, eroding public trust.

The post-revolutionary government in Tunisia has taken steps to improve the regulatory environment, but it does not enforce regulations uniformly. In addition, the government has failed to establish an independent regulator for the electricity sector in the face of resistance from the national utility company and electricians' unions, and Lebanon has delayed the establishment of an independent regulator for the electricity sector for decades. The Jordanian government has struck agreements with private companies in the water sector with little public disclosure.

Stakeholders often have limited avenues to hold government officials accountable for poor service provision. Overlapping authorities and responsibilities between different ministries and agencies frustrate citizens' ability to hold underperforming officials to account. Tunisia has made some progress in this regard, and the decentralization process has enhanced local accountability for waste management. However, local officials often lack adequate resources to fulfill their responsibilities.

HUMAN AND TECHNICAL CAPACITY

Interviews in all three countries cited limited human capacity as an important obstacle to more sustainable service provision. The local politicians who won Tunisia's 2018 elections became responsible for waste management, but few had any experience in the sector, and budget constraints have prevented many municipalities from hiring staff with the requisite skills. In Lebanon, periodic government hiring freezes have simultaneously barred highly competent people from serving in the government while insulating unproductive employees from accountability. The Jordanian government lacks necessary technical skills among its workforce, with the limited technical capacity of municipal officials posing a particular challenge.

Jordan, Lebanon, and Tunisia struggle to utilize the human capital that exists. Poor environments for innovation and entrepreneurship often prompt the most promising entrepreneurs to seek opportunities abroad rather than in their home country. Weak links between academia and entrepreneurship also undermine the potential of innovation in sustainable initiatives to deliver services.[162] The business community has some environmental expertise, but outside of that, those with relevant skills find it difficult to engage in any way on policy decisions with environmental implications.

Aging and dilapidated infrastructure is a further problem, undermining service delivery and the potential to transition to more sustainable systems. In Jordan and

Lebanon, the electricity grid does not allow for an effective use of renewables; in Tunisia and Lebanon, almost half of mobilized water is wasted due to leakage and other inefficiencies in the system. Infrastructure must be rehabilitated and upgraded to reduce waste, increase supply, and facilitate a transition to sustainability.

CAPITAL

Governments cannot simply spend more money to remedy these issues. All three countries have poor tax collection regimes. Jordan and Lebanon have among the lowest rates of tax collection in the Middle East, and just 29 percent of Tunisians pay municipal taxes, which fund waste management. Low tax revenue is partly the result of inefficiencies in government collection systems, but it also represents a growing trend of citizens refusing to pay taxes and utility bills on principle. These protests contribute to a vicious cycle in which citizens withhold funds to protest the government's poor performance, leaving the government with even less ability to improve service provision.

Governments also struggle to attract foreign investment to improve service provision. All three countries have had multiple changes in governments in the past decade, undermining investor confidence in consistent policies and raising fears of destabilizing power vacuums. Beyond political instability, poor services also contribute to a vicious cycle for the private sector: unreliable supplies of electricity deter investment that could improve those same services.

VESTED INTERESTS

Government attempts to encourage greater investment and private sector participation in service provision are met with resistance from powerful actors with vested interests. National utility companies often consider moves to open up their sectors to new actors to be a threat. In Lebanon, Electricité du Liban dominates the energy sector and tries to quash independent electricity initiatives. In Tunisia, both the national electricity and gas company, Tunisian Company of Electricity and Gas (STEG), and the electricians' union have resisted the government's attempts to increase the privatization of the energy sector for fear of a loss of jobs and lower salaries. In Jordan, electricity distributors are locked into long-term contracts and lack incentives to deal with the variable nature of renewables on the grid.

Powerful constituencies have also resisted government plans to enforce environmental standards. In Jordan, several prominent landowners and agricultural companies wield significant power, and they lobby the government against enforcing water conservation strategies. In Lebanon, factions in the government and so-called "generator mafias" have worked to resist the introduction of renewable technologies.

These vested interests accentuate a feeling that corruption is pervasive. Powerful constituencies' ability to block government initiatives undermines any confidence that developments in service provision will be done in good faith. Social groups are divided against each other.

While weaker groups believe that cheating is necessary for their survival, they also believe that what is truly corrosive is the massive cheating that the powerful pursue to advance their own interests.

THE TRUST DEFICIT

There is little doubt that a transition toward more sustainable systems of service delivery in the Middle East would require new technologies, infrastructure, fee systems, and regulations. All of these can be bought off the shelf or be custom-designed by consultants with global experience. On paper, the new systems will be geared for success. And yet, even the best systems in the world cannot succeed by themselves. Governments implementing these systems must acknowledge and respond to the nuances of their local contexts, address the foundations of their political economy, and act with transparency and inclusivity. These requirements may appear daunting, but they come down to something quite fundamental: if these efforts are to succeed, governments must build trust.

TRUST AND SERVICE DELIVERY

Trust is easier to feel than to define. Philosophers, psychologists, economists, political scientists, and others have pondered trust for as long as their academic fields have existed. Trust is a pervasive characteristic of human interaction, shaping expectations of behavior between individuals in communities, organizations, and societies.

Academics have broken trust down into several categories. The most fundamental form of trust is relational trust between two people, in which an individual accepts some kind of vulnerability based on a positive expectation about the intentions or behavior of another.[163] The next level of trust is organizational trust, which is a generalized expectation or belief that comes from membership in an organization.[164] A broader sense of trust is institutional trust, which is a sense of security based on guarantees, safety nets, or other structures.[165] Francis Fukuyama articulated an even broader understanding of generalized trust, which is "the expectation that arises within a community of regular, honest, and cooperative behavior, based on commonly shared norms, on the part of other members of that community."[166] Political trust is linked to the latter two, representing confidence in the state's ability to mediate between the demands of competing groups in society.[167]

The Middle East is broadly considered to be a low-trust environment.[168] This is in part because of the region's widespread economic insecurity. Where people feel economically secure, they are more likely to trust their government and have confidence in public institutions; when citizens fear for their own livelihoods and perceive their country to be suffering economically,

they are less likely to trust their governments.[169] In addition, studies have found that institutional trust has deteriorated in societies rocked by the Arab Spring. This seems to stem, in part, from citizens' feeling that the uprisings were disruptive but provoked little meaningful positive change.[170] Given the economic crises that are currently raging across the Middle East—which the Covid-19 pandemic has exacerbated—trust in government in Jordan, Lebanon, and Tunisia is likely to have further declined.

Service provision plays an intimate role in shaping citizens' attitudes toward the state. Citizens' experiences when governments provide services poorly affect not only their views of state capacity, but of the state itself.[171] Institutional trust has been found to be the greatest factor determining resource stakeholders' perceptions of legitimacy: Low levels of trust in institutions are associated with low levels of legitimacy.[172] Poor government performance abets rule breaking and promotes defiance in the sectors the government is seeking to administer, further handicapping government efforts to improve that performance.

Low-trust environments shape the decisions that individuals make regarding services and natural resources. Many feel a need to pursue individual, short-term gains at the expense of long-term, communal interests because of scant trust that any future benefits will materialize. Such individuals are therefore more likely to exhaust accessible resources, such as groundwater supplies, irrespective of the long-term consequences for themselves and those around them. The behavior pattern, which academics term a "tragedy of the commons," jeopardizes the futures of individuals and communities alike.[173]

> **If these efforts are to succeed, governments must build trust.**

Low levels of trust also drive individuals toward informal channels to access services. In the Middle East, this takes the form of investing in wasta (personal connections) and bribery to obtain services.[174] A belief that individual citizens lack recourse when rules are not followed also pushes citizens toward clientelist networks that are both economically inefficient and drive further rule-breaking.[175]

Seen broadly, low levels of trust increase costs to governments and consumers alike. Individuals are unwilling to invest in better outcomes, seeking to maximize what they can extract immediately. Governments face reduced compliance by users; users find they must pay to supplement inadequate services, enter into

costly networks to ensure services are delivered, and sometimes both. The patterns create cycles of growing distrust that raise costs for all parties. The antagonism that the distrust creates spreads into other aspects of social and political life. Without enhancing trust, no government strategy to deliver sustainable services will succeed.

BUILDING TRUST IN LOW-TRUST ENVIRONMENTS

Building trust in low-trust environments such as the Middle East is difficult. Some scholars have proposed a phased approach up the chain of trust described above. That is, one should begin with efforts to enhance relational trust among individuals and within small groups, then organizational trust, then institutional trust, and finally generalized trust.[176] Based on this approach, policymakers may wish to focus on building trust within individual communities as a first step. Building community trust could ward against marginalized individuals' tendency to make myopic decisions.[177] When individuals have confidence their community can help cushion any short-term pain of transitions and ensure longer-term benefits, they are more likely to prioritize future gains such as the transition to sustainability. Sustained engagement of the community is one way that policymakers can build this trust.

In another strategy, local organizations operating in low-trust environments can build "secluded worlds" of high trust.[178] They may not be able to rely on generalized trust in society, but they can build organizational or even interorganizational trust. Cooperative enterprises that manage resources or provide utilities have built pockets of trust in other low-trust environments.[179] These experiences indicate that entrepreneurial and local initiatives may be key to building the trust required for a transition to sustainability.

However, the task of building trust in low-trust environments is not reserved for local initiatives alone. Governments can build trust by identifying and amplifying success stories. The World Bank has argued that "states can identify and popularize local successes by using the media, awards, and other campaigns to draw attention to best practices and to the social norms of responsive and clean service delivery and government."[180] Policymakers can also learn from those who have made the system work to identify ways of circumventing vested interests and building on those insights.[181]

BUILDING TRUST IN JORDAN, LEBANON, AND TUNISIA

Regional governments, donors, and international organizations are properly focused on technical efforts to promote more sustainable utility services in Jordan, Lebanon, and Tunisia. Yet, technology is only a part of the equation. Governments' ability to earn the trust of their citizens is the other part. Societies must not only pay the costs of outdated and inefficient infrastructure; so too must they pay the very real costs of defiance and circumvention of consumption constraints, utility theft,

bribery, supplemental services, and political corruption.

Governments must also build citizens' trust in the business environment. They must demonstrate that rules will be applied evenly, and they must engender confidence that future government strategies will not undermine sustainable business models. Insufficient strategic planning has long undermined companies working in renewables in Lebanon and Jordan. By handicapping entrepreneurs, governments undermine their own plans for a sustainable future.

The onus does not rest entirely on governments. Greater sustainability will require changes in behavior from a wide range of stakeholders. Elites—from the heads of utility companies to wealthy farmers—cannot be allowed to wield vetoes over policy. On the other end of the spectrum, marginalized communities must be weaned from consumption patterns that rely on highly subsidized government services. In truth, the status quo has been entrenched by incentives that reward current behaviors. These behaviors will need to be dismantled by a careful deployment of carrots and sticks. Trust is the currency that runs through these relationships, and that trust must be enhanced.

THE GOVERNMENT'S ROLE

The most fundamental way of increasing public and private sector trust in the transition to sustainability is to increase transparency and clamp down on corruption. Doing so is not as hard as it sounds. Records for procurement processes and accounts can be digitized and made publicly available. Independent regulatory authorities to enforce regulations and allow for auditing are also required. High-profile investigations into elite corruption, such as the Italian waste scandal in Tunisia, can help address the trust deficit and show seriousness of government action on corruption. Technology also provides multiple ways for citizens to undermine corrupt monopolies. On the one hand, fintech allows for the efficient, transparent, and low-cost transfer of cash, eliminating predatory middlemen. Technology also allows citizens to share both analysis and documentation freely, whether of conditions at the point of service or corruption at senior levels. While those with malign intent can use technology to obscure and obfuscate, the greater trend is using technology to level the playing field between the powerful and everyone else.

Governments must also support inclusion. They should increase stakeholder consultation and participation to government planning and decisionmaking processes. Being more inclusive will allow policymakers to target social and economic incentives to different communities to encourage them to engage in more environmentally sustainable initiatives. Providing context-specific carrots (and sticks, when necessary) is key to persuading skeptical stakeholders that the government understands their concerns.

National strategies should be built to maximize the benefits for those who need it most. Focusing on local job creation will also build trust. Part of utility unions' aversion to innovation in the services sector is

a fear of job losses. Governments should seek to ensure that the transition to sustainable services will demonstrably grow the economy, stimulate job creation for local communities, and develop the skills of the workforce to work in new industries.

Governments should also adopt new strategies to build awareness of their sustainability programs. Communication strategies should be tailored to ensure that they resonate with specific communities and stakeholders. Providing more space for civil society to operate independently will buttress these efforts and increase an important source of accountability in service provision. And governments should amplify success stories through strategies such as media campaigns and awards.

Governments' must price services more sustainably. Untargeted subsidies are not only costly overall, but subsidies increase as consumption increases, and they provide the greatest benefits to the wealthiest. In reducing subsidies, governments will need to do so in phases while simultaneously enhancing social safety nets. Supplemental cash transfers to vulnerable communities must accompany price increases. Higher prices are necessary to foster entrepreneurship in sustainability, but suddenly removing energy subsidies without any compensatory income—as may happen in Lebanon—will further grow the trust deficit.

Governments must forge new partnerships with the private sector that escape from traditional patron-client relationships and spur the private sector toward socially desirable entrepreneurship. Demonstrating a clear and long-term commitment to environmentally sustainable initiatives will help reassure private sector entities that participating in the sector will have long-term benefits. Governments should also examine and rework investment codes to facilitate local and foreign investment while providing businesses incentives to train workers and hire locally.

> **The status quo has been entrenched by incentives that reward current behaviors. These behaviors will need to be dismantled by a careful deployment of carrots and sticks.**

INNOVATION, ENTREPRENEURSHIP, AND TRUST

While national governments can create a broad environment that is conducive to entrepreneurship, local initiatives have

an important role to play in bolstering the government-led transition to sustainability. They can do this by creating pockets of trust and effectiveness. Local initiatives can improve state services when their efforts relieve pressure on state suppliers, making those services more reliable and building public confidence in the overall system. Such initiatives can also relieve pressure on state budgets.

Local and decentralized initiatives can also play a critical role in achieving community buy-in for sustainable service delivery. Local initiatives are likely to be more responsive to local needs, prompting context-specific solutions that are effective in the local political economy. If initiatives focus on local job creation, they can combat brain drain and help ensure the retention of skilled employees. Private entities have an important role to play in developing the skills of local communities so that they can perform the required jobs. For example, Biome Solar Industry in Tunisia established a training center for the installation of solar water heaters, which led to the creation of more than 90 micro-enterprises across the country.

Private initiatives contribute new streams of revenue to the government through taxation. A subsequent benefit of increasing taxation enforcement is that it can help build accountability in the government, and so reinforce the social contract between citizens and the government. Non-state initiatives may be more cost effective than public sector initiatives and have lower operating costs. Therefore, they can contribute to lower costs for consumers.

For all of the differences in environmental conditions, political structures, and business environments in the countries under study, very strong commonalities link them. What were once revolutionary and successful enterprises to provide services to expanding portions of the population are now strained institutions. Subsidies on utility services have become entitlements, straining the budgets of institutions that provide them and driving consumption of those services higher. Popular politics provide little check on government action, in part because politicians support the subsidies and in part because the utilities fit into broader patterns of political and commercial patronage.

Environmentally sustainable initiatives do more than merely hold out the promise of reliable and economical provision of services; they also help build trust by providing tangible evidence of government and private-sector activity that improve people's lives. From the seed of seemingly pedestrian public utilities, a more vibrant relationship can emerge between the governing and the governed.

CONCLUSION

Library shelves groan under the weight of decades worth of policy studies on the Middle East.

Every aspect of the region's foreign affairs, politics, economic development, social and educational policy, and agricultural strategies seems to have been examined closely. Yet very few of those studies consider the provision of public services, and that is a mistake.

Public services such as power, water, and waste seem hopelessly pedestrian and remote from serious policy concerns in a world of glamorous conferences and high-wire diplomacy.

Few scholars of the region have been to cities and neighborhoods where services are irregular. Their contacts, almost inevitably living in wealthy neighborhoods in capital cities, have found work-arounds. The failure to provide services is lamentable, but too often it is seen as marginal to the real issues at hand.

As previously suggested, public services such as power, water, and waste provide a powerful lens through which to view the actual interactions between governments and societies, and between elites and the public, in the Middle East. These utilities account for massive amounts of public spending, and they affect the lives of every resident. In many middle-income countries, including the ones under study, these utilities have become increasingly contentious as governments have strained to meet swiftly escalating demand. Many efforts to meet that rising demand have layered incremental solutions on top of incremental solutions. The results have been expensive, environmentally unsustainable, and ultimately inadequate for national needs.

Technological advances in recent years provide opportunities for more affordable and sustainable solutions. Operating costs are lower, negative environmental impacts are minimized, and reliability is increased. As an added benefit, many of these advances can be managed locally, connecting communities to services and creating jobs for young people.

And yet, widespread skepticism of government inhibits the adoption of many of these technologies. Overly centralized organization, a checkered record of performance, and deep perceptions of favoritism and self-dealing make millions doubt that sustainable solutions are sustainable at all. The public fears that such efforts will only enrich the powerful and exacerbate the unfair status quo. In addition, the political economies of many countries do not reward entrepreneurs working in these fields, in part because of inadequate support for entrepreneurs in general, and in part because of the political benefits that accrue from sustaining the status quo.

Public services such as power, water, and waste provide a powerful lens through which to view the actual interactions between governments and societies, and between elites and the public, in the Middle East.

Yet, those same obstacles signal the importance of success in this endeavor. Sustainable delivery of services will do more than merely improve environmental conditions in the Middle East and provide more reliable services to broad populations; it is also a vehicle to address the corrosive lack of trust in many Middle Eastern societies. That distrust is growing as governments are increasingly unable to meet the needs of their citizens. Building the capacity and accountability of local authorities will change their relationship with citizens for the better. Governments that are able to model effectiveness, efficiency, and fairness in the provision of services will win greater compliance in a range of regulatory activities. Nurturing a climate that fosters and rewards innovation in the environmental field will have ancillary benefits as well, not only creating a market for technological innovation but also providing opportunities for talented young men and women to advance their countries while they advance their own careers.

The policy studies on the Middle East address a myriad of issues, attribute them to many causes, and prescribe a wide array of solutions. Their diversity can feel overwhelming. To an unusual degree, a serious effort to increase the environmental sustainability of utilities would have a positive impact well beyond its notional parameters. It would have a halo effect on many of the most serious social, economic, and political challenges facing these societies. Technological advances allow services to be provided more effectively, economically, and sustainably than they are now, reaching larger populations more efficiently. The systems, habits, and behaviors necessary to do so are within reach, and their benefits would extend far beyond the narrow realm of the services themselves. Technology can provide the pathway, but it is not enough. Governments and their citizens must seize the opportunity.

Governments that are able to model effectiveness, efficiency, and fairness in the provision of services will win greater compliance in a range of regulatory activities.

ABOUT THE AUTHORS

JON B. ALTERMAN

is a senior vice president, holds the Zbigniew Brzezinski Chair in Global Security and Geostrategy, and is director of the Middle East Program at CSIS. Prior to joining CSIS in 2002, he served as a member of the Policy Planning Staff at the U.S. Department of State and as a special assistant to the assistant secretary of state for Near Eastern affairs, and from 2009-2019 he served as a member of the Chief of Naval Operations Executive Panel. In addition to his policy work, he often teaches Middle Eastern studies at the Johns Hopkins School of Advanced International Studies and the George Washington University. Earlier in his career, Alterman was a scholar at the U.S. Institute of Peace and at the Washington Institute for Near East Policy and a legislative aide to Senator Daniel P. Moynihan (D-NY) responsible for foreign policy and defense. From 1993 to 1997, Alterman was an award-winning teacher at Harvard University, where he received his PhD in history.

NATASHA HALL

is a senior fellow with the Middle East Program at the Center for Strategic and International Studies. Natasha has over 15 years of experience as an analyst, researcher, and practitioner in complex humanitarian emergencies and conflict-affected areas with a specialty in the Middle East. Most recently, she has worked on the Syrian conflict with The Shaikh Group, GIZ, Mayday Rescue, Center for Civilians in Conflict, and the U.S. government's Refugee Affairs Division. She has lived and worked in over 15 countries in the Middle East, Africa, Asia, the Southern Caucasus, and Europe. Her work has focused on conflict resolution, governance, displacement, environmental issues, resilience, and civilian protection. Her reports have spurred congressional hearings and high-level donor responses on Syria. She is a commentator and contributor for a number of media outlets including CNN, BBC, MSNBC, the Washington Post, Newsweek, U.S. News & World Report, the Atlantic Council, the United States Institute for Peace, and the Carnegie Endowment for International Peace, among others. Natasha is also the founder of Art in Exile. She earned her master's from Georgetown's School of Foreign Service and her BA from the University of Virginia in foreign affairs and Middle East studies. She did a Fulbright Fellowship in Jordan from 2006–2007 and a Boren Fellowship in Syria in 2010.

WILL TODMAN

is a fellow in the Middle East Program at CSIS. He has conducted field research in seven countries across the Middle East and North Africa, and his analysis has been published in peer-reviewed journals, by think tanks, and humanitarian organizations. Will has briefed U.S. officials, UN Security Council members, and foreign diplomats. He has also commented in print and on live television to

various outlets, including the BBC, CBS, CNN, and the Washington Post. Will previously lived in Beirut, where he worked at the British embassy and for the office of the UN special envoy to Syria. Will holds a BA in Arabic and modern Hebrew from Oxford University and an MA in Arab studies from Georgetown University.

ENDNOTES

1 Suleiman Al-Khalidi, "Jordan's public debt hits record $45 billion amid COVID-19 spending," Reuters, September 30, 2020, https://www.reuters.com/article/jordan-economy-debt-int/jordans-public-debt-hits-record-45-billion-amid-covid-19-spending-idUSKBN26L3L0.

2 Jennifer Gnana, "Exclusive: Jordan eyes oil shale production by 2020, energy minister says," The National, April 11, 2019, https://www.thenationalnews.com/business/energy/exclusive-jordan-eyes-oil-shale-production-by-2022-energy-minister-says-1.847735.

3 Al-Khalidi, "Jordan's public debt hits record $45 billion."

4 "USAID Water and Development Country Plan for Jordan," U.S. Agency of International Development (USAID), n.d., https://www.globalwaters.org/sites/default/files/Jordan%20Country%20Plan%20final.pdf.

5 Author's interview with Hanna Zaghloul, Kawar Energy, February 4, 2021.

6 "Jordan," U.S. Energy Information Administration (EIA), March 2014, https://www.eia.gov/international/analysis/country/JOR.

7 Gnana, "Exclusive: Jordan eyes oil shale production by 2020."

8 Ghaida Abu-Rumman, Adnan I. Khdair, and Sawsan I. Khdair, "Current Status and Future Investment-Potential in Renewable Energy in Jordan: An Overview," *Heliyon* 6, no. 2 (February 1, 2020): e03346, doi:10.1016/j.heliyon.2020.e03346.

9 "Jordan 3rd in renewable energy growth globally, 1st in region," *Jordan Times,* February 11, 2018, https://www.jordantimes.com/news/local/jordan-3rd-renewable-energy-growth-globally-1st-region%E2%80%99.

10 Sylvain Côté, "Renewable Energy and Employment: The Experience of Egypt, Jordan and Morocco," King Abdullah Petroleum Studies and Research Center, November 2019, https://www.kapsarc.org/research/publications/renewable-energy-and-employment-the-experience-of-e-egypt-jordan-and-morocco/.

11 Interview with Hanna Zaghloul.

12 Mohammed Ghazal, "All set for building oil shale-fired power plant," *Jordan Times*, May 16, 2017, http://jordantimes.com/news/local/all-set-building-oil-shale-fired-power-plant.

13 "Attarat Oil Shale Powerplant," Mostaqbal, https://www.mostaqbal.jo/project/attarat-oil-shale-power-plant/; and "Gov't, NEPCO initiate arbitration over Attarat project's PPA," Jordan Times, December 19, 2020, https://www.jordantimes.com/news/local/govt-nepco-initiate-arbitration-over-attarat-projects-ppa.

14 "NEPCO says Noble Energy was last option as debt hits JD5.5b," *Jordan Times,* January 6, 2020, https://www.jordantimes.com/news/local/nepco-says-noble-energy-was-last-option-debts-hit-jd55b.

15 Author's interview with Mohammed Ramadan, Cowater International, August 6, 2020.

16 Author's interview with Ruba Zuabi, formerly with Jordan Ministry of Energy and CEO of EDAMA, November 10, 2020.

17 Interview with Hanna Zaghloul.

18 "Jordan Assessment Report: Executive Summary," Organization for Economic Co-Operation and Development (OECD), 2014, https://www.oecd.org/mena/competitiveness/ISMED-Jordan-Executive-Summary.pdf; and interview with Hanna Zaghloul.

19 Interview with Hanna Zaghloul.

20 Rana F. Sweis, "A Parched Jordan Places Hopes in Reservoir," *New York Times*, November 28, 2012, https://www.nytimes.com/2012/11/29/world/middleeast/a-parched-jordan-places-hopes-in-reservoir.html.

21 Author's interview with Lara Nasser, November 6, 2020.

22 Chris Arsenault, "Climate change, refugees worsen Jordan's water woes: scientists," Reuters, August 30, 2017, https://www.reuters.com/article/us-mideast-jordan-climatechange-water/climate-change-refugees-worsen-jordans-water-woes-scientists-idUSKCN1BA2ER.

23 Khaldoun Said Qtaishat, "Reducing non revenue water in Jordan using GIS," *Proceedings* SPIE 11524, Eighth International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2020), no. 1152410 (August 26, 2020), doi:10.1117/12.2570784.

24 Taylor Luck, "Facing an even hotter, drier climate, Jordan testing desert agriculture," *Christian Science Monitor*, October 4, 2017, https://www.csmonitor.com/World/Middle-East/2017/1004/Facing-an-even-hotter-drier-climate-Jordan-testing-desert-agriculture.

25 USAID, *USAID Water and Development Country Plan for Jordan.*

26 Alex Russin, "Mobilizing Private-Sector Investment to Transform Jordan's Water System," Millennium Change Corporation (blog), February 22, 2017, https://www.mcc.gov/blog/entry/blog-022217-mobilizing-private-sector-jordan.

27 Pay Drechsel, G.K. Danso, and Munir Hanjra, "Viability gap funding (As Samra, Jordan)," in *Resource Recovery from Waste: Business Models for Energy, Nutrient, and Water Reuse in Low- and Middle-Income Countries,* ed. Miriam Otoo and Pay Drechsel (Oxon, UK: Routledge Earthscan; Oxon, 2018), 642-55, http://www.iwmi.cgiar.org/Publications/Books/PDF/resource_recovery_from_waste-642-655.pdf.

28 Anu Kerttula, "Jordan Is On The Edge Of A Water Disaster – The Home Of Jordanians And Arab Refugees Could Run Out Of Fresh Water In The Next Few Decades," Crisis and Environment, n.d., https://crisisandenvironment.com/jordan-is-on-the-edge-of-a-water-disaster-the-home-of-jordanians-and-arab-refugees-could-run-out-of-fresh-water-in-the-next-few-decades/.

29 "Jordan: Water Resources and the Environment," USAID, https://www.usaid.gov/jordan/water-and-wastewater-infrastructure.

30 Valerie Yorke, "Jordan's Shadow State and Water Management: Prospects for Water Security Will Depend on Politics and Regional Cooperation," in *Society - Water - Technology: A Critical Appraisal of Major Water Engineering Projects*, eds. Reinhard F. Hüttl et al. (Cham: Springer International Publishing, 2016), 227–51, doi:10.1007/978-3-319-18971-0_15.

31 Hana Namrouqa, "Local authorities tackle 30,000 violations on water resources since 2013," Jordan Times, May 6, 2017, https://www.jordantimes.com/news/local/authorities-tackle-30000-violations-water-resources-2013.

32 USAID, *USAID Water and Development Country Plan for Jordan.*

33 Yorke, "Jordan's Shadow State and Water Management."

34 Dante Toppo, *Political Agitation and Water Shortages in the Hashemite Kingdom of Jordan* (Claremont, CA: Claremont McKenna College, 2013), https://www.cmc.edu/sites/default/files/keck/Dante-Toppo-Hendricksen-Fellowship-Submission.pdf.

35 Wes Fry et al., *Human Rights Risk Assessment: Disi Water Conveyance Project Financial Sector Perspective* (Denver, CO: NomoGaia, 2015), https://media.business-humanrights.org/media/documents/files/documents/Disi_HRIA_Narrative_-_Report.pdf; and Daanish Mustafa, Amelia Altz-Stamm, and Laura

Mapstone Scott, "Water User Associations and the Politics of Water in Jordan," World Development 79 (March 1, 2016): 164–76, doi:10.1016/j.worlddev.2015.11.008.

36 Don Humpal et al., *A Review of Water Policies in Jordan and Recommendations for Strategic Priorities* (Amman, Jordan: USAID, May 18, 2012), https://pdf.usaid.gov/pdf_docs/PBAAE636.pdf.

37 USAID, *USAID Water and Development Country Plan for Jordan.*

38 Yorke, "Jordan's Shadow State and Water Management"; and Bahaa Al Deen Al Nawas, "Jordan Valley farmers welcome halt to citrus imports," *Jordan Times,* September 17, 2019, https://jordantimes.com/news/local/jordan-valley-farmers-welcome-halt-citrus-imports.

39 Maha Kattaa, Meredith Byrne, and Alaa Al-Arabiyat, *Decent Work and the Agriculture Sector in Jordan: Evidence from Workers' and Employers' Surveys* (Amman, Jordan: International Labor Organization, 2018), http://www.ilo.org/beirut/publications/WCMS_646170/lang--en/index.htm.

40 Peter Schwartzstein, "How Jordan's Climate and Water Crisis Threatens Its Fragile Peace," *Center for Climate & Security* (blog), September 9, 2019, https://climateandsecurity.org/2019/09/climate-water-security-and-jordans-fragile-peace/.

41 Yorke, "Jordan's Shadow State and Water Management."

42 Heinrich Böll Foundation, *Plastic Atlas: MENA Region First Edition 2020* (Lahr, Germany: Heinrich Böll Foundation, 2019), https://ps.boell.org/sites/default/files/2020-12/FINAL_Plastic%20Atlas%202020%20-%20English%20-%20DEC.pdf.

43 "Initial Action Document for the Support to the Implementation of the National Solid Waste Management Strategy (NSWMS)," European Commission, 2016, https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/c_2016_6629_jordan_aap_2016_part_2_aap_2017_part_1_annex_1.pdf.

44 European Commission, *Annual Action Programme 2016.*

45 Hani Abu Qdais et al., "The Role of Solid Waste Composting in Mitigating Climate Change in Jordan," *Waste Management & Research* 37, no. 8 (August 1, 2019): 833–42, doi:10.1177/0734242X19855424; and Fawzi Suleiman Gharagheer, Moshrik R. Hamdi, and Subhi M. Bazlamit, "Recovery of Recyclables of Municipal Solid Waste: The Case of Jordan," Journal of Environmental Engineering and Science 14, no. 4 (December 7, 2018): 212–17, doi:10.1680/jenes.18.00028.

46 "Solid Waste in Jordan," Beitak Baytak, https://www.beitakbaytak.com/solid-waste-in-jordan/.

47 "Using the Biogas of the Al-Ghabawi Landfill for Energy. Commissioning the Plant," Idom, November 25, 2019, https://www.idom.com/new/aprovechamiento-del-biogas-del-vertedero-de-al-ghabawi-recepcion-oficial-de-la-planta/.

48 "Turning waste into an asset in Aqaba, Jordan," United Nations Environment Programme, March 28, 2019, https://www.unenvironment.org/news-and-stories/story/turning-waste-asset-aqaba-jordan; and "Transforming Jordan's Recycling Industry," Chemonics International, https://chemonics.com/projects/transforming-jordans-recycling-industry/.

49 "Transforming Jordan's Recycling Industry," Chemonics International.

50 European Commission, *Annual Action Programme 2016.*

51 International Monetary Fund Middle East and Central Asia Department, *Jordan 2020 Article IV Consultation and Request for an Extended Arrangement under the Extended Fund Facility-Press Releases; Staff Report; and Statement by the Alternate Executive Director for Jordan* (Washington, DC: International Monetary Fund, 2020), https://www.imf.org/en/Publications/CR/Issues/2020/04/10/Jordan-2020-Article-IV-Consultation-and-Request-for-an-Extended-Arrangement-under-the-49324.

52 Elizabeth Picard and Alexander Ramsbotham, *Reconciliation, Reform and Resilience: Positive Peace for Leb-*

anon (London, UK: Conciliation Resources, 2012), https://rc-services-assets.s3.eu-west-1.amazonaws.com/s3fs-public/Accord24_Lebanon_ENG_0.pdf.

53 Angus McDowall, "Fixing Lebanon's ruinous electricity crisis," Reuters, March 29, 2019, https://www.reuters.com/article/us-lebanon-economy-electricity/fixing-lebanons-ruinous-electricity-crisis-idUSKCN1RA24Z.

54 "Lebanon," Global Waters, https://www.globalwaters.orgcurrent-page.

55 David Enders, "'The smell can kill you:' Lebanon's toxic disaster is only getting worse," *The National,* July 1, 2018, https://www.thenationalnews.com/world/mena/the-smell-can-kill-you-lebanon-s-toxic-disaster-is-only-getting-worse-1.745995.

56 SWEEP-Net, *Country report on the solid waste management in Lebanon* (Tunis, Tunisia: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2014), 8, http://www.moe.gov.lb/getattachment/%D8%A7%D9%84%D8%AA%D9%88%D8%AC%D9%8A%D9%87-%D8%A7%D9%84%D8%A8%D9%8A%D9%8A%D9%8A/%D9%85%D8%B9%D9%84%D9%88%D9%85%D8%A7%D8%AA-%D9%88%D9%86%D8%B5%D8%A7%D9%8A%D8%AD-%D8%A8%D9%8A%D9%8A%D9%8A%D8%A9/%D9%82%D8%B7%D8%A7%D8%B9-%D8%A7%D9%84%D9%86%D9%81%D8%A7%D9%8A%D8%A7%D8%AA-%D8%A7%D9%84%D9%85%D9%86%D8%B2%D9%84%D9%8A%D8%A9-%D8%A7%D9%84%D8%B5%D9%84%D8%A8%D8%A9-%D9%81%D9%8A-%D9%84%D8%A8%D9%86%D8%A7%D9%86/2-LEBANON-COUNTRY-REPORT-ON-SWM-2014.pdf.aspx?lang=ar-LB.

57 Nabil Makari, "How long will the lights stay on?," *Executive Magazine*, December 31, 2020, https://www.executive-magazine.com/economics-policy/energy/how-long-will-the-lights-stay-on.

58 AFP, "Lebanon Protesters Storm Energy Ministry, Spark Scuffles," Barron's, August 4, 2020, https://www.barrons.com/news/lebanon-protesters-storm-energy-ministry-spark-scuffles-01596546005; and Abbie Cheeseman, "'We're on the road to collapse': Inside Lebanon's crippling economic crisis," NBC News, July 18, 2020, https://www.nbcnews.com/news/world/we-re-road-collapse-inside-lebanon-s-crippling-economic-crisis-n1234005.

59 International Monetary Fund Middle East and Central Asia Department, *Lebanon 2019 Article IV Consultation-Press Release; Staff Report; Informational Annex; and Statement by the Executive Director for Lebanon* (Washington DC: International Monetary Fund, 2019), https://www.imf.org/en/Publications/CR/Issues/2019/10/17/Lebanon-2019-Article-IV-Consultation-Press-Release-Staff-Report-Informational-Annex-and-48733.

60 "Renewable Energy in Lebanon: Can the Country Embrace its Resources Sustainably?," Heinrich Böll Stiftung, March 1, 2019, https://lb.boell.org/en/2019/03/01/renewable-energy-lebanon-can-country-embrace-its-resources-sustainably; and Carlos Abou Jaoude et al. "Lebanon," in *The Energy Regulations and Markets Review*, ed. David L. Schwartz, 9th ed., (London: July 2020), 151–62, https://thelawreviews.co.uk/title/the-energy-regulation-and-markets-review/lebanon.

61 Jamal Saghir et al., *Summary: Lebanon's Electricity Sector* (Beirut: Kulluna Irada, The Lebanese Foundation for Renewable Energy (LFRE) July 2020), http://kullunairada.s3.amazonaws.com/blog/3223_1596016622_summary_lebanonelectricitysector.pdf.

62 IMF Middle East and Central Asia Dept., *Lebanon 2019 Article IV Consultation-Press Release; Staff Report; Informational Annex; and Statement by the Executive Director for Lebanon.*

63 Philip Issa, "Plagued by cuts, Lebanon survives on floating power plants," Associated Press, July 22, 2018, https://apnews.com/article/20e21b2c469c4653ae32167f15ac631c.

64 Leila Molana-Allen, "Lebanon's power barges pay a heavy environmental price," France 24, August 27, 2018, https://www.france24.com/en/20180823-lebanon-heavy-price-fuel-burning-barges-solve-energy-crisis.

65 Ibid.

66 Author's interview with Rony Karam, Lebanese Foundation for Renewable Energy, November 3, 2020.

67 Tom Perry and Ellen Francis, "Special report: Lebanon's power struggle – why a failing state can't get the lights on," Reuters, August 10, 2020, https://www.reuters.com/article/us-lebanon-crisis-power-special-report-idCAKCN25626G.

68 Melda Jabbour and Rana El-Guindy, *National Energy Efficiency and Renewable Energy Action* (NEEREA) (Cairo: Regional Center for Renewable Energy and Energy Efficiency, 2014), https://www.rcreee.org/sites/default/files/lebanon_neerea_web.pdf.

69 Author's interview with Rony Karam, Lebanese Foundation for Renewable Energy, November 3, 2020.

70 For an example from Qabrikha, see UNDP-CEDRO Team, "Sustainable Impacts of Energy Projects on Livelihoods, Education and Health," United Nations High Commissioner for Refugees, October 2018, 28, https://data2.unhcr.org/es/documents/download/66478.

71 Author's interview with Jessica Obeid, August 28, 2020.

72 Henrietta L. Moore and Hannah Collins, "Decentralised Renewable Energy and Prosperity for Lebanon," *Energy Policy* 137 (February 1, 2020): 111102, doi:10.1016/j.enpol.2019.111102; Heinrich Böll Stiftung, "Renewable Energy in Lebanon"; Issam Shabani and Mohammad Chaaban, "Technical Overview of the Net Metering in Lebanon," *Trends in Renewable Energy* 6, no. 3 (October 28, 2020): 266–84, doi: 10.17737/tre.2020.6.3.00126.

73 Author's interview with Antoine Kaldany, Yelloblue, December 11, 2020.

74 Ibid.

75 UNDP, *Lebanon: Derisking Renewable Energy Investment* (New York: United Nations Development Programme, 2017), http://climatechange.moe.gov.lb/viewfile.aspx?id=262; and Heinrich Böll Stiftung, "Renewable Energy in Lebanon."

76 Interview with Rony Karam; and Heinrich Böll Stiftung, "Renewable Energy in Lebanon."

77 Heinrich Böll Stiftung, "Renewable Energy in Lebanon."

78 Sarah Tabbara, "Lebanon's wind power story," Middle East Institute, September 5, 2018, https://mei.edu/publications/lebanons-wind-power-story#:~:text=The%20mean%20potential%20of%20wind,provide%20electricity%20to%20Lebanese%20consumers.

79 Anna Walnycki and Marwan Husseiki, "Five fundamentals to keep Lebanon's water flowing," International Institute for Environment and Development, December 18, 2017, https://www.iied.org/five-fundamentals-keep-lebanon-water-flowing; and "Water supply is top priority issue for the south," New Humanitarian, March 12, 2007, https://www.thenewhumanitarian.org/fr/node/235926.

80 Ibid.

81 Ibid.

82 Stéphane Ghiotti and Roland Riachi, "Water Management in Lebanon: A Confiscated Reform?," Études Rurales 192, no. 2 (2013): 135–52, https://www.cairn-int.info/article-E_ETRU_192_0135--water-management-in-lebanon.htm.

83 Fadi Karam et al., "Wastewater Management and Reuse in Lebanon," *Journal of Applied Sciences Research* 9 (January 1, 2013): 2868-79, https://www.researchgate.net/publication/249967889_Wastewater_management_and_reuse_in_Lebanon.

84 World Bank MNSSD, *Republic of Lebanon Country Environmental Analysis* (Washington DC: World

Bank, June 2011), http://documents1.worldbank.org/curated/en/360011468265768992/pdf/622660ESW0Gray0c060601100BOX361480B.pdf; and Karam et al., "Wastewater management and refuse."

85 Author's interview with Claire Papin Stammose, October 8, 2020; and Walnycki and Husseiki, "Five fundamentals."

86 Gebran Bassil, "National Water Sector Strategy," Ministry of Energy and Water, 2012, http://extwprlegs1.fao.org/docs/pdf/leb166572E.pdf.

87 Author's interviews with Nadim Farajallah, American University of Beirut, September 22, 2020; Sara Dia, Waterlution Lebanon, January 7, 2021; and Karim Eid-Sabbagh, September 16, 2020; Mohammed Zaatari, "Southern water employees stage sit-in," *The Daily Star*, December 29, 2004, https://www.dailystar.com.lb/News/Lebanon-News/2004/Dec-29/3039-southern-water-employees-stage-sit-in.ashx.

88 Karim-Philipp Eid Sabbagh, *A political economy of water in Lebanon: water resource management, infrastructure production, and the International Development Complex,* (PhD thesis, University of London, 2015), https://doi.org/10.25501/SOAS.00020365.

89 As of 2016, 67 agricultural schemes operate based on the same private water rights as prior to the reforms. Roland Riachi, *Water Policies and Politics in Lebanon: Where Is Groundwater?* (Colombo, Sri Lanka: International Water Management Institute, January 2016), http://gw-mena.iwmi.org/wp-content/uploads/sites/3/2017/04/Rep.9-Groundwater-Governance-in-Lebanon_final.pdf.

90 Anna Walnycki, "Making Lebanon's Water Flow: Delivering Better Basic Urban Services," International Institute for Environment and Development, November 1, 2017, https://pubs.iied.org/17442IIED; and Michele Pierpaoli, *Cost Recovery and Demand Management in Lebanese Water Sector* (Lebanon: Gruppo di Volontariato Civile, 2016), https://www.pseau.org/outils/biblio/resume.php?d=6503&l=en.

91 Author's interview with Marie-Helene Nassif, September 23, 2020.

92 Eid Sabbagh, "A political economy of water in Lebanon."

93 Marwan El Solh, "Lebanon's dam obsession: who pays the price?," Middle East Eye, February 4, 2016, https://www.middleeasteye.net/opinion/lebanons-dam-obsession-who-pays-price.

94 Interview with Marie-Helene Nassif.

95 "ReWater MENA visits two wastewater treatment facilities in the Bekaa region, Lebanon in December 2018," ReWater MENA, January 13, 2019, https://rewater-mena.iwmi.org/2019/01/13/rewater-mena-visits-two-wastewater-treatment-facilities-in-the-bekaa-region/.

96 Daniel Nammour, "The Case of South Lebanon Water Establishment," December 3, 2018, https://acwua.org/wp-content/uploads/2019/01/Day-1Session-2-Lebanon-case-of-South-Lebanon-Water-Establishment.pdf.

97 Christophe Maroun, "The Litani River, Lebanon's main artery, is facing an environmental crisis," Global Voices, November 11, 2018, https://globalvoices.org/2018/11/11/the-litani-river-lebanons-main-artery-is-facing-an-environmental-crisis/.

98 Interview with Claire Papin Stammose.

99 Interview with Sara Dia.

100 Emily Lewis, "Out of sight, out of mind: Lebanon expands landfill to clear garbage from streets," Al Arabiya English, May 9, 2020, https://english.alarabiya.net/en/features/2020/05/09/Out-of-sight-out-of-mind-Lebanon-expands-landfill-to-clear-garbage-from-streets.

101 Jacob Boswall, *Lebanon: the state of waste* (Beirut, Lebanon: Heinrich Böll Stiftung, December 20, 2019), http://www.lb.boell.org/sites/default/files/2019-12/lebanon_the_state_of_waste_1.pdf.

102 "Lebanon: Huge Cost of Inaction in Trash Crisis," Human Rights Watch, June 9, 2020, https://www.hrw.org/news/2020/06/09/lebanon-huge-cost-inaction-trash-crisis.

103 Ismail Abbas et al., "Solid Waste Management in Lebanon: Challenges and Recommendations," *Journal of Environment and Waste Management* 4, no. 2, (October 2017): 053–63, https://premierpublishers.org/jewm/050820178401.pdf?view-type=inline.

104 Sami Atallah, "Garbage Crisis: Setting the Record Straight," Lebanese Center for Policy Studies, August 2015, https://www.lcps-lebanon.org/featuredArticle.php?id=48.

105 Author's interview with Marc Aoun, Compost Baladi, November 12, 2020.

106 Andrea Romboli et al., "The Lebanon Municipal Solid Waste Crisis and Pathways Forward," Arthur D. Little, September 2018, https://www.adlittle.com/sites/default/files/viewpoints/adl_the_lebanon_municipal_solid_waste_crisis_and_possible_pathways_forward-compressed_0.pdf.

107 AP Archive, "Reax to cancellation of Sidi Bouzid ceremony," YouTube video, December 22, 2020, 1:58, https://www.youtube.com/watch?v=0n_CVPYeLMQ.

108 Jon Alterman, *Ties that Bind: Family Tribe, Nation, and the Rise of Arab Individualism* (Washington, DC: CSIS, December 2019), https://www.csis.org/analysis/ties-bind-family-tribe-nation-and-rise-arab-individualism.

109 According to World Bank data, Tunisia's population increased from 10.6 million in 2010 to 11.7 million in 2019. "Population, total - Tunisia," World Bank, https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TN. During the same period, the urban population grew from 7.1 million to 8.1 million. "Urban population – Tunisia," World Bank, https://data.worldbank.org/indicator/SP.URB.TOTL?locations=TN.

110 Nadine May, *Eco-balance of a Solar Electricity Transmission from North Africa to Europe* (Diploma Thesis, Technical University of Braunschweig, August 7, 2005), https://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/projects/Ecobalance_of_a_Solar_Electricity_Transmission.pdf.

111 For example, see Institute of Electrical and Electronics Engineers (IEEE) tweet: "If you filled 16% of the Sahara Desert with #solarpanels, you could power the entire Earth." IEEE, Twitter post, August 18, 2014, 9:36 a.m., https://twitter.com/IEEEorg/status/501407177702006786.

112 Hamza Hamouchene, "Desertec: The Renewable Energy Grab?," New Internationalist, March 1, 2015, https://newint.org/features/2015/03/01/desertec-long.

113 Nicolai Kwasniewski, "Competitors and Opponents Threaten Energy Plan," Der Spiegel, April 3, 2013, https://www.spiegel.de/international/europe/competitors-and-local-opposition-threatens-desertec-solar-plan-a-892332.html.

114 Tunisian Company of Electricity and Gas, *2017 Annual Report* (Tunisian Company of Electricity and Gas, 2018), https://steg.com.tn/ar/institutionnel/publication/rapport_act2017/Rapport_Activite_steg_2017_ar.pdf.

115 Maurice Döring and Rami El Golli, *Background paper: Country Fact Sheet Tunisia* (Bonn, Germany: Bonn International Center for Conversion, 2019), MENA Select Working Paper, https://menaselect.info/uploads/countries/tunisia/Country%20Fact%20Sheet%20Tunisia_Energy%20and%20Development%20at%20a%20Glance%202018.pdf.

116 Ibid., 39.

117 Faten Attig Bahar et al., "Green Transition in North Africa: Snapshot on the Energy Changing Landscape in Tunisia and Morocco," *HSOA Journal of Atmospheric and Earth Science* 3, no. 2 (2019), 2, https://www.heraldopenaccess.us/article_pdf/15/green-transition-in-north-africa-snapshot-onthe-energy-changing-landscape-in-tunisia-and-morocco.pdf.

118 "The STEG union strikes on July 15 to protest against a bill," Webdo, June 30, 2014, https://www.webdo.tn/2014/06/30/syndicat-steg-en-greve-15-juillet-protester-contre-projet-loi/#.YBwVamRuf0o.

119 Jean-Yves Moisseron, Khaled Guesmi, and Marie Gerin-Jean, "Assessing EU–Mediterranean Policies in the Fields of Energy from a Bottom-up Perspective: The Case of Tunisia," MEDRESET Working papers no. 33, January 9, 2019, 7, http://www.medreset.eu/assessing-eu-mediterranean-policies-fields-energy-bottom-perspective-case-tunisia/.

120 Ibid., 7.

121 "Tunisia Energy Sector Improvement Project," World Bank, June 3, 2019, 6, http://documents1.worldbank.org/curated/en/296941561687292260/pdf/Tunisia-Energy-Sector-Improvement-Project.pdf.

122 Ibid., 6.

123 Khemaies Krimi, "Green Energy: Tunisia is determined to make up for lost time," Kapitalis, May 8, 2018, http://kapitalis.com/tunisie/2018/05/08/energies-vertes-la-tunisie-determinee-a-rattraper-le-temps-perdu/.

124 Author's interview with Ahmed Ernez, Biome Solar Industry, August 28, 2020.

125 Author's interview with Dr. Faten Attig Bahar, October 20, 2020.

126 Ibid.

127 "Announcement of Prayer for Rain," *Ministry of Religious Affairs,* March 4, 2021, http://www.affaires-religieuses.tn/public/ar/actualites/166977759.

128 Habib Ben Boubaker, "Water in Tunisia: Is the worst to come?," Center of Mediterranean and International Studies, December 2016, 3, https://docplayer.fr/56910234-L-eau-en-tunisie-faut-il-s-attendre-au-pire.html.

129 Raoudha Gafrej, "Climate change and Tunisia's water management challenge," Qantara, October 6, 2020, https://en.qantara.de/content/water-shortage-in-the-maghreb-climate-change-and-tunisias-water-management-challenge?nopaging=1.

130 Boubaker, "Water in Tunisia," 2.

131 "National Report of the Water Sector," Ministry of Agriculture, Water Resources and Fisheries, 2018, 71, http://www.onagri.nat.tn/uploads/statistiques/PRINT-2019%20Secteur-eau.pdf.

132 "Tunisia Water Sector Reform Project," World Bank, August 21, 2018, 4–5, http://documents1.worldbank.org/curated/en/183991537626737059/pdf/Concept-Stage-Program-Information-Document-PID-Tunisia-Water-Sector-Reform-Project-P162165.pdf.

133 Alvar Closas, Amar Imache, and Insaf Mekki, *Groundwater Governance in Tunisia: A Policy White Paper* (International Water Management Institute, USAID, April 2017), 9, https://gw-mena.iwmi.org/wp-content/uploads/sites/3/2017/04/Policy-White-Paper-Tunisia.pdf.

134 Ibid., 17.

135 Closas et al., "Groundwater Governance in Tunisia," 21.

136 Imen Louati and Camille Balcou, "Water policy: Will the new water code be able to respond to the water crisis in Tunisia?," Observatoire Tunisien de L'Economie, Policy Brief no. 6, November 13, 2019, http://www.economie-tunisie.org/en/observatory/water-policy-will-new-water-code-be-able-respond-water-crisis-tunisia.

137 "'We are thirsty' say Tunisians as drought creates tensions," Al Arabiya English, September 24, 2016, https://english.alarabiya.net/features/2016/09/24/-We-are-thirsty-say-Tunisians-as-drought-creates-

tensions.

138 "We must rethink GDAs to prevent tensions over water," Web Manager Center, June 18, 2020, https://www.webmanagercenter.com/2020/06/18/452308/il-faut-repenser-les-gda-en-vue-de-prevenir-les-tensions-sur-leau/.

139 Ibid.

140 Simon Speakwell Cordall, "Tunisia minister sacked and arrested in scandal over illegal waste from Italy," *The Guardian*, December 24, 2020, https://www.theguardian.com/global-development/2020/dec/24/tunisia-minister-sacked-and-arrested-in-scandal-over-waste-from-italy-mustapha-aroui.

141 Salma Halioui, Michelle Heese, and Michael Schmidt, "Evaluating the Potential of a Green Economy in Tunisia: A System Dynamics Modelling Approach for the Solid Waste Management Sector," in *Sustainable Global Value Chains*, eds. Michael Schmidt, Daniele Giovannucci, Dmitry Palekhov, and Berthold Hansmann, (Cham: Springer International Publishing, 2019), 369, https://www.springerprofessional.de/en/evaluating-the-potential-of-a-green-economy-in-tunisia-a-system-/17431388.

142 Interview with director of Tunisie Recyclage, November 3, 2020.

143 Agence Nationale de Gestion des Déchets.

144 Agnes Bünemann et al., *ECO-LEF in Tunisia: A Case Study* (Bonn, Germany: GIZ GmbH/PREVENT Waste Alliance, 2020), 4, https://prevent-waste.net/wp-content/uploads/2020/11/Tunisia.pdf.

145 Interview with Tunisian solid waste management specialist, January 29, 2021.

146 Wassim Chaabane, "Gestion des déchets plastiques en Tunisie: Vers une responsabilité partagée," Heinrich Böll Stiftung, March 5, 2020, https://tn.boell.org/fr/2020/03/05/gestion-des-dechets-plastiques-en-tunisie-vers-une-responsabilite-partagee.

147 Halioui et al., 367.

148 Chaabane, "Gestion des déchets plastiques en Tunisie: Vers une responsabilité partagée."

149 World Bank, *Report No. 88598-TN* (Washington, DC: 2014), http://documents1.worldbank.org/curated/en/994861468117292382/pdf/885980PAD0P130010Box385274B00OUO090.pdf.

150 Author's interview with the Tunisian chief of staff of a U.S.-funded project on decentralization, September 17, 2020.

151 Bünemann et al., *ECO-LEF in Tunisia.*

152 Author's interview with the Tunisian chief of staff of a U.S.-funded project on decentralization, September 17, 2020.

153 More than 30 majors resigned between 2018 and mid-2020 out of a total of 350; "Démissions de maire en cascade en Tunisie," RTS, June 30, 2020, https://www.rts.ch/play/radio/tout-un-monde/audio/demissions-de-maire-en-cascade-en-tunisie?id=11421419.

154 "Tunisia: Sustainable Municipal Solid Waste Management Project - P095012," World Bank, February 10, 2015, https://projects.worldbank.org/en/projects-operations/project-detail/P095012.

155 Katharina Ferl, *Tunisia: Sustainable Municipal Solid Waste Management Project* (Washington, DC: World Bank, 2015), http://documents1.worldbank.org/curated/en/391811468189543213/pdf/ICRR14729-P095012-Box393183B-PUBLIC.pdf.

156 Ibid.

157 Author's interview with Dr. Wassim Chaabane, September 9, 2020.

158 Author's interview with Reingard Bretreche, Tunisie Recyclage, November 3, 2020.

159 Chandni Dwarkasing, "Wastepickers (Such as the Barbechas) Struggle Forth in Post-Revolution Tunisia," Environmental Justice Atlas, December 21, 2019, https://ejatlas.org/conflict/wastepickers-in-tunis-struggle-forth-in-post-revolution-tunisia.

160 Author's interview with Dr. Wassim Chaabane, September 9, 2020. Morocco has had some success incorporating former waste-pickers into recycling operations. In Meknes, for example, some 150 former waste-pickers have formed a cooperative that sorts recyclables from the municipal landfill. See "How the Moroccan City of Meknes Got Its Sprawling Landfill Under Control," aclima, November 2, 2017, https://aclima.eus/en/how-the-moroccan-city-of-meknes-got-its-sprawling-landfill-under-control/.

161 Layli Foroudi, "As garbage piles up in Tunisian cities, waste pickers demand recognition," Reuters, July 31, 2019, https://www.reuters.com/article/us-tunisia-waste-rights/as-garbage-piles-up-in-tunisian-cities-waste-pickers-demand-recognition-idUSKCN1UR300.

162 Author's interview with a Tunisian businessman, February 5, 2021.

163 Denise M. Rousseau, Sim B. Sitkin, Ronald S. Burt, and Colin Camerer, "Not So Different After All: A Cross-Discipline View of Trust," *Academy of Management Review* 23, no. 3 (1998): 395, doi:10.5465/amr.1998.926617.

164 Roderick M. Kramer, "Collective Trust Within Organizations: Conceptual Foundations and Empirical Insights," *Corporate Reputation Review* 13, no. 2 (2010): 85, doi:10.1057/crr.2010.9.

165 D.H. McKnight, Larry L. Cummings, and Norman L. Chervany, "Initial Trust Formation in New Organizational Relationships," *Academy of Management Review* 23, no 3 (1998): 475, doi:10.5465/amr.1998.926622.

166 Francis Fukuyama, *Trust: The Social Virtues and the Creation of Prosperity* (New York: Free Press, 1995), 25.

167 Melani Cammett, Ishac Diwan, and Irina Vartanova, "Insecurity and Political Values in the Arab World," *Democratization* 27, no. 5 (2020): 699-716, doi:10.1080/13510347.2020.1723081.

168 Esteban Ortiz-Ospina and Max Roser, "Trust," Our World in Data, 2016, https://ourworldindata.org/trust.

169 Cammett, Diwan, and Vartanova, "Insecurity and Political Values."

170 Niels Spierings, "Trust and Tolerance across the Middle East and North Africa: A Comparative Perspective on the Impact of the Arab Uprisings," *Politics and Governance* 5, no. 2 (2017): 4–15, https://www.cogitatiopress.com/politicsandgovernance/article/view/750.

171 Hana Brixi, Ellen Lust, and Michael Woolcock, *Trust, Voice, and Incentives: Learning from Local Success Stories in Service Delivery in the Middle East and North Africa* (Washington, DC: World Bank, 2015), 216, https://documents.worldbank.org/en/publication/documents-reports/documentdetail/381671468280164518/trust-voice-and-incentives-learning-from-local-success-stories-in-service-delivery-in-the-middle-east-and-north-africa.

172 Rachel A. Turner et al., "Trust, Confidence, and Equity Affect the Legitimacy of Natural Resource Governance," *Ecology and Society* 21, no. 3 (September 2016): 18, http://www.ecologyandsociety.org/vol21/iss3/art18/.

173 Jon M. Jachimowicz et al., "Community Trust Reduces Myopic Decisions of Low-Income Individuals," *Proceedings of the National Academy of Sciences* 114, no. 21 (2017): 5401–6, https://www.pnas.org/content/114/21/5401.

174 Brixi, Lust, and Woolcock, "Trust, Voice, and Incentives," 217.

175 Adam Harris, Kristen Kao, Ellen Lust, Jens Ewald, and Petter Holmgre, "Governance and Service Delivery in the Middle East and North Africa," University of Gothenburg Program on Governance and Local Development, Working Paper No. 10 (2017), 32, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3581800.

176 Dominika Latusek and Tomasz Olejniczak, "Development of Trust in Low-Trust Societies." *Polish Sociological Review* 195, no. 3(2016): 309–25, http://polish-sociological-review.eu/Development-of-Trust-in-Low-Trust-Societies,119562,0,2.html.

177 Jachimowicz et al., "Community Trust Reduces Myopic Decisions of Low-Income Individuals."

178 Latuzek and Olejniczak, "Development of Trust in Low-Trust Societies."

179 Fabio Sabatini, Francesca Modena, and Ermanno Tortia, "Do Cooperative Enterprises Create Social Trust?," *Small Business Economics* 42, no.3 (2014): 621-41, https://mpra.ub.uni-muenchen.de/39814/.

180 Brixi, Lust, and Woolcock, "Trust, Voice, and Incentives," 311.

181 Ibid., 290.

COVER ADOBE STOCK

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

1616 Rhode Island Avenue NW
Washington, DC 20036
202 887 0200 | **www.csis.org**

ROWMAN & LITTLEFIELD
Lanham • Boulder • New York • London
4501 Forbes Boulevard
Lanham, MD 20706
301-459-3366 | **www.rowman.com**

978-1-5381-4038-3
9 781538 140383
90000