THE RIGHT TO WATER AND CLIMATE CHANGE

2025

THE ARAB WATCH REPORT ON ECONOMIC AND SOCIAL RIGHTS

EXPLOITING RESOURCES, IGNORING RIGHTS:

A Political Ecology of Water and Energy in the Arab World

Cynthia Gharios

post-doctoral researcher at the University of Münster

annd

Arab NGO Network for Development

شبكة المنظمات العربية غير الحكومية للتنمية

This report is published as part of the Arab NGO Network for Development's Arab Watch Report on Economic and Social Rights (AWR) series. The AWR is a periodic publication by the Network and each edition focuses on a specific right and on the national, regional and international policies and factors that lead to its violation. The AWR is developed through a participatory process which brings together relevant stakeholders, including civil society, experts in the field, academics, and representatives from the government in each of the countries represented in the report, as a means of increasing ownership among them and ensuring its localization and relevance to the context.

The seventh edition of the Arab Watch Report focuses on the right to water. It was developed to provide a comprehensive and critical analysis of the status of this right across the region, particularly in the context of climate change and its growing impacts. The information and analyses presented aim to serve as a platform for advocacy toward the realization of this fundamental right for all.

The views expressed in this publication are solely those of the author and do not necessarily reflect the positions of the Arab NGO Network for Development (ANND), Brot für die Welt, or Norwegian People's Aid.

The report is published by the **Arab NGO Network for Development** (ANND). It can be obtained from ANND or can be downloaded from the following website

http://www.annd.org

SUPPORTED BY

Brot für die Welt | Norwegian People's Aid

THE RIGHT TO WATER AND CLIMATE CHANGE 2025 THE ARAB WATCH REPORT ON ECONOMIC AND SOCIAL RIGHTS

EXPLOITING RESOURCES, IGNORING RIGHTS:

A Political Ecology of Water and Energy in the Arab World

Cynthia Gharios

post-doctoral researcher at the University of Münster

Cynthia Gharios is a post-doctoral researcher at the University of Münster, German. Her research revolves around the topics of agriculture, the environment, technology, and the global agri-food system, adopting a political ecology perspective. She focuses particularly on the financialization of agriculture, land grabs and foreign direct investment, technology and smart farming, and the imaginary of agrarian future(s). Her research focuses on the MENA region. Her PhD research explores the intersection of environment and agricultural technology in the United Arab Emirates. She collaborated with Cornell University on a research project examining AgTech intermediaries in Memphis, USA. This project investigates how entrepreneurs, investors, and innovation intermediaries navigate competing imperatives of technological advancement and social impact. Previously, she examined the transformation of agrarian landscapes in South Lebanon, highlighting the link between long-term land access for farmers and the social, ecological, and spatial consequences of land-use change. She also contributed to studies on agricultural war damage in Yemen and on agricultural investment dynamics in Morocco. She holds a PhD in Geography from the University of Münster (Germany), MSc in Landscape Architecture and Planning with a specialisation in Cultural Geography from Wageningen University (the Netherlands), and a BSc in Landscape Design and Ecosystem Management (with the diploma of ingénieur agricole) from the American University of Beirut (Lebanon).

CONTENTS

01

INTRODUCTION

Global reliance on fossil fuels remains entrenched. In 2023, oil, natural gas, and coal supplied over 80% of the world's energy consumption (International Energy Agency (IEA), n.d.). Yet these energy sources are criticized for being the primary contributors to greenhouse gas emissions and a major driver of climate change (Clarke et al, 2022). As global energy demand continues to rise[1], the push for alternative and "cleaner" energy sources is also accelerating. Renewable technologies such as solar, wind, and green hydrogen[2] are increasingly portrayed by policymakers and scholars as key pathways toward achieving energy sustainability (Chu et al. 2017; United Nations Economic Commission for Europe (UNECE) 2020). Yet, energy production often requires vast amounts of water, whether for fossil fuel extraction, cooling in thermal power plants, hydropower generation, or solar panel maintenance. Conversely, water systems depend on energy for treatment, transport, and desalination. The mutual dependence of energy and water systems has emerged as a critical site for political, environmental, and social consternation. While both academic and grey literature highlight the potential of renewable energy to support continued global economic growth while cutting emissions, its associated social implications and impact on water demand are often overlooked.

The entanglement of these two resources presents particular challenges in the Arab World. There, energy production, water scarcity, and climate change converge with complex political, economic, and social dynamics. The region holds some of the world's largest fossil fuel reserves – Gulf states, Algeria, Libya, and Iraq together account for 46.7% of proven global fossil fuel reserves (Organization of the Petroleum Exporting Countries 2025). The region is also among the most water-scarce in the world. Mostly classified as arid or semi-arid, it experiences low and variable rainfall, high evaporation rates, and frequent droughts. Across the region, the various methods used to access water are also heavily energy-dependent. Oil-rich countries in the Gulf rely almost entirely on desalination, water treatment facilities, and large dams to meet domestic needs. Meanwhile, countries in the Maghreb and parts of the Levant depend on overdrawn groundwater aquifers and intermittent surface water, both of which increasingly require energy-intensive pumping and distribution systems. The substantial energy inputs required highlight the tightly coupled relationship between water and energy infrastructures. These interdependencies not only create technical challenges but also expose deep-rooted structural inequalities and environmental injustices. As climate impacts across the region intensify

[1] Global energy demand grew by 2.2% between 2023 and 2024 (International Energy Agency (IEA) 2025), and this growth is expected to persist.
[2] Energy produced by using renewable electricity to split water molecules into hydrogen and oxygen.

— manifesting in more frequent and prolonged droughts, shifting rainfall patterns, devastating floods, severe heat waves, recurrent sandstorms, wildfires, and the rise of sea levels — pressure mounts on already strained water and energy infrastructures. Pressures that are further exacerbated by rapid urbanization, population growth, and economic expansion.

Meanwhile, the region seeks to position itself as a hub for renewable energy development. According to the International Renewable Energy Agency (IRENA),[3] scaling up the share of renewables in the energy mix has over the past decade become a major policy priority in several Arab countries, which are adopting strategies to increase their contribution of renewable energy (IRENA (International Renewable Energy Agency) 2020). From the Arabian Peninsula to Morocco, megaprojects of solar parks and wind farms[4], alongside emerging green hydrogen infrastructures (most notably in Morocco and Tunisia) and hydropower infrastructures (particularly those in Sudan and Egypt), are rapidly reshaping the region's energy landscape. These renewable energy projects, together with ambitious national energy-transition strategies, are often celebrated by governments, international organizations, and policy actors alike as steps toward a more sustainable energy future for the region (ESCWA (Economic and Social Commission for Western Asia) 2017; IRENA (International Renewable Energy Agency) 2014).

This chapter critically examines the intertwined challenges of energy production, water access, and climate change in the Arab region through the dual theoretical lenses of political ecology and climate justice. Political ecology provides a framework for unpacking the power relations that shape environmental degradation and resource management. It emphasizes that environmental problems are never merely "technical" in nature but are rooted in historical, political, and economic processes. Political ecology challenges the dominant narratives that frame water and energy issues as neutral or technocratic. Instead, it highlights the political and social dimensions of resource governance. This approach is particularly relevant in the Arab World, where authoritarian governance, Neoliberal reforms, and elite-driven development projects are closely linked to patterns of persistent Neo-colonial relations. Such a perspective helps us determine who has access to, and control over, natural resources and renewable energy. The climate justice framework, meanwhile, foregrounds questions of equity and rights – highlighting the disproportionate burdens faced by marginalized and vulnerable communities. By centering human rights, environmental justice, and the lived experiences of affected populations, this perspective challenges dominant climate and development policies that prioritize market efficiency or state interests over social well-being. Taken together, these two frameworks support a holistic analysis of how renewable energy production practices affect water access in contexts shaped by historical and structural inequalities.

Guided by these critical perspectives, this chapter asks: *How do energy production practices across the Arab region reshape access to water, and how do political, economic, and social dynamics drive and mediate these transformations?* In exploring these questions, the chapter examines how energy infrastructures such as fossil

[3] A global intergovernmental organization that promotes the sustainable use of all forms of renewable energy by supporting countries in their energy transitions.

[4] Such megaprojects include the Mohammed bin Rashid Al Maktoum Solar Park in the UAE, the Benban Solar Park in Egypt, the Sakaka photovoltaic solar project in Saudi Arabia, the Noor Abu Dhabi Solar Power Project in the UAE, the Ouarzazate Solar Power Station in Morocco, the Dumat Al Jandal Wind Farm in Saudi Arabia, the Suez Wind Energy Project in Egypt, The Dhofar Wind Farm in Oman, the Tafila and Al Rajef Wind Farms in Jordan, to name some of the largest projects

fuel extraction, hydropower systems, large-scale solar and wind farms, and green hydrogen projects affect water systems and water availability. It also investigates how policy choices, capital flows, and governance regimes shape the development and implementation of these projects. This chapter also addresses the environmental and social implications of these energy-water transformations. Drawing on regional case studies from Gulf States, Sudan, the Levant, and the Maghreb, the chapter illustrates how energy and water policies often reinforce existing inequalities and serve elite or external interests. It critiques technocratic policy frameworks that obscure these dynamics and often frame water scarcity and energy transitions as neutral, technical challenges, rather than politically charged processes. Instead, it calls for grounded, justice-oriented responses. Ultimately, it argues that any sustainable solution to the Arab region's water and energy crises must begin by recognizing them as deeply political – and by asking whose interests are being served, and whose are being side-lined, in the pursuit of environmental transformation.

This chapter unfolds in three main sections. The first examines how fossil fuel economies in the Arab region, particularly in the Gulf, shape energy-intensive water systems such as desalination. The second analyzes the water dependencies and social impacts of renewable energy projects – hydropower, solar, and wind – focusing on issues of land use and exclusion. The third explores emerging green hydrogen initiatives in North Africa, highlighting concerns around energy imperialism, water reallocation, and Neo-colonial dynamics. The chapter concludes by reflecting on alternative approaches to water-energy governance grounded in justice and equity.

02

FOSSIL FUEL ECONOMIES AND THE ENERGY-WATER NEXUS

In the Arab region, hydrocarbon wealth has played a central role in shaping national economies and geopolitical influences. Oil-rich Gulf states have used fossil fuel revenues to finance infrastructure, welfare systems, and ambitious development agendas, while consolidating state authority and regional power. In Libya, Algeria, and Iraq, fossil fuel resources have likewise underpinned state revenues and development strategies – though often in contexts marked by political instability, contested authority, and stark inequalities in wealth distribution. Fossil-fuel-based energy systems have also deepened water stress in a region already grappling with water scarcity. Fossil fuel extraction – particularly for oil and gas – is a highly water-intensive process. To address the water scarcity, many governments across the region have turned to large-scale desalination and deep aquifer pumping, solutions that are themselves highly energy-intensive. The interdependencies between water and energy production in this context are increasingly fraught, as climate change intensifies pressure on both energy and water systems, revealing their environmental trade-offs and reinforcing social inequalities.

HYDROCARBON EXTRACTION AND WATER TENSIONS

Water is required at nearly every stage of the fossil fuel life-cycle: from drilling and hydraulic fracturing, to oil refining, cooling in power generation, and other industrial processes. For instance, hydraulic fracturing uses millions of gallons of water per well to release gas and oil from underground formations (Schettler, 2024). Enhanced Oil Recovery (EOR), a method increasingly deployed in aging oil fields, demands massive water volumes, averaging around 10 barrels of water per barrel of oil recovered (Veil and Quinn, 2008; Waisi et al., 2015). Given the large amount of water needed, the fossil fuel economy across the Arab region significantly contributes to intensifying water stress, compounding one of the most critical environmental challenges facing the area. In the water-scare context of the Gulf States, these water-energy tensions are particularly stark. These states have built their economies around oil and gas exports, with energy extraction and refining forming the backbone of national revenue. Yet rainfalls there rarely exceed 100mm per year, and renewable water available per capita per year is approximately 500m3[5]. As a result, these countries have increasingly turned to desalination to meet their water needs. Desalination, while

[5] The WHO defines water scarcity as when renewable resources are less than 1000 m3 per year per capita (Abdelraouf, 2024).

providing a vital source of potable water, is also an energy-intensive process predominantly powered by fossil fuels, thereby creating a feedback loop that exacerbates both water scarcity and carbon emissions.

In addition, fossil fuel extraction practices and their associated risks, such as oil spills, pipeline leaks, and industrial waste, have contributed to the widespread contamination of surface and groundwater systems (Freije, 2015). The release of heavy metals, hydrocarbons, and chemicals into rivers and groundwater poses significant risks to both human health and ecological systems, especially in contexts where these water sources are used for agriculture and as drinking water. These types of pollution have particularly affected Iraq. The oil sector accounts for about 42% of the country's GDP and more than 99% of export revenues (World Bank, 2022). The concentration of oil infrastructures in the southern region is linked to widespread water pollution and increased salinization of agricultural land. Studies have documented elevated levels of pollutants such as cadmium, mercury, and lead in the Shatt Al-Arab river, attributed to oil industry activities nearby (Al-Asadi et al., 2019). The agricultural sector, which relies heavily on irrigation from this river and canals, suffered due to the degraded water quality, which led to reduced crop yields. Furthermore, the competition for water between the oil industry and agriculture has intensified in regions like Basra, where water scarcity is particularly acute. The degradation of marshlands near Basra or the Hawizeh Marshes is also an example of the environmental ramifications of oil extraction. Once a thriving ecosystem and home to vibrant agricultural communities, these marshes have become severely degraded. Local farmers report increased salinity, crop failures, and declining fish stocks — all linked to the combination of upstream water diversion, climate change, and contamination from nearby oil facilities. These developments have not only undermined rural livelihoods but also contributed to social unrest and rural displacement, and food insecurity.

Oil-rich states in North Africa also witnessed the degradation of water quality due to contamination from fossil fuel operations. Algeria faces significant water scarcity challenges exacerbated by its energy extraction activities. The country's oil and gas fields are concentrated in the arid southern Sahara, far from the more water-abundant northern coast. The processes involved in oil and gas extraction consume substantial amounts of water, often sourced from deep underground aquifers with limited recharge capacity. These operations compete directly with local agricultural and pastoral uses, leading to conflicts over groundwater access, long-term depletion of water reserves, and food security. Climate change further compounds these issues, as decreasing rainfall and increasing temperatures strain existing water resources. Additionally, the centralized control of energy revenues has contributed to uneven development, with southern communities often excluded from the benefits of extraction while bearing the environmental burdens. Public protests over water shortages, land degradation, and lack of infrastructure have periodically erupted in these regions, reflecting broader grievances about exclusion and marginalization.

In Libya, the water-energy crisis is further complicated by prolonged political instability. Given its arid climate and limited renewable water resources, ground-

water is the primary source for domestic, agricultural, and industrial use. Yet, the country's oil industry is depleting aquifers and contaminating water supplies, which is affecting agriculture and local communities. The Great Man-Made River Project, designed to transport fossil water from the Nubian Sandstone Aquifer to coastal cities, is increasingly being used to support oil extraction and associated infrastructure — a dynamic that places agricultural communities in direct competition with energy interests. The expansion of irrigated agriculture also increased water demand, leading to over-extraction and declining water tables. This situation is aggravated by the lack of effective water management policies and the absence of a comprehensive legal framework to regulate water use. As state capacity has weakened since 2011, governance over water and energy resources has become fragmented and contested.

All these implications are further exacerbated by the impact of fossil fuel extraction on climate change. Rising temperatures and shifting rainfall patterns are already reducing surface water flows and groundwater recharge rates across the Arab region, making the competition for water even more acute. The 2023 oil boom has been linked to worsening water crises (Manisera and Sala, 2023). The intersection of fossil fuel extraction and water stress in the Arab world underscores the need for integrated resource management strategies. Addressing these challenges requires a shift towards sustainable energy practices, improved water governance, and investment in technologies that minimize environmental impact while ensuring water and energy security for the region's populations.

DESALINATION AND PUMPING: ENERGY-INTENSIVE AND INEQUITABLE

In much of the Arab region, access to water is heavily dependent on fossil fuels, highlighting a critical yet often overlooked aspect of the energy-water nexus. Due to the region’s arid climate and limited renewable freshwater sources, many countries have turned to energy-intensive technologies, such as desalination and groundwater pumping, to meet rising water demands. These processes rely overwhelmingly on fossil fuel-based energy, creating a structural dependency where water security is directly tied to continued fossil fuel use. For example, desalination plants across the region primarily run on oil and natural gas, locking water provisioning systems into carbon-intensive energy pathways. The Gulf state in particular accounts for over half of the world’s desalination capacity, with major facilities in Saudi Arabia, the UAE, Kuwait, and Qatar. In these countries, the reliance on non-conventional water resources, including desalination, has become paramount due to the scarcity of renewable water, often supplying a significant portion of municipal needs. In Saudi Arabia, the overexploitation of fossil groundwater reserves to sustain agricultural activities has led to significant depletion of these non-renewable resources. This overuse has prompted a policy shift away from food self-sufficiency towards greater reliance on food imports, aiming to preserve remaining water resources for higher-value industrial and domestic uses. Similarly, in Qatar, the energy demands for water pumping and desalination constitute a significant fraction of total energy use, highlighting the intertwined nature of water and energy challenges in the region.

As desalination enabled urban expansion and industrial development, it became one of the most energy-intensive forms of

water provision. Most desalination plants in the Arab world operate on fossil fuels, reinforcing a carbon-intensive development pathway and undermining climate mitigation efforts. In 2016, desalination accounted for just 3% of the Middle East's water supply but 5% of its total energy consumption (Walton, 2019). The energy-water feedback loop is stark: water scarcity drives desalination, which consumes energy and emits greenhouse gases, further exacerbating climate change, which in turn worsens water stress. This reliance not only strains energy resources but also raises concerns about the sustainability and environmental impact of desalination practices. This dependency exacerbates a vicious cycle: the more water is needed due to climate change and population growth, the more fossil fuel energy is consumed, contributing further to greenhouse gas emissions and long-term environmental degradation.

Moreover, the geo-economic politics of desalination are important issues to address. Jordan is an important example. Facing chronic water shortages, the country has embraced desalination projects (such as the Aqaba-Amman Water Desalination and Conveyance Project) as part of a broader strategy to secure water supplies. However, these projects are heavily dependent on international financing, including loans from the World Bank and bilateral aid. This external reliance shapes domestic water policy and limits democratic participation in resource governance. The costs of these projects — both financial and ecological — are often borne by Jordanian citizens, particularly low-income communities in urban and rural peripheries. Moreover, Jordan's pivot to desalination aligns with a broader trend of technocratic, market-oriented solutions that fail to address the deeper structural drivers of water scarcity: mismanagement, political exclusion, and regional power asymmetries.

The reliance on fossil fuel infrastructure for basic water access often diverts resources from investing in more sustainable or decentralized alternatives, such as solar-powered water systems or community-based water harvesting. This entrenched dependence underscores the urgent need to rethink water strategies in the region, not only to decarbonize water systems but also to ensure long-term resilience and equity in access to this essential resource. Desalination poses further serious environmental and social challenges. One of the most pressing is the disposal of brine — the highly saline by-product of desalination — which is often discharged back into the sea. This can harm marine ecosystems, reduce oxygen levels, and alter coastal salinity gradients, with cascading effects on fisheries and biodiversity.

03

RENEWABLE ENERGY PROJECTS: HYDROPOWER, SOLAR, AND WIND

The Arab region's transition toward renewable energy introduces new water-energy dynamics that warrant careful consideration. While these initiatives aim to reduce carbon emissions and diversify energy sources, they also present challenges related to water usage in a region where water scarcity is already a pressing concern. In this second section, I explore the region's investment in renewable energy and analyze the material impacts of these infrastructures on local water systems. I give attention to the political and economic conditions under which these projects are implemented, and analyze their social impact, particularly instances of land appropriation and displacement, processes often framed as cases of "green grabbing."[6] This section underscores how renewable energy is not inherently just or sustainable, but is shaped by broader dynamics of state power, private capital, and socio-spatial exclusion.

HYDROPOWER AND ITS SOCIO-ECOLOGICAL CONSEQUENCES

Hydropower development in the Arab region has, since the 1970s, emerged as a central strategy for addressing energy deficits and promoting economic development, particularly in water-rich basins. The Nile and the Tigris-Euphrates rivers have been the main target of such projects. The Aswan High Dam on the Nile (completed in 1970) is probably the largest project across the region. It has been a landmark for hydroelectric power generation as well as a symbol of national sovereignty, regional modernization, and geopolitical alignment during the Cold War. The Mosul Dam (completed in 1986) and the Haditha Dam (completed in 1987), both on the Tigris-Euphrates, provided close to 20% of Iraq's energy needs in the 1980s. The Tabqa Dam (completed in 1973) is Syria's largest hydropower facility, with the original capacity to provide some 90% of the country's energy needs. More recently, the Merowe Dam (completed in 2009) in Sudan has been a prime example of the expansion of large-scale hydropower projects. This project is framed by state actors as a means of achieving energy independence and climate resilience and a central tool to Sudan's modernization goals. Yet while the national energy production in most of these places remained dominated by fossil fuels, these hydropower projects offered auxiliary supply and grid stability.

However, this framing masks a complex set of social, environmental, and political

[6] First coined by (Vidal, 2008), green grabbing refers to to the appropriation of land and natural resources for environmental ends, often under the guise of sustainability or climate action, but which frequently displaces local communities and reinforces existing power inequalities.

consequences, many of which are rooted in colonial-era water governance models. The Merowe Dam displaced over 50,000 people, predominantly from the Manasir, Hamadab, and Amri communities, without adequate compensation or resettlement infrastructure (Verhoeven, 2011). These forced displacements not only disrupted traditional livelihoods and social structures but also echoed historical patterns of state-driven marginalization of rural populations in Sudan, tracing back to British colonial interventions in the Nile basin. Indeed, the British administration prioritized water management for imperial agricultural schemes, establishing a technocratic water bureaucracy that continues to shape Sudan's hydro-development logic (Barnes, 2014). Similarly, Sudan's support of the Grand Ethiopian Renaissance Dam (GERD), while strategically motivated to secure a share of generated electricity, places it in a precarious position vis-à-vis Egypt, revealing the ongoing complexities of transboundary water politics in the Nile basin. The Nile Waters Agreements of 1929 and 1959, signed during colonial and early postcolonial periods, granted Egypt and Sudan disproportionate rights over Nile waters, marginalizing upstream states like Ethiopia (Lumumba, 2007). These agreements continue to influence current disputes, illustrating how hydropower projects are entangled with enduring colonial legacies and competing sovereignties.

The paradox of hydropower as a climate adaptation strategy is also evident in the environmental vulnerabilities it exacerbates. Large dams, while touted as low-carbon energy sources, often result in the inundation of ecologically sensitive zones, loss of biodiversity, and increased vulnerability to extreme flood events – particularly as climate change intensifies hydrological variability. One of the most significant consequences of large dams is the disruption of natural river flows, which undermines the seasonal flooding cycles that historically sustained floodplain agriculture, wetlands, and biodiversity downstream. In Sudan, both the Merowe Dam and the planned Kajbar Dam threaten to amplify existing environmental fragilities in flood-prone regions and undermine adaptive capacities, especially for pastoralist and riverine communities. Egypt's Aswan High Dam also drastically altered the hydrology of the Nile, leading to the degradation of the Nile Delta and a reduction in soil fertility due to sediment trapping (Said 1993; Stanley and Warne 1998). This sediment retention contributes to coastal erosion and saltwater intrusion from the Mediterranean Sea. In Iraq and Syria, dams have similarly impacted aquatic ecosystems by modifying flow regimes and reducing habitat quality for native fish and riparian vegetation. Moreover, the large surface areas of reservoirs in hot climates result in substantial evaporation losses. Lake Nasser, the reservoir behind the Aswan Dam, loses an estimated 10 to 16 billion cubic meters of water annually (Bastawesy et al., 2008). The creation of large reservoirs has also led to population displacement and the submergence of agricultural lands and cultural heritage sites. The displacement of the Nubian communities during the construction of the Aswan High Dam remains a stark example of the social cost of hydropower development. Moreover, the placement of major dams on transboundary rivers has exacerbated regional water conflicts, particularly between upstream and downstream riparian states. In the Tigris-Euphrates basin, Turkey's GAP project, involving a cascade of dams, has significantly reduced water flows to Iraq and Syria, sparking regional tensions and reviving Ottoman-era notions of upstream dominion. Even in North Africa, Morocco's Al Massira Dam, constructed during the

late colonial and early post-independence era, reflects the legacy of French hydraulic engineering, which emphasized water control over equitable distribution. Finally, the impact of the dam was also to facilitate centralized state control over water – mirroring colonial logics of hydro-sovereignty, as well as geopolitical alignment (Mitchell 2002; Ohlendorf 2023; Shokr 2009). Taken together, these environmental and ecological effects raise critical questions about the long-term sustainability of large-scale hydropower in the Arab region. While these projects have contributed to national energy goals, their socio-environmental costs are unevenly distributed and frequently borne by already vulnerable ecosystems and communities. Hydropower thus exemplifies the contradictions at the heart of contemporary water and energy governance.

GREEN GRABBING AND THE WATER-ENERGY NEXUS IN RENEWABLE ENERGY PROJECTS

The rapid expansion of renewable energy infrastructure across the Arab region has been widely celebrated as a step toward sustainable development and carbon neutrality. However, the socio-environmental consequences of these projects raise critical concerns, particularly in relation to land and water use. Increasingly, these projects exhibit patterns of what scholars refer to as green grabbing: the appropriation of land and water resources under the guise of environmentally friendly agendas (Fairhead et al., 2012). In many cases, large-scale solar and wind developments proceed without equitable benefit-sharing and often intensify existing inequalities in access to land, water, and energy.

In Morocco, flagship solar megaprojects illustrate this dynamic vividly. The Ouarzazate Solar Power Station, part of the Noor Complex, employs concentrated solar power (CSP) technology, which relies heavily on water for cooling and panel cleaning. This water is diverted from local drinking and agricultural supplies, undermining regional water security in a semi-arid zone already facing chronic scarcity (Hamouchene, 2023). Funded by an estimated $9 billion in debt from international financial institutions, the project showcases Morocco's renewable ambitions. Yet local communities – especially pastoral groups – have faced displacement, restricted access to traditional grazing lands, and little to no benefit in terms of employment or energy access. The Noor Midelt and Tafilalet projects follow similar trajectories. These hybrid CSP-photovoltaic installations source water from the Hassan II Dam, initially constructed to support agricultural irrigation. The redirection of dam water toward energy production represents a shift in priorities that sacrifices food production and small-scale agriculture in favor of export-oriented energy development. Once again, land expropriation and community exclusion have accompanied these projects, exacerbating local grievances (Hamouchene 2023).

Solar parks in Egypt (the Benban Solar Park) and in the United Arab Emirates (Mohammed bin Rashid Al Maktoum Solar Park) exemplify the water-energy trade-offs embedded in desert-based solar energy production. Both projects contribute significantly to the energy mix of these countries. The Benban Solar Park, arguably the world's 4th largest photovoltaic installation, was planned to produce 1,650 MW, equivalent to 90% of the energy produced from the Aswan Dam (Ecohz, n.d.; Raven, 2017). The Mohammed bin Rashid Al Mak-

toum Solar Park, one of the world's largest, not only generates significant electricity but also incorporates a pilot solar-powered desalination plant(Government of Dubai, n.d.; Watts 2025). This facility produces 50 cubic meters of drinking water per day, demonstrating an integrated approach to addressing water scarcity through renewable energy. Yet both these projects (as well as other across the region hyper-arid context) require frequent water-intensive cleaning of panels to maintain efficiency (Koch 2023; Najmi et al. 2023). This demand exacerbates existing water scarcity issues, highlighting the need for sustainable water management practices in renewable energy projects. Such initiatives have raised questions around the ecological impacts of desert solar expansion and the marginalization of local needs.

These examples reveal a paradox in the pursuit of renewable energy: while aiming to mitigate climate change and reduce reliance on fossil fuels, these projects intensify water scarcity challenges. Addressing these challenges requires rethinking water governance not merely as a technical issue, but as a deeply political process shaped by historical injustices and power asymmetries, while also ensuring a just transition toward sustainable energy sources that does not compromise water security.

04

GREEN HYDROGEN AND THE POLITICS OF ENERGY IMPERIALISM

Europe's decarbonization strategy – shaped by the dual imperatives of climate neutrality and energy independence, especially relevant since the Russian-Ukrainian war – has made renewable energy and green hydrogen key priorities. The EU's ambitious hydrogen agenda, shaped by the European Green Deal and the 2020 Hydrogen Strategy, envisions importing up to 10 million tonnes of green hydrogen by 2030 (Amouzai and Haddioui 2023). Its southern Mediterranean neighbors – particularly Tunisia and Morocco – have emerged as strategic suppliers of green hydrogen: the region is geographically close to Europe and offers significant potential to generate renewable electricity.

In this section, I address the rise of green hydrogen as a new frontier in energy development across North Africa. Focusing on the cases of Morocco and Tunisia, I examine how Neoliberal state policies, coupled with the EU's external energy strategy, serve to reconfigure local resource governance around export imperatives, while marginalizing social and ecological needs at home. This model of energy export exacerbates an already fragile water and agrifood context. This dynamic is particularly visible in the case of green hydrogen production, which may entrench new forms of dependency under the guise of sustainability. Using a few specific examples, I show how green hydrogen projects and their associated infrastructure of desalination and renewable energy parks are being positioned to serve European energy markets, and the implications of this export-oriented model for domestic water use, agricultural land, and energy sovereignty.

THE CASE OF TUNISIA

Over the past decade, Tunisia has emerged as a key site in the global green energy transition, but the direction of this transition reveals a troubling paradox. While the country faces mounting energy, water, and food insecurities, its renewable energy policies are increasingly geared toward serving European energy demands rather than domestic needs. Some 97% of Tunisia's energy sector today remains dependent on fossil fuels (Ben Rouine and Roche, 2023). As energy demand rises, domestic energy resources are steadily declining. The country also lacks enough refining capacity to process its crude oil, which itself falls short of meeting national demand (Ben Ammar & Ammar, 2024). To address this gap, Tunisia imports a signifi-

cant portion of its energy. More than half of its natural gas needs, for example, are imported from Algeria. At the same time, since signing the Paris Agreement in 2015, Tunisia has committed to reducing its greenhouse gas emissions and has adopted a strategy to expand its renewable energy sector, including solar, wind, and biomass. As part of this transition, Tunisia is projected to produce up to eight million tons of green hydrogen annually by 2050 (GFA/ALCOR, 2024). Yet, over three-quarters of this supply (around six million tons) is destined for export to Europe (Ben Ammar & Ammar, 2024). Another prominent example of this export-oriented logic is the TuNur project, a large-scale solar initiative that, once operational, aims to deliver electricity to two million European homes. Rather than prioritizing renewable electricity for domestic use to close the energy gap, the government plans to convert this electricity into green hydrogen for export to the EU.

Beyond this export paradox, the infrastructure required for green hydrogen production reinforces a broader logic of resource extraction, as it will rely on desalinated seawater. The desalination capacity needed to support hydrogen exports is estimated to match the annual drinking water needs of approximately 400,000 Tunisians (Ben Ammar & Ammar, 2024) – a staggering figure for a country facing recurrent droughts and rising difficulty in securing potable water for its population. Agricultural pressures further complicate the picture. Tunisia is a net food importer, with over 50% of the food consumed locally being imported, including 94% of its soft wheat. Yet the country continues to export water-intensive crops such as strawberries, tomatoes, dates, and olive oil (Ben Ammar & Ammar, 2024), placing additional strain on already limited water and land resources. What is more, in 2022, the government enacted legislation permitting agricultural land to be repurposed for renewable energy infrastructure. In other words, to meet the EU's green hydrogen import targets, Tunisia would need to allocate roughly 500,000 hectares of land to renewable energy development, which is expected to lead to a significant shift away from food production toward energy export. While such incentives have attracted foreign companies with promises of cheap land, abundant solar exposure, and favorable export conditions, they risk deepening Tunisia's ongoing agrarian crisis.

Moreover, green hydrogen development requires substantial infrastructure investment, including hydrogen extraction plants, solar and wind installations, desalination facilities, and cross-border transport networks. These infrastructures depend on imported technologies, proprietary patents, and foreign expertise. Much of the financing is expected to come from private foreign investors and public loans – particularly from institutions such as the World Bank, the European Investment Bank, and the European Bank for Reconstruction and Development (GFA/ALCOR, 2024). This financial model threatens to lock Tunisia into new forms of long-term debt and create new forms of structural dependency (Ben Rouine and Roche, 2023).

THE CASE OF MOROCCO

Like Tunisia, Morocco seeks to position itself as a leading actor in the global green energy transition. This shift is unfolding in the context of deep energy depend-

ency: as of 2020, over 88% of Morocco's energy needs were met through fossil fuel imports. In response, the Moroccan government has set ambitious targets to reduce this dependency to 34% by 2040 and 17% by 2050, while simultaneously aiming to increase the share of renewable energy in its national energy mix from 11% in 2017 to 52% by 2030 (IRENA, 2020; 2025). To support this trajectory, Morocco has actively cultivated international partnerships and foreign investment. In 2012, the Moroccan and German governments signed the German–Moroccan Energy Partnership (PAREMA), under which the German Agency for International Cooperation (GIZ) has provided technical support to improve Morocco's renewable energy policy and regulatory frameworks. While this partnership is often framed as supporting Morocco's strategic goals of renewable energy production, it places significant emphasis on energy export to the European Union. This raises critical questions about the balance of benefits in such arrangements, especially given Morocco's ongoing domestic energy insecurity.

In 2019, the Moroccan government created the National Hydrogen Commission to develop a Green Hydrogen Roadmap and establish a domestic industry based on renewable-energy-derived hydrogen and its derivatives. These efforts coincide with the EU's Clean Energy for All Europeans package (2019), which encourages greater cross-border electricity trading between the EU and North African states as part of its broader Green Deal strategy. While marketed as mutually beneficial, these mechanisms increasingly bind Moroccan energy policy to European energy security priorities. At the same time, Morocco's large-scale renewable energy projects reflect a fusion of national elite interests with foreign capital. The wind energy sector, for instance, is dominated by Énergie Éolienne du Maroc (EEM), a subsidiary of Nareva Holding, whose major shareholder is the Moroccan royal family. EEM currently operates six large wind farms, with five more under construction, primarily concentrated between Tarfaya and Boujdour. These projects are part of joint ventures between Nareva and European multinationals such as Engie (France) and Enel (Italy), and are financed through institutions like the African Development Bank (AfDB), the European Investment Bank (EIB), and the German Development Bank (KfW). The result is a renewable energy landscape shaped by both Moroccan elite capital and imperial capital from the Global North.

While Morocco's green energy strategy is widely celebrated, its growing entanglement with European export demands and financial institutions suggests an emerging model of green dependency. Renewable infrastructures are being built with external financing, operated through transnational partnerships, and designed in part to serve foreign energy markets. This raises broader questions about sovereignty, resource allocation, and the environmental and social impacts of an externally oriented energy transition. In this context, Morocco's energy shift risks reinforcing the very inequalities and power asymmetries that climate action is meant to challenge.

Taken together, these developments reveal a deeply asymmetrical relationship between Tunisia and Morocco, and Europe, and raise urgent questions about resource allocation and national priorities. Both countries supply land, solar energy, and water – often at minimal cost – while bearing the ecological and social consequences of an externally driven energy agenda. Solar projects like TuNur in Tunisia and Noor Midelt in Morocco are being

developed specifically to produce renewable energy for the production of hydrogen to be exported to Europe. Such projects are supported by EU financing mechanisms, including €30 billion mobilized through the European Hydrogen Bank (Amouzai and Haddioui, 2023). Although framed as win-win solutions that promise climate progress and economic opportunity, these developments reveal a deeper asymmetry. Indeed, European countries benefit from a steady supply of "clean" energy without absorbing the environmental and social burdens associated with its production. This emerging model, heavily promoted by the European Union and spearheaded by countries such as Germany – along with its development agency GIZ – represents more than a green transition. The current dynamics reflect a form of green colonialism[7], wherein Europe externalizes the socio-environmental costs of its energy transition to the Global South. It reflects a continuation of core–periphery dynamics in which the Global South is expected to supply raw inputs for a low-carbon future it did not design. At the same time, rather than addressing domestic energy and food insecurity, state policies in Tunisia and Morocco prioritize foreign investment and export-oriented growth, reinforcing Neo-colonial patterns of resource extraction and land appropriation. In this context, the so-called green transition risks reproducing old hierarchies under a new ecological veneer. In this sense, the green hydrogen economy risks replicating the very structures of exploitation that the energy transition claims to overcome. If left unchallenged, it may mark the rise of a new form of energy imperialism – one in which technological and financial control remains concentrated in the Global North, while the social and environmental costs are externalized to the South.

[7] I define green colonialism as the extension of the colonial relations of plunder and dispossession to the green era of renewable energy with the accompanying displacement of socio-environmental costs onto peripheral countries and communities, prioritizing the energy needs of one region of the world over another.

05

TOWARD MORE EQUITABLE WATER-ENERGY GOVERNANCE

The interdependence of water and energy systems in the Arab region – set against a backdrop of ecological fragility, political complexity, and socio-economic inequality – reveals that the shift toward renewable energy is not inherently just or sustainable. From fossil fuel–driven desalination in the Gulf to water-intensive solar megaprojects in Morocco and green hydrogen initiatives in Tunisia, energy transitions often reproduce the very injustices they claim to resolve. The examples I highlighted above reveal a recurring paradox: projects designed to reduce emissions and promote sustainability simultaneously deepen local vulnerabilities, particularly in relation to water access, land rights, and social equity. These developments are shaped by uneven power relations – both within states and between the Global South and North – driven by foreign capital, export-oriented agendas, and technocratic policy frameworks that sideline local needs. This chapter has argued that addressing the region's energy and water crises demands more than technical solutions: it requires confronting the structural drivers of inequality and recognizing the political nature of environmental change.

As the region positions itself as a global supplier of clean energy, renewable energy development must be guided by integrated planning frameworks that acknowledge the political ecology of land and water governance. Only through a justice-centred approach – one that prioritizes the rights, voices, and livelihoods of marginalized communities – can truly sustainable and equitable water-energy futures be envisioned for the Arab world. A truly just energy transition in the Arab region must begin with prioritizing domestic needs – closing energy import gaps, securing equitable water access, and strengthening local food systems – before turning to export-oriented agendas. Without such a reorientation, the energy transition risks reinforcing Neo-colonial extractive patterns under a green façade. Countries like Tunisia risk becoming little more than solar and hydrogen batteries for Europe, sacrificing long-term resilience for short-term investment flows. At the same time, both import and export dependencies – whether through reliance on foreign oil and gas or on international financing for renewables – bind regional actors to broader geopolitical structures. These entanglements are not merely technical or economic; they are deeply political, reproducing historical legacies of colonialism, global market integration, and uneven resource control. The energy-water nexus thus emerges as a critical site where questions of vulnerability, sovereignty, and power converge

– demanding not just technological innovation, but a fundamental rethinking of whose needs are being met, and at what cost.

REFERENCES

- Abahussain, A., Abdu, A., Al Zubari, W., ElDin, N. A., and Abdelrahim, M. (2002) Desertification in the Abdelraouf, Mohamed. 2024. 'Water Issues in the GCC Countries: Status, Challenges, and Solutions'. Gulf Research Center, October 20. Link.
- Al-Asadi, Safaa A. R., Adnan B. Al Hawash, NoorAl-Huda A. H. Alkhlifa, and Hussein Badr Ghalib. 2019. 'Factors Affecting the Levels of Toxic Metals in the Shatt Al-Arab River, Southern Iraq'. Earth Systems and Environment 3 (2): 313–25. Link.
- Amouzai, Ali, and Ouafa Haddioui. 2023. Green Hydrogen in Morocco: Just Transition or Greenwashing Neocolonialism? The Case of Guelmim-Oued Noun. Transnational Institute - Link, The Committee for the Abolition of Third World Debt (CADTM) - Link, Siyada Network - en.siyada.org.
- Barnes, Jessica. 2014. Cultivating the Nile: The Everyday Politics of Water in Egypt. New Ecologies for the Twenty-First Century. Duke University Press.
- Bastawesy, Mohamed A., Fikry I. Khalaf, and Sayed M. Arafat. 2008. 'The Use of Remote Sensing and GIS for the Estimation of Water Loss from Tushka Lakes, Southwestern Desert, Egypt'. Journal of African Earth Sciences 52 (3): 73–80. Link.
- Ben Ammar, Elyes, and Saber Ammar. 2024. Green Hydrogen in Tunisia: A New Mechanism of Plunder and Exploitation. Transnational Institute. Link.
- Ben Rouine, Chafik, and Flavie Roche. 2023. 'Renewable Energy in Tunisia: An Unjust Transition'. In Dismantling Green Colonialism: Energy and Climate Justice in the Arab Region, edited by Hamza Hamouchene and Katie Sandwell. Pluto Press.
- Clarke, L.,Y.-M.Wei, A. De La Vega Navarro, A. Garg, A.N. Hahmann, S. Khennas, I.M.L.Azevedo, A. Löschel, A.K.Singh, L. Steg, G. Strbac, K.Wada, 2022: Energy Systems. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change.Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.). Cambridge University Press, Cambridge, UK and New York, NY, USA. Doi: 10.1017/9781009157926.008.
- Chu, Steven, Yi Cui, and Nian Liu. 2017. 'The Path towards Sustainable Energy'. Nature Materials 16 (1): 16–22. Link.
- ecohz. n.d. 'Benban Solar Power in Egypt'. Company website. Ecohz. Accessed 24 November 2025. Link.
- ESCWA (Economic and Social Commission for Western Asia). 2017. Arab Region Progress in Sustainable Energy: Global Tracking Framework Regional Report. E/ESCWA/SDPD/2017/2. ESCWA (Economic and Social Commission for Western Asia).
- Fairhead, James, Melissa Leach, and Ian Scoones. 2012. 'Green Grabbing: A New Appropriation of Nature?' The Journal of Peasant Studies 39 (2): 237–61. Link.
- Freije, Afnan Mahmood. 2015. 'Heavy Metal, Trace Element and Petroleum Hydrocarbon Pollution in the Arabian Gulf: Review'. Journal of the Association of Arab Universities for Basic and Applied Sciences 17 (April): 90–100. Link.
- GFA/ALCOR. 2024. National Strategy for the Development of Green Hydrogen and Its Derivatives in Tunisia. Project Report Green Hydrogen for Sustainable Growth and a Decarbonized Economy in Tunisia, Implemented by the Ministry of Industry, Mines and Energy in close collaboration with GIZ Tunisia, on Behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). Ministry of Industry, Energy and Mines, in collaboration with GIZ Tunisia.
- Government of Dubai. n.d. 'Sustainability & Innovation Centre | Mohammed Bin Rashid Al Maktoum Solar Park'. Company website. Mohammed Bin Rashid Al Maktoum Solar Park Sustainability & Innovation Centre. Accessed 24 November 2025. https://www.mbrsic.ae/en/about/mohammed-bin-rashid-al-maktoum-solar-park/?utm_source=chatgpt.com.

- Hamouchene, Hamza. 2023. 'The Energy Transition in North Africa: Neocolonialism Again!' In Dismantling Green Colonialism: Energy and Climate Justice in the Arab Region, edited by Hamza Hamouchene and Katie Sandwell. Pluto Press.
- International Energy Agency (IEA). 2025. Global Energy Review 2025. Analysis. International Energy Agency (IEA). Link.
- International Energy Agency (IEA). n.d. Energy Supply. Energy Statistics and Balances. Energy Mix. International Energy Agency (IEA). Accessed 14 November 2025. Link.
- IRENA (International Renewable Energy Agency). 2014. Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation. IRENA (International Renewable Energy Agency).
- IRENA (International Renewable Energy Agency). 2020. Power Sector Planning in Arab Countries: Incorporating Variable Renewables. International Renewable Energy Agency.
- IRENA (International Renewable Energy Agency). 2025. 'Energy Profile - Morocco'. International Renewable Energy Agency. Report. Link.
- Koch, Natalie. 2023. 'Solar Power's Water Problem in the Gulf'. Think Tank website. Bourse & Bazaar Foundation, December 17. Link.
- Lumumba, Patrick Loch Otieno. 2007. 'The Interpretation of the 1929 Treaty and Its Legal Relevance and Implications for the Stability of the Region'. African Sociological Review / Revue Africaine de Sociologie 11 (1): 10–24.
- Manisera, Sara, and Daniela Sala. 2023. 'Iraq's Oil Boom Blamed for Worsening Water Crisis in Drought-Hit South | Water | The Guardian'. The Guardian, June 3. Link.
- Mitchell, Timothy. 2002. Rule of Experts: Egypt, Techno-Politics, Modernity. University of California Press.
- Najmi, Nouhaila, Ahmed Rachid, Nouhaila Najmi, and Ahmed Rachid. 2023. 'A Review on Solar Panel Cleaning Systems and Techniques'. Energies 16 (24). Link.
- Ohlendorf, Aurelia. 2023. 'Tabqa: The Sister of the Aswan High Dam in Syria. How the Soviet Union Tried to Gain a Monopoly in Hydraulic Infrastructures in the Middle East.' Comparativ: Leipziger Beiträge Zur Universalgeschichte Und Vergleichenden Gesellschaftsforschung 33 (3): 339–58. 173879684. https://doi.org/10.26014/j.comp.2023.03.04.
- Organization of the Petroleum Exporting Countries. 2025. OPEC Annual Statistical Bulletin. Annual Report 60th edition. OPEC.
- Raven, Andrew. 2017. 'A New Solar Park Shines a Light on Egypt's Energy Potential'. Development institution. International Finance Corporation (World Bank Group), October 29. Link.
- Said, R. 1993. The River Nile: Geology, Hydrology and Utilization. Elsevier.
- Schettler, Ted. 2024. 'Competing for Water, Driving Climate Change'. The Science and Environmental Health Network, February 26. Link.
- Shokr, Ahmad. 2009. 'Hydropolitics, Economy, and the Aswan High Dam in Mid-Century Egypt'. The Arab Studies Journal 17 (1): 9–31.
- Stanley, Daniel Jean, and Andrew G. Warne. 1998. 'Nile Delta in Its Destruction Phase'. Journal of Coastal Research 14 (3): 795–825.
- United Nations Economic Commission For Europe (UNECE). 2020. Pathways to Sustainable Energy: Accelerating Energy Transition in the UNECE Region. ECE Energy Series, no. 67. United Nations.
- Veil, J.A., and J.J. Quinn. 2008. Water Issues Associated with Heavy Oil Production. Prepared for U.S. Department of Energy, National Energy Technology Laboratory ANL/EVS/R-08/4. http://www.osti.gow/bridge.

- Verhoeven, Harry. 2011. 'Climate Change, Conflict and Development in Sudan: Global Neo-Malthusian Narratives and Local Power Struggles'. Development and Change 42 (3): 679–707. Link.
- Vidal, John. 2008. 'The Great Green Land Grab'. Environment. The Guardian, February 13. Link.
- Waisi, B. I. H., U. F. A. Karim, D. C. M., Augustijn, M. H. O. Al-Furaiji, and S. J. M. H. Hulscher. 2015. 'A Study on the Quantities and Potential Use of Produced Water in Southern Iraq'. Water Supply 15 (2): 370–76. Link.
- Walton, Molly. 2019. 'Desalinated Water Affects the Energy Equation in the Middle East – Analysis'. IEA, January 21. Link
- Watts, Nora. 2025. 'Dubai Solar Park Expands'. NEWS. Utilities Middle East (Dubai, UAE), November 11. Link
- World Bank. 2022. 'The World Bank in Iraq'. Text/HTML. World Bank, June 1. Link.

The Arab NGO Network for Development
works in 12 Arab countries, with 9 national networks (with an extended membership of 250 CSOs from different backgrounds) and 25 NGO members.

P.O.Box Mazraa 5792/14 Beirut, Lebanon