Empowering Sustainable Futures

MENA NDCs Climate Action

INTERNATIONAL ENERGY FORUM

CCE Regional Collaboration

Middle East Green Initiative

A Report by the International Energy Forum produced in cooperation with the Middle East Green Initiative and Circular Carbon Economy Regional Collaboration

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About the Middle East Green Initiative

The Middle East Green Initiative (MGI) is a regional effort led by Saudi Arabia to mitigate the impact of climate change on the region and to collaborate to meet global climate targets. By increasing regional cooperation and creating the infrastructure needed to reduce emissions and protect the environment, MGI can amplify impact in the global fight against climate change, whilst creating far-reaching economic opportunities for the region.

About the Circular Carbon Economy Regional Collaboration

The Circular Carbon Economy Regional Collaboration initiative was established under the Middle East Green Initiative to help MENA countries advance their climate ambitions while supporting continued economic development. The initiative brings together regional expertise, decision-makers and partners to accelerate practical pathways toward climate targets. Its mission is to unite leading minds and enable leaders through regional collaboration, supporting action across four key cooperation pillars: technical knowledge building, human capacity building, joint investments and policy dialogues to strengthen cooperation, build capacity and support the development of practical, scalable solutions for a more sustainable and economically resilient future across the region.

About the International Energy Forum

The International Energy Forum (IEF), the global home of energy dialogue, is a trusted and neutral intergovernmental platform for energy dialogue among member states, industry leaders, and experts. Its Ministers represent producing, consuming, and transit countries in every region, at every stage of economic development, and across both established and emerging energy-system supply chains. The IEF advances global energy security through open and inclusive dialogue spanning all energy, technologies and systems.

Acknowledgement

This report was prepared by the IEF Office of Global Energy Dialogue at the request of Secretary General Jassim Alshirawi and under the supervision of Director Energy Dialogue Christof van Agt Ross.

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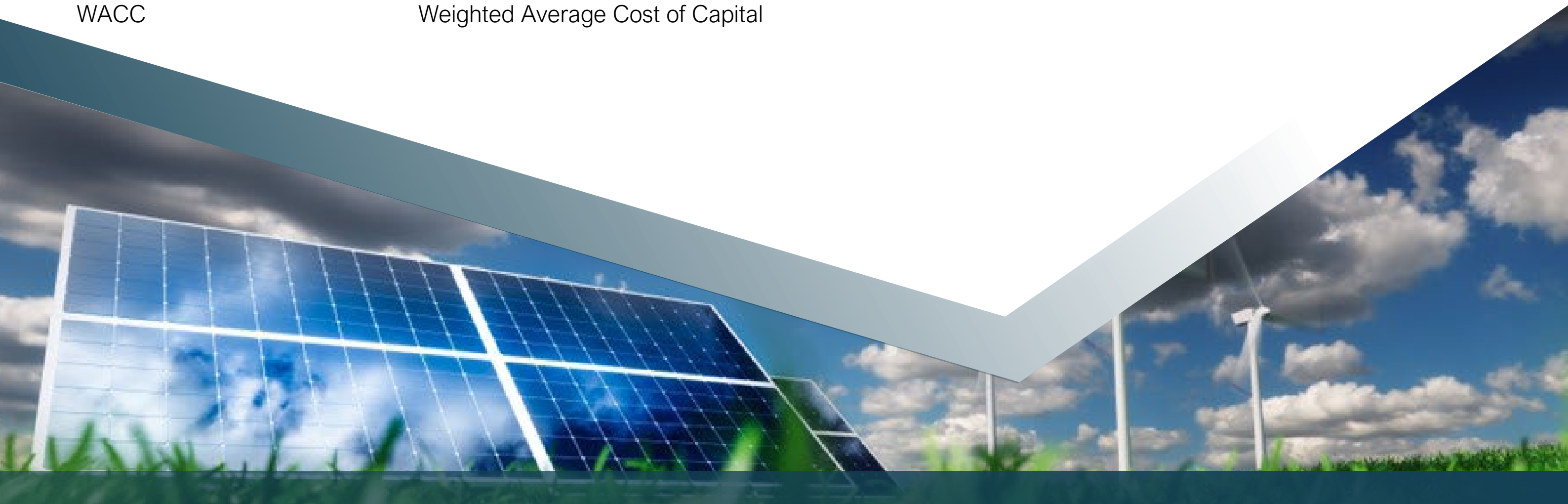
List of Abbreviations

BECCS	Bioenergy with Carbon Capture and Storage
BTRs	Biennial Transparency Reports
BURs	Biennial Update Reports
CAFÉ	Corporate Average Fuel Economy
CCE	Circular Carbon Economy
CCFDs	Carbon Contracts For Difference
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization, and Storage
CEM	Clean Energy Ministerial
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CSP	Concentrated Solar Power
DAC	Direct Air Capture
DACCS	Direct Air Capture with Storage
ESG	Environmental, Social and Governance
ETF	Enhanced Transparency Framework
EVs	Electric Vehicles
EW	Early-Warning
GCC	Gulf Cooperation Council
GCF	Green Climate Finance
GCFC	Green Climate Finance Center
GDP	Gross Domestic Product
GIS	Geographic Information System
HVDC	High-Voltage Direct Current
IAEA	International Atomic Energy Agency
ICTU	Improved Common Transparency and Understanding
IEA	International Energy Agency
IEF	International Energy Forum
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
ITMOs	Internationally Recognized Mitigation Outcomes
JODI	Joint Organizations Data Initiative
LCOE	Levelized Cost of Energy
LNG	Liquefied Natural-Gas
LPG	Liquefied Petroleum Gas
MENA	Middle East and North Africa
MGI	Middle East Green Initiative
MHEWS	Multi-Hazard Early Warning Systems
MOUs	Memoranda of Understanding
MRV	Monitoring, Reporting, and Verification
NDC	Nationally Determined Contribution
OPEC	Organization of the Petroleum Exporting Countries
PPP	Public Private Partnership
R&D	Research and Development
RSLR	Relative Sea-Level Rise
SAF	Sustainable Aviation Fuels
SMRs	Small Modular Reactors
Tech CDR	Technological Carbon Dioxide Removal
UNFCCC	United Nations Framework Convention on Climate Change
WACC	Weighted Average Cost of Capital



Foreword

The IEF Progress Report for MENA NDCs (Nationally Determined Contributions) and Climate Action presents an integrated overview of the region's climate progress and emerging priorities. Drawing from countries' official submissions to the United Nations Framework Convention on Climate Change (UNFCCC) and national strategies, the report reflects on how the countries within the Middle East and North Africa (MENA) region are advancing toward the shared goals of the Paris Agreement. It provides an evidence-based foundation for understanding the trajectory of climate ambition across the region and the enablers that will shape its next phase of action.

The region stands at a unique intersection of opportunity and constraint. It possesses tremendous diverse energy resources, ranging from renewable sources to hydrocarbon reserves, that position it as a key player in reliable and affordable global energy transitions. At the same time, it faces acute challenges of extreme water stress and droughts, rising temperatures, and rapidly growing urban populations. These pressures unfold alongside economies that are still shaped by energy-intensive development patterns. Such conditions demand a deliberate approach to climate action that safeguards energy security, maintains affordability, and builds resilience while driving emissions reduction. Climate policy in MENA is therefore not only centered on mitigation and adaptation, but also on redefining long-term economic and social resilience amid accelerating just transitions, including within the context of the Middle East Green Initiative (MGI) and through dialogue and collaboration in various international energy platforms including the International Energy Forum (IEF) and Clean Energy Ministerial (CEM).

Across this complex landscape, the region is already demonstrating meaningful progress. Countries are scaling up clean power generation, expanding electricity grid infrastructure, and embedding efficiency across industries and cities ensuring long-term economic and social stability of the region in the context of multiple just transitions. Accelerated deployment of renewables, early investments in hydrogen and carbon capture, utilization, and storage as well as efforts in methane reduction and flaring control are positioning MENA as a hub for new energy technologies.

Similar advances in climate adaptation are improving food and water security, protecting coasts and cities, and restoring ecosystems through large-scale nature-based solutions such as mangrove and land rehabilitation, and afforestation. Together, these measures reflect a growing momentum to intersect national development agendas with lower-emissions and climate-resilient growth.

Yet, the pace and depth of progress remain closely tied to the means of implementation that underpin every national effort. Many targets and actions depend on strengthened access to finance, technology, and capacity building.

These conditionalities highlight the importance of creating supportive environments for investment and innovation, guided by clear policy frameworks, robust data systems, and institutional coordination. Expanding regional and international cooperation, including through the IEF and MGI platforms can further unlock opportunities for knowledge exchange, technology transfer, and sustainable financing, enabling countries to translate ambition into long term transitions.

The Circular Carbon Economy (CCE) framework offers a practical framework to help further guide this process. By managing emissions across four interconnected pillars, reduce, reuse, recycle, and remove, it provides a coherent structure for countries to pursue net-zero goals while advancing energy security and economic diversification. The CCE represents a systems-based approach that integrates technological innovation, policy design, and market mechanisms to balance emissions with removals, bridging growth, resilience, and sustainability in the region's transitions.

Through this IEF report, the region's progress is captured as a collective step forward in defining a distinct MENA pathway. One that builds resilience, fosters innovation, and contributes meaningfully to global climate solutions. It highlights that climate action in MENA is driven not only by global commitments but by the region's pursuit of sustainable and resilient prosperity.

Executive summary

The IEF Progress Report for MENA NDCs and Climate Action provides an integrated account of how countries across the MENA region are advancing their climate agendas. Drawing on official submissions to the United Nations Framework Convention on Climate Change and complementary national policies, the report consolidates regional progress on mitigation, adaptation, and enabling measures. It highlights how MENA countries are reshaping their development trajectories to contribute towards achieving global climate goals while addressing local environmental and socio-economic realities. The scope of the analysis considers 22 countries, collectively referred to as the MENA region in this report. This includes Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Kingdom of Saudi Arabia (KSA), Somalia, Sudan, Syria, Tunisia, the United Arab Emirates (UAE), and Yemen.

The MENA region occupies a uniquely strategic position in the global climate agenda due to its combination of scale, geography, and energy potential. Spanning approximately 13 million square kilometers, around nine percent of the world's landmass, it is home to nearly 493 million people, or six percent of the global population (World Bank, 2022; World Data, 2025). Population growth continues at nearly twice the global average, and two-thirds of residents live in cities, underscoring the need for sustainable energy, water, and infrastructure systems (UNESCWA, 2025). The region's distinct advantage lies in its exceptional potential for renewable energy resources; it receives roughly 22–26 percent of all solar irradiation striking the Earth and over 75 percent of its land area experiences wind speeds suitable for utility-scale generation (World Bank, 2024). Economically, MENA represents around USD 2.85 trillion in gross domestic product and serves as a critical hub for global trade and energy supply. The Suez Canal, Bab el-Mandeb Strait and Strait of Hormuz together handle around 15 percent of world seaborne trade including approximately 35-40 percent of globally seaborne traded hydrocarbons, or about 20-25 percent of all globally traded hydrocarbons, including around 20-25 percent of global LNG supply (UNCTAD 2024;2025, EIA 2024;2025. IEA 2026), reinforcing the region's centrality to both global logistics and the future of energy security.

Despite its scale and economic centrality, the region's contribution to global emissions remains comparatively small. Today, MENA accounts for roughly six percent of total global greenhouse gas emissions (EDGAR, 2024). Historically, from 1970 to 1996, the region's share averaged between three and four percent, confirming that it remains far less responsible for cumulative global emissions than other regions. This context underscores that the region's growing climate ambition is driven by its strategic opportunity to shape global effort towards limiting the rise in global average temperatures while ensuring energy stability and economic diversification.

The regional context presents some constraints. Water scarcity defines MENA's physical and economic landscape, with more than 90 percent of the region classified as arid or semi-arid (UNESCWA, 2023). Desertification, land degradation, and rising temperatures threaten food production and rural livelihoods. Rapid urban growth continues to place pressure on limited infrastructure and utilities, particularly water and power. Economically, dependency on hydrocarbons exposes countries to global price volatility, while technical readiness remains uneven across sectors. Together, these structural pressures create an urgent need for integrated approaches that address climate, economic, and social priorities in parallel.

Across this challenging backdrop, climate ambitions under the Paris Agreement are gaining traction. Twelve MENA countries have already submitted their second nationally determined contributions, while several others are in advanced stages of revision. Collectively, these submissions signal rising ambition, greater transparency, and closer alignment between climate targets and national development plans. While the quantitative scope varies across submissions, the regional trend is clear: countries are broadening sectoral coverage, setting more measurable mitigation targets, and strengthening adaptation objectives.

The region has increasingly pursued mitigation as part of its broader climate action. Governments are investing in renewable energy, energy efficiency, carbon capture, utilization and storage, clean hydrogen, and low-emissions industrial development. MENA's share of global renewable capacity is expanding quickly, with some of the lowest electricity generation costs worldwide achieved in recent years. Large-scale projects are transforming national energy systems into models of technological innovation and integrated planning. The Mohammed Bin Rashid Al Maktoum Solar Park in UAE, with a planned capacity of 5,000 megawatts by 2030, represents one of the world's largest solar developments and demonstrates competitive cost structures for large-scale power generation. The Saudi Electricity Company Bisha Battery Storage Facility represents the world's largest single-phase grid-connected battery energy storage system and showcases the growing role of grid stabilization in enabling renewable integration. The Ras Laffan CO_2 (carbon dioxide) Capture Facility in Qatar captures over 2 million tons of carbon dioxide each year from gas processing and demonstrates industrial decarbonization in practice.

The El Dabaa Nuclear Power Plant in Egypt, with an anticipated 4.8 gigawatts of capacity, further highlights nuclear energy as a reliable and emissions-free baseload source. Collectively, these projects reflect a regional effort to modernize energy systems, diversify supply, and advance technologies central to the Circular Carbon Economy. Adaptation holds equal importance in the region's climate vision, given its high exposure to physical risks. Governments are pursuing integrated programs that strengthen resilience across ecosystems, economies, and communities. Water security initiatives focus on improving desalination efficiency, expanding wastewater reuse, and developing national water-conservation strategies. In agriculture, climate-smart practices and precision irrigation technologies are being deployed to safeguard productivity against droughts and rising heat.

Biodiversity and land restoration programs are gaining scale, from mangrove rehabilitation in coastal zones to desert greening projects that enhance carbon sequestration and ecosystem health. Coastal and marine protection has become a priority due to the concentration of population and infrastructure along shorelines, leading to expanded flood defense infrastructure and early warning systems. Urban resilience efforts are reshaping cities through green corridors, reflective surfaces, and sponge-city designs that mitigate heat and flooding, while national disaster risk frameworks are improving preparedness and response capacity. Together, these measures demonstrate how adaptation is being integrated into the fabric of national development planning.

The success of these initiatives depends on the means of implementation that underpin them. Many national commitments include conditional targets, reflecting that the realization of climate ambition is tied to access to finance, technology, and institutional capacity. The Global Center on Adaptation estimates cumulative climate investment needs for developing countries, including MENA, at more than USD 200 billion by 2030 (GCA, 2024). Scaling climate finance will require a combination of public investment, private participation, and financial mechanisms such as green bonds and blended finance. Technological progress, particularly in hydrogen, carbon capture, and energy storage, remains central to achieving cost-effective decarbonization. Capacity building across institutions, data systems, and regulatory agencies will be essential for monitoring, reporting, and verification. Policy frameworks are also evolving, with growing interest in carbon markets and crediting mechanisms to mobilize private investment and incentivize emissions reduction. Finally, international dialogue and cooperation, including improving data transparency on traditional and sustainable energy within the Joint Organizations Initiative (JODI) that the IEF coordinates, continues to play a vital role by enabling knowledge exchange, facilitating trade, investment and technology transfer, and driving regional goals towards achieving global objectives.

The MENA region is entering a critical decade for climate action. The region's limited historical contribution to emissions contrasts with its outsized potential to accelerate just transitions increasing energy market resiliency within the region and globally. By expanding renewable energy, advancing hydrogen and nuclear programs, capturing and reusing carbon, and improving resource efficiency, MENA is charting a path that aligns economic diversification with sustainability. Guided by the principles of the Circular Carbon Economy framework, which seeks to reduce, reuse, recycle, and remove carbon, the region is transforming its resource base and industrial systems into a foundation for resilience and long-term prosperity. In doing so, MENA is demonstrating that climate action can serve as both a catalyst for economic transformation and a bridge toward a more balanced and sustainable global energy future.

Scope and approach

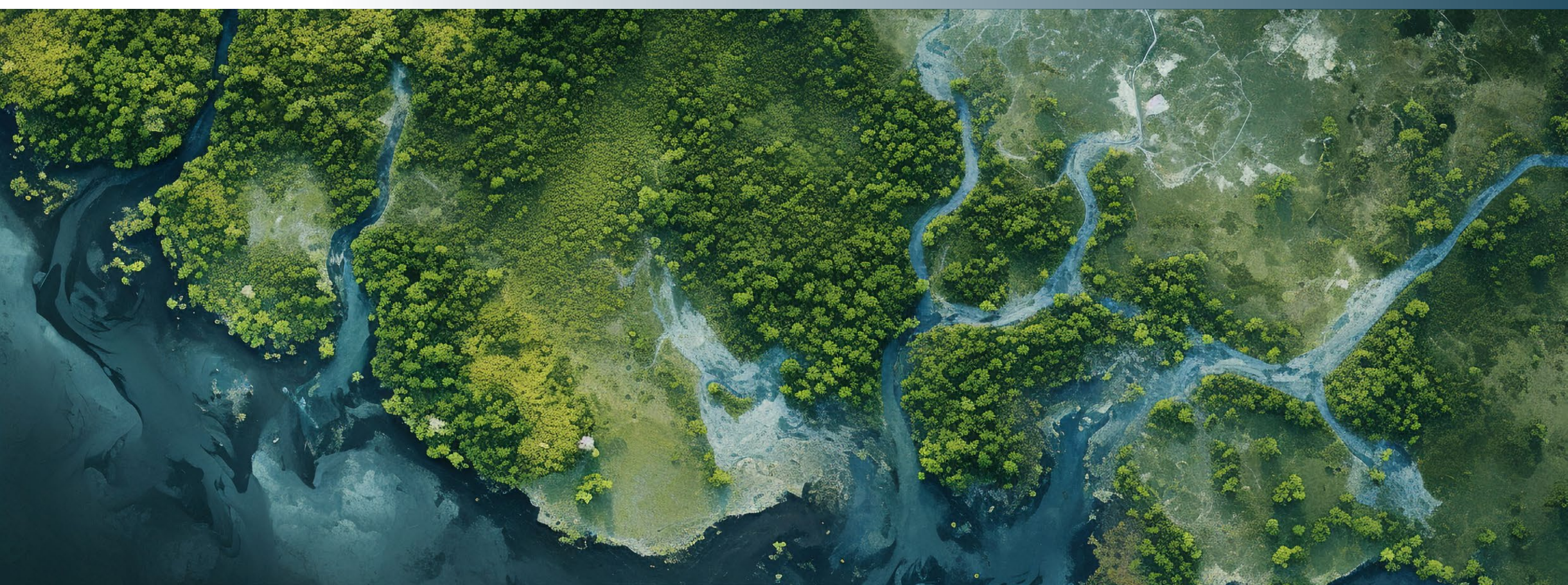
This IEF report aims to present an overview of climate action progress across the MENA region. Progress is assessed based on a consolidated view of national commitments and the concrete actions taken by countries on mitigation and adaptation, alongside the availability and mobilization of means of implementation. The report consolidates regional patterns derived from official submissions and other credible data sources, rather than analyzing country-specific progress. It focuses on planned measures and ongoing implementation efforts, providing an overview of the region's aggregate level of ambition and pace of execution. The report also seeks to enable regional cooperation by identifying shared progress areas and opportunities within the broader climate action landscape.

The scope of the analysis considers 22 countries, collectively referred to as the MENA region in the report. This includes Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, KSA, Somalia, Sudan, Syria, Tunisia, UAE, and Yemen. Specific country names are mentioned in the report when referring to publicly verified achievements, including record-breaking renewable energy projects, major cross-border interconnections, or technological and policy milestones.

The analytical foundation of the report is drawn from the UNFCCC NDCs registry, which provides the official source for national targets, sectoral coverage, mitigation, and adaptation pathways. Each country's NDC was systematically reviewed to extract quantitative and qualitative information on mitigation, adaptation, and means of implementation. These documents were complemented with national submissions, sectoral strategies, biennial transparency reports (BTRs), biennial update reports (BURs), and other publicly available data issued up to December 2025, which were integrated into the analysis to enhance the depth and context of findings. Only twelve MENA countries have submitted second NDCs, for the remaining countries without a second NDC submission, the assessment was conducted using their most recent available submission. This approach ensures full representation across the region and maintains comparability and consistency in all analytical outputs.

Market-based analyses, such as the results of renewable energy auctions, power purchase agreements, or national investment programs, were included only when validated through at least one official or institutional source. Media and news outlets were used exclusively to confirm the implementation status of officially announced projects, and only when such information could not be obtained from regulatory or institutional databases. The analysis also draws on recent IEF dialogue outcomes and reports published, including for the CCE Knowledge Hub, public datasets and institutional reports from national strategies, official government communications, and international references such as the World Bank, the International Renewable Energy Agency (IRENA), the International Energy Agency (IEA), and BloombergNEF. Any subsequent announcements or revisions issued after December 2025 are excluded to preserve methodological consistency and ensure comparability across countries. All findings presented in this report are based strictly on publicly available information; no assumptions, estimations, or extrapolations have been made beyond what is explicitly stated in the source materials.

By grounding all conclusions in official and publicly accessible information, the report provides a transparent basis for assessing regional progress toward climate goals while acknowledging the evolving nature of NDC submissions and implementation pathways across the MENA region.



Overview of the latest MENA NDC submissions

As of December 2025, twelve MENA countries have submitted their second NDCs, reflecting a continued evolution toward more structured frameworks for mitigation, adaptation, and implementation. Collectively, these submissions emphasize accelerating clean-power deployment, improving end-use efficiency, and strengthening adaptation systems, while enhancing transparency and alignment with the Paris Agreement. Although levels of ambition vary, a common regional direction is emerging, centered around energy-mix diversification, resilience building, and institutional reform. The key challenge ahead is to maintain momentum through stronger financing mechanisms, increased cross-border cooperation, and greater private-sector engagement to translate commitments into measurable results.

Mitigation measures and co-benefits

The majority of the 2025 NDC submissions set quantified renewable capacity or energy-mix diversification targets. Solar continues to dominate, while green hydrogen and nuclear energy are gaining policy traction. Many NDCs also expand coverage to industrial decarbonization, through fuel-switching, carbon-capture pilots and projects, and low-carbon product standards in cement and steel. Several include transport and waste as emerging priorities, introducing electric-mobility programs, recycling targets, and waste-to-energy pathways that align with circular economy principles.

Mitigation actions are also being designed to deliver broad socio-economic co-benefits. Key mitigation co-benefits highlighted across NDCs include strong economic and social elements. Expanding clean-energy industries is creating new jobs and supporting local manufacturing. Efficiency improvements in buildings and are lowering household energy costs, easing pressure on public budgets. At the same time, sustainable infrastructure programs are linking climate action with social inclusion by opening opportunities for youth employment and skill development in emerging clean sectors. Together, these co-benefits strengthen the case for climate investment, not only as an environmental priority, but as a driver of inclusive growth and long-term economic resilience.

Adaptation pathways

Adaptation has become a central component of MENA's climate strategies, reflecting the region's exposure to rising temperatures, desertification, and extreme weather events. All 2025 NDC submissions integrate adaptation into national development frameworks, moving from reactive measures toward proactive, system-wide resilience planning. Water resilience features prominently across submissions, consistent with the region's predominantly arid and semi-arid conditions. Governments are strengthening integrated approaches that link water management with food security, health, and land restoration. In addition, emerging frameworks emphasize climate-smart agriculture, early-warning systems, and nature-based solutions such as mangrove restoration and coastal protection. In parallel, several countries have established institutional mechanisms, including adaptation funds and local resilience plans, to enhance coordination and ensure more effective implementation across sectors.

Means of implementation

A key trend in this NDC cycle is the gradual shift from high-level ambition toward more operational and measurable implementation frameworks. Several countries are enhancing alignment with the Improved Common Transparency and Understanding (ICTU) and the Enhanced Transparency Framework (ETF), developing monitoring, reporting, and verification (MRV) systems to better track progress and outcomes.

Financial architecture is also evolving, with the introduction of green-finance instruments, including sukuk, sustainability-linked bonds, and national climate funds, mobilizing domestic and international capital. Several submissions quantify investment needs through 2035, identifying persistent financing gaps, particularly in adaptation and technology deployment. Collaboration under Article six is gaining traction, supported by regional efforts to establish carbon registries, trading platforms, and integrity frameworks. Technology transfer and capacity-building feature prominently across NDCs, spanning digital MRV tools, renewable-industry workforce training, and knowledge partnerships with multilateral and regional institutions.

Role of the MENA region on the global stage

Role of the MENA region on the global stage

Vast landscapes with rapid population growth

The MENA region spans across 13 million square kilometers, representing around nine percent of the world's landmass. Its climate and landscapes range from Mediterranean coasts and fertile highlands to expansive deserts and hyper-arid zones, with nearly 90 percent of the region classified as arid or semi-arid (World Bank, 2024; UNESCWA, 2023). It is home to a population of 493 million, hosting approximately six percent of the global population and continues to grow at two percent annually, almost twice the global average (UNESCWA, 2025; World Data, 2024). Two-thirds of MENA residents live in cities, and in several economies, urbanization exceeds 85 percent (Middle East Institute, 2024). This growing urban footprint is shaping future demand for energy, water, and services that are both climate-resilient and sustainable.

A global energy hub and trade gateway

The MENA region sits at the crossroads of global energy and trade flows, serving as a bridge between major consumer and producer markets across Asia, Europe, and Africa. The region's combined Gross Domestic Product (GDP), estimated at around USD 2.85 trillion in 2024, accounts for roughly 3–4 percent of global output, supported by strong financial, investment, and logistics linkages (World Bank, 2025). Growth is projected to strengthen gradually, from about 1.8 percent in 2024 to 3.4 percent by 2026, driven by hydrocarbon revenues, ongoing diversification reforms, and expanding services and connectivity (IMF, 2024).

Economic structures across the region remain diverse yet interconnected. Hydrocarbons, manufacturing, and utilities combined account for around 40 percent of total economic output in the MENA region, especially in oil-exporting economies where hydrocarbons alone reach or surpass 25–30 percent of GDP, with the remainder contributed by energy-intensive industry and utilities (IMF, 2024). This composition reflects both the historical prominence of resource-based industries and the expanding role of trade, logistics, and technology-driven services. Despite differences and disparities in economic structure and fiscal capacity, regional priorities are increasingly converging around diversification, investment attraction, and sustainable growth pathways.

Trade remains a defining pillar of the region's economy. MENA hosts some of the world's most strategic maritime corridors, The Suez Canal, Bab el-Mandeb Strait, and Strait of Hormuz together handle around 15 percent of world seaborne trade including approximately 35-40 percent of globally seaborne traded hydrocarbons, or about 20-25 percent of all globally traded hydrocarbons, including around 20-25 percent of global LNG supply (UNCTAD 2024;2025, EIA 2024;2025. IEA 2026), reinforcing the region's centrality to both global logistics and the future of energy security. Beyond hydrocarbons, the region is strengthening its role in logistics, manufacturing, and digital connectivity, positioning itself as a central hub in emerging low-emissions supply chains and global energy markets.

GHG emissions and transition pathways

MENA contributes roughly six percent of global greenhouse-gas emissions (EDGAR, 2024), primarily from power generation and heavy industry. This share remains limited considering the region's economic scale and pivotal role in global energy supply. Rooted in long-established fossil-based systems that have supported both domestic development and international markets, these emissions now form the basis for a transformation toward cleaner energy pathways. Through efficiency improvements, large-scale renewable deployment, and emerging carbon capture technologies, MENA is progressively decarbonizing its production and exports in ways that can generate benefits extending well beyond the region.

The clean-energy landscape is rapidly scaling up. The region's distinct advantage lies in its exceptional potential for renewable energy resources; it receives roughly 22–26 percent of all solar irradiation striking the Earth and over 75 percent of its land area experiences wind speeds suitable for utility-scale generation (World Bank, 2024). MENA now hosts several of the world's largest solar and wind projects, with regional renewable-energy capacity exceeding 35 GW in 2024 and continuing to expand through a growing pipeline of clean-energy investments, grid interconnections, and emerging low-carbon technologies (ESMAP & World Bank, 2025). These developments are gradually shifting the region's narrative from hydrocarbon exporter to clean-energy innovator and future hydrogen hub.

MENA regional context

MENA regional context

Advancing climate action despite regional constraints

The MENA region faces a complex and unique landscape that shapes the pace and design of its climate action. First, structural economic disparities persist, with wide variation in fiscal capacity and institutional maturity across countries. These differences influence access to technology, investment, and human capital, which are key enablers of climate implementation. Second, armed conflict and longstanding geopolitical challenges in the region continue to divert policy focus and resources toward short-term security and reconstruction priorities, limiting the space for sustained climate investment. Third, the dependence on hydrocarbons for fiscal revenues also impacts diversification efforts, as government budgets remain sensitive to fluctuations in global oil and gas prices. At the same time, many economies are navigating overlapping transitions, from debt management to labor market modernization, which challenges the policy landscape. Collectively, these factors create a complex starting point for climate action and policy but also underscore the importance of pursuing sustainability as a pathway to greater economic and social resilience.

Despite the unique context of the region, it has positioned itself at the forefront of sustainability efforts globally, advancing climate action through a combination of national reforms, regional cooperation, and large-scale clean-energy investments. The MENA region has become one of the most active emerging markets for clean-energy transformation. Renewable power capacity now exceeds 35 GW, with solar and wind accounting for most new installations (IRENA, 2024). Several governments have set clear targets to double or triple installed capacity by 2035, supported by record-low renewable auction prices and robust national investment programs. The region also hosts nine of the world's 20 largest announced hydrogen projects, highlighting its potential to become a global hub for low-carbon fuels (IEA, 2025). Carbon capture capacity continues to expand, with facilities in KSA, the UAE, and Qatar collectively capturing and storing more than 3 million tons of CO_2 per year (IEF CCE Knowledge Hub 2024, IEA CCUS Tracker, 2025).

MENA's effort is further reflected in its ability to deliver projects of global scale and significance. From the UAE's COP28 presidency and Net Zero by 2050 strategy to KSA's Circular Carbon Economy framework and Egypt's Nexus of Water, Food and Energy platform for green investment, countries are translating policy ambition into concrete outcomes. Flagship projects such as Morocco's Noor Ouarzazate solar complex, the NEOM Green Hydrogen Project, and Egypt's Benban Solar Park have become international reference points for large-scale clean-energy deployment in emerging economies. Together, these developments demonstrate that, despite structural and geopolitical challenges, MENA continues to play a proactive and influential role in shaping the global sustainability agenda, anchoring its climate action in innovation, partnership, and economic transformation.

Key regional challenges

Beyond its unique context, the MENA region faces a set of persistent challenges that are consistently highlighted across NDCs. While each country operates within its own political, economic, and environmental realities, several overarching barriers emerge as common to the region. These shared challenges span environmental, economic, and institutional dimensions detailed in Figure 1, and are linked to the mitigation and adaptation priorities outlined in national submissions. Recurring priorities across NDCs include water scarcity, rapid urbanization, fragmented utilities, technical and capacity gaps, economic vulnerability, and exposure to climate-induced disasters as cross-cutting stressors that heighten implementation risks and reinforce the need for sustained regional cooperation and external partnerships.

Figure 1 – Key regional challenges

Water scarcity

Water scarcity refers to the limited availability of renewable freshwater resources to meet demand. 17 MENA countries fall below global water-security thresholds, making it the most water-stressed region in the world (World Bank, 2017). Roughly 60 percent of the population lives in areas facing high water stress (World Bank, 2025). This scarcity constrains agricultural productivity, industrial processes, and domestic supply. MENA countries are addressing the challenge through large-scale desalination, reuse systems, and cross-sector water-efficiency programs.

Rapid urbanization

Rapid urbanization reflects the accelerated growth of cities and urban populations. In MENA, urban areas have nearly tripled in size between 1992 and 2020 (ESCWA, 2025), placing significant pressure on housing, transport, and basic utilities. This expansion drives higher energy demand and increases exposure to heat stress, flooding, and pollution. Without climate-sensitive urban planning, such growth risks amplifying inequality and environmental degradation.

Economic disparity

Economic disparity refers to the significant differences in income levels, fiscal capacity, and access to resources across the region. MENA exhibits a wide income gap, with GDP per capita ranging from under USD 500 to over USD 80,000 (World Bank, 2024). Several economies face fiscal constraints, high debt burdens, and post-conflict recovery needs that limit their ability to finance climate programs or attract private investment.

Desertification

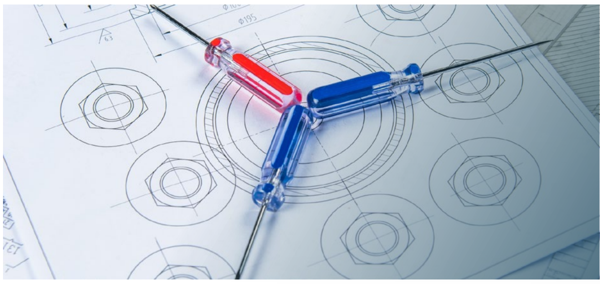
Desertification is the degradation of land in arid, semi-arid, and dry sub-humid areas caused by climatic variations and human activities. With nearly 90 percent of the region classified as arid, unsustainable land use and frequent droughts are intensifying soil degradation, posing serious risks to food security and rural livelihoods (UNESCWA, 2023). Desertification also drives rural-to-urban migration, further straining cities already under environmental and economic pressure.

Climate & natural risk

Climate and natural risks refer to the increasing frequency and severity of extreme weather events that threaten ecosystems, infrastructure, and public health. MENA faces rising temperatures, heatwaves, floods, cyclones, and sea level rise, intensifying vulnerabilities across sectors. These hazards disrupt economic activity, damage infrastructure, and exacerbate food and water insecurity, particularly in coastal and low-lying areas.

Technical & capacity gap

This challenge reflects the limited domestic expertise, infrastructure, and research capacity required to scale up advanced climate technologies. Hydrogen, carbon capture, utilization, and storage (CCUS), and smart-grid systems still rely heavily on imported technology, foreign investment, and external technical support. This dependence slows innovation and raises project costs, even as electricity demand has tripled since 2000 (IEA, 2025). Closing this gap requires long-term workforce development and regional research and development (R&D)



Weak & fragmented utilities

Weak and fragmented utilities describe outdated or poorly coordinated infrastructure systems for power, water, and waste management. These inefficiencies reduce service reliability, increase operational losses, and constrain the scale-up of low-emissions and climate-resilient infrastructure. Long-standing governance and regulatory gaps, combined with limited cost recovery and financial autonomy, continue to hinder modernization efforts (world Bank, 2018).

Mitigation measures and technologies

Renewables

Key highlights

Solar PV in MENA is expected to add 220–450 GW by 2035, lifting its share of renewables in electricity generation to 25 percent by 2035

As of 2024, 16 of MENA NDCs include an explicit 2030 renewable target, with twelve specifying a power-mix share and four setting GW levels

Public auctions have yielded record lows on renewable prices, solar USD 10–13/MWh (2024) and onshore wind USD 16–17/MWh (2024), reflecting top-quartile irradiance, scale, and bankable offtake

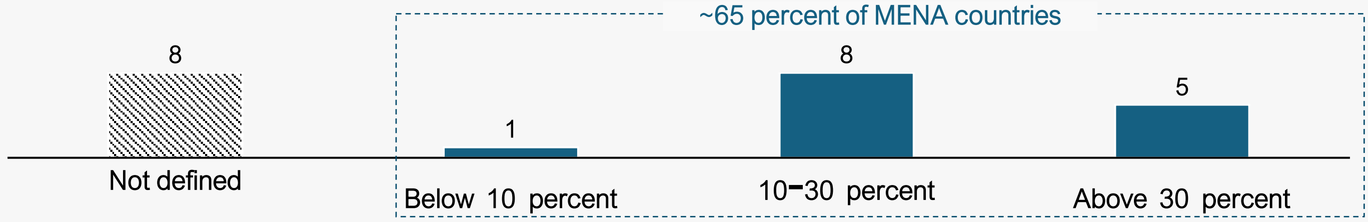
The region hosts several of the world's largest renewable complexes, with individual projects exceeding 2–5 GW (e.g., Mohammed bin Rashid Al Maktoum Solar Park 5 GW) that demonstrate scale and signal long-term leadership

The MENA region is steadily positioning itself as a global frontrunner in renewable energy scale-up, combining ambitious targets with rapid project deployment and record-setting market outcomes.

MENA is emerging as one of the world's most ambitious clean energy investment regions

Ambition across the MENA countries has advanced significantly in recent years. As of 2024, 14 MENA countries included explicit renewable energy targets in their NDCs. Among these, twelve targets are framed as shares of electricity generation (e.g., ≥30 percent by 2030), while four specify absolute capacity additions in GW terms. Importantly, countries in the region have also set long-term 2050 net-zero or renewable-share targets, anchoring the sector's growth in broader national emissions reduction strategies (UNFCCC NDC Registry, 2025). This ambition is not uniform in design, reflecting different starting points and system needs, but the collective signal is clear: to ensure secure and resilient energy mixes across MENA. The aggregation of these commitments suggests a structural shift toward embedding clean power as a foundational pillar of development policy.

Figure 2 – Distribution of MENA renewable energy mix targets



14 MENA countries now have quantified renewable energy targets, and majority aim for ≥10 percent renewable electricity generation by 2030.

Solar and wind pipelines scale up to reshape the regional power mix

Renewable energy delivery is now visibly accelerating in the region, primarily through solar and wind. Utility-scale solar PV remains the leading technology, reflecting exceptional solar irradiance, availability of land, and clear regulatory pathways. Solar capacity in the MENA region is expected to grow rapidly from 18 GW in 2023 to 220 GW by 2035 under existing policies and could reach 450 GW with faster adoption (IEA, 2025). This increase would raise the share of renewables in electricity generation to 25 percent by 2035, compared to six percent in 2024 (IEA, 2025; Arab Gulf States Institute, 2025).

Moreover, wind power is gaining momentum in areas with high-capacity factors (more than 40 percent), while concentrated solar power (CSP) projects have slowed due to high capital costs and limited concessional financing availability.

In addition, several countries in the region possess vast, largely untapped renewable energy potential, characterized by high solar irradiation and extensive available land, including Algeria, Libya, and Sudan. Algeria aims to install approximately 15 GW of renewable capacity by 2035, leveraging its Sahara solar irradiation above 2,500 kWh/m² annually (SFA Oxford, 2025).

Libya has outlined a target of ten percent renewable energy contribution to its electricity mix by 2025 under its National Strategy for Renewable Energy and Energy Efficiency (Libya Summit, 2024). Sudan, though currently using only ~0.78 percent of non-hydro renewable sources, has announced plans to install around 2,190 MW of solar PV and 50 MW of solar thermal by 2035, reflecting its large but untapped solar belt (Engineering Reports Renewable Energy in Sudan, 2025).

In parallel, countries facing persistent grid instability and high energy costs, such as Lebanon, Syria and Yemen, are increasingly turning to decentralized renewable solutions. In Lebanon, rooftop solar and solar-plus-battery systems have expanded dramatically, with capacity estimated at 1,200 -1,300 MW from 2021-2024 in response to above mentioned challenges (The Century Foundation, 2025). In Syria, off-grid solar and hybrid mini-grids have emerged to help restore supply after grid infrastructure damage (Renewables Now, 2025). In Yemen, off-grid solar systems have become essential to power homes, clinics and schools in areas cut off from the central grid (UNDP, 2024).

Grid links and storage unlock flexibility for accelerated build-out

To accommodate rapid renewable expansion, MENA governments are pairing deployment targets with strategic grid and system integration measures. Cross-border power interconnectivity is becoming a key enabler: a 3 GW High-Voltage Direct Current (HVDC) interconnection linking North Africa and the Gulf is entering service in 2024–2025, while GCC (Gulf Cooperation Council) transmission upgrades will expand bilateral exchange capacities to over 3 GW per corridor (GCC Interconnection Authority, 2024). These initiatives significantly enhance system flexibility, reduce curtailment risk, and position the region as a hub for transnational electricity trade.

Storage technologies are also advancing from pilot to procurement scale. Multiple countries have announced multi-gigawatt-hour battery storage tenders and CSP projects with thermal storage, with the aim of smoothing variability and enabling round-the-clock clean power supply. Alongside physical assets, market frameworks are evolving: the shift from feed-in tariffs to competitive auction models has created more transparent, cost-effective procurement processes that attract global developers and financiers.

Record-low prices meet surging green finance to anchor future growth

The MENA region has redefined the global Levelized Cost of Energy (LCOEs) benchmarks for renewables. In the Gulf region, a large solar PV auction was awarded at around USD 13.5 per megawatt-hour (MWh), among the global lowest recorded in past years. Saudi Arabia currently holds the record for the lowest wind and solar electricity costs, with the Dawadmi Wind Energy Project in the Riyadh province and the Najran Solar Energy Project in the Narjan region achieving LCOE rates at 13.38 US / MWh) and 10.96 US / MWh, for wind and solar respectively, surpassing previous records (Kingdom of Saudi Arabia, 2025). Auction price data for on-shore wind in the wider MENA around USD 16-17 / MWh has been cited in industry commentary but is not yet substantiated in public institutional databases (MESIA Solar Outlook Report, 2024). These outcomes are enabled not only by natural resource quality but also by robust financial ecosystems that ensure bankability.

Capital markets are increasingly active. Regional issuance of green bonds and sukuk reached USD 16.7 billion in the first nine months of 2024, with Environmental, Social and Governance (ESG) sukuk volumes rising 48 percent year-on-year in H1-2024 (Arab News, 2025 and Gulf Business, 2024). This surge reflects both investor confidence and the alignment of renewable projects with sustainable finance frameworks. Weighted average cost of capital (WACC) has trended downward as sovereign support, international financial institution backing, and deepening domestic capital markets have converged to lower risk premiums.

The combination of globally competitive LCOEs and growing green finance volumes ensures that renewables in MENA are not only economically viable but also increasingly attractive to long-term institutional investors.

Key flagship projects in the region

United Arab Emirates Mohammed Bin Rashid Al Maktoum Solar Park

The largest single-site solar park in the world based on the Independent Power Producer (IPP) model. It has a planned production capacity of 5,000 MW by 2030, with investments totaling AED 50 billion. When completed, it will save over 6.5 million tons of carbon emissions annually (Mohammad bin Rashid Al Maktoum Solar Park, n.d.).

Saudi Arabia Electricity Company Bisha Battery Storage Facility

One of the largest single-site battery energy storage systems in the world, with a capacity of 500 MW/ 2,000 MWh commissioned in 2025. Designed to enhance grid stability and flexibility, enabling greater integration of renewable energy into KSA's power system (Saur Energy International, 2025).

Morocco Noor Ouarzazate CSP and Solar Complex

A landmark multi-technology solar complex combining concentrated solar power and photovoltaic systems totaling 580 MW. The facility provides dispatchable renewable electricity to over one million people. It reduces Morocco's CO_2 emissions by nearly 760,000 tons each year (Heidelberg Materials, n.d.).

Energy Efficiency

Key highlights

All MENA countries' reference energy efficiency in their NDC and 18 have dedicated national plans, marking it as a central policy pillar

Efficiency measures cover power, transport, buildings, and industry, which can lead up to 10–25 percent savings in energy consumption according to the IEA and World Bank Energy Transition Report

Expanding MRV systems, Energy Service Company finance, and regional collaboration will translate ambition into measurable results

Large-scale urban retrofits, grid modernization, and flaring-reduction initiatives are proving that efficiency can deliver measurable emission cuts, fiscal savings, and productivity gains at scale

Energy efficiency is embedded across the MENA's energy and climate policy landscape. If implemented at scale, current measures could reduce cumulative emissions by several hundred million tons of CO_2 by 2030, lower national energy intensities by double-digit percentages, and yield substantial fiscal savings.

Efficiency anchors the region's transition toward sustainable energy systems

Energy efficiency refers to improving how energy is produced and consumed to deliver the same output using fewer resources. Globally, energy-related activities account for approximately 75.7 percent of greenhouse gas emissions, underscoring efficiency's centrality to climate mitigation (World Resources Institute, 2024). In MENA, where economies remain energy intensive and population growth continues to accelerate demand, efficiency has become the most immediate and cost-effective route to reduce emissions, preserve fuel, and enhance long-term energy security.

Efficiency in the region spans both supply and demand dimensions. On the supply side, efforts focus on optimizing generation performance, modernizing transmission infrastructure, and improving operational efficiency across upstream and midstream energy systems. On the demand side, efficiency gains are driven by industrial process upgrades, enforcement of minimum energy performance standards for equipment and appliances, particularly in cooling systems and lighting, and the introduction of vehicle efficiency regulations consistent with Corporate Average Fuel Economy (CAFE) standards (United for Efficiency, 2023). Consumer awareness and behavioral change initiatives further complement these measures, reinforcing sustainable consumption patterns across sectors.

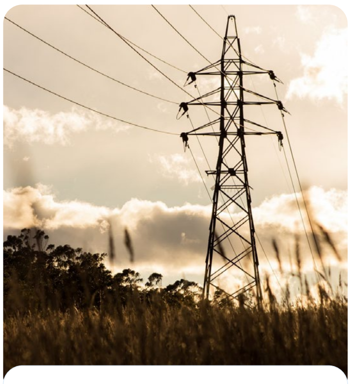
Ambitions expand as national strategies mature

Energy efficiency features in every NDC submitted by MENA countries. Submissions identify efficiency as a mitigation or adaptation measure, while seven countries include quantified energy efficiency targets. The targets articulated in the NDCs vary across countries, with some committing to percentage reductions in electricity consumption, while others target emissions reduction estimates linked to sectoral programs. The remaining submissions describe efficiency qualitatively, often through standards, audits, and technology deployment initiatives (UNFCCC NDC Registry, 2025).

This growing emphasis is reinforced by a strong institutional foundation. 18 of the MENA countries have formal national energy efficiency action plans or dedicated strategies. These frameworks establish baselines, specify implementation mechanisms, and outline investment pathways, ensuring that efficiency objectives are translated into measurable outcomes. Collectively, they signal a structural transition from fragmented pilot projects to coordinated, policy-driven programs supported by ministries, regulators, and dedicated energy efficiency agencies.

Deployment is advancing across key emitting sectors

Efficiency implementation is expanding across the sectors that dominate MENA's energy demand, power, buildings, and industry, which together represent more than two-thirds of final energy consumption. Efficiency measures covering these sectors can lead up to 10–25 percent savings in energy consumption according to the IEA and World Bank Energy Transition Report (IEA, 2023; World Bank, 2024).



In the **power sector**, countries are modernizing gas-fired generation fleets, deploying combined-cycle units, and upgrading transmission and distribution systems to reduce technical losses. Efficiency gains in this area not only cut emissions but also free up natural gas for export or domestic industrial use.

In the **transport sector**, efforts focus on improving fleet efficiency, gradual electrification, and better use of public transport. These shifts help moderate fuel consumption, reduce congestion, and improve urban air quality as transport demand continues to grow.

In the **industrial sector**, governments are introducing energy-management systems, conducting mandatory audits, and establishing performance benchmarks in high-emitting industries such as cement, petrochemicals, and steel. This shift aligns industrial competitiveness with emerging global trade requirements related to carbon intensity.

In the **built environment**, efficiency improvements are driven by new codes, appliance-labelling programs, and retrofitting schemes. Cooling represents one of the fastest-growing sources of energy demand in the region. Efficiency measures in air-conditioning systems and thermal insulation are therefore critical to moderating peak loads and reducing electricity demand growth.

Future opportunities for scaling energy efficiency

Unlocking large-scale energy efficiency in the MENA region hinges on strengthening the enabling environment that turns ambition into measurable outcomes. Most countries have already introduced national programs and targets, yet further institutional alignment and market readiness are needed to translate these efforts into sustained impact. Establishing or empowering national agencies with clear mandates, standardized methodologies, and accountability frameworks can reinforce coordination between ministries, utilities, and regulators and ensure that efficiency becomes embedded in long-term planning.

Financial and market enablers are equally critical to move from policy to pipeline. Access to affordable capital remains limited for retrofits and performance-based contracts, particularly among small and medium consumers. Expanding public–private financing instruments, such as green credit lines, blended finance facilities, and guarantee schemes, can reduce perceived risk, mobilize private participation, and scale investment in energy-saving technologies.

Finally, capacity development underpins every stage of implementation. Targeted training programs for auditors, building inspectors, and facility managers can close technical and operational gaps, while integrating energy management and auditing into vocational and professional curricula will help build a future-ready workforce. Taken together, these reforms would institutionalize energy efficiency as a mainstream investment class and a foundational pillar of the region's low-emissions, resource-efficient future.

Key flagship projects in the region

Morocco
Accelerating the Uptake of Energy Systems by Industry

A UNIDO-led program supported Moroccan industries in adopting ISO 50001 energy management systems through training 18 companies, 13 consultants, and nine government officials. Participants achieved up to nine percent energy savings using low-cost operational measures and better monitoring (UNIDO, 2023).

Egypt
Public Buildings Retrofit and Street Lighting

A UNDP-led market-transformation project that implemented 15+ lighting-retrofit pilot sites in public and private buildings, alongside minimum performance standards and labeling (UNDP, n.d.).

Jordan
Energy Efficiency in Public Buildings

A program (2015–2022) that upgraded 202 public buildings, including schools, hospitals, and offices, with LED lighting, solar PV & thermal, achieving annual savings ~18,900 MWh and CO_2 reductions ~13,000 t (GFA Group, 2023).

Hydrogen

Key highlights

Hydrogen is a prominent technology across the MENA countries, with 17 of them referencing hydrogen in NDCs or national strategies

Regional production could reach 5–10 million tons by 2040, dominated by green hydrogen and dependent on financing and infrastructure challenges

Implementation progress remains uneven, with some projects experiencing delays due to financial, regulatory, and infrastructure constraints

The region is developing record-scale capacities, demonstrated by the NEOM hydrogen project that aims to produce 1.2 million tons of green ammonia annually

The MENA region is rapidly emerging as a strategic hub for clean hydrogen. Since 2022, hydrogen has gained prominence across MENA policy frameworks, featuring as a key pillar of regional emissions reduction and export agendas. Yet, implementation remains uneven, with some projects experiencing delays due to financial, regulatory, and infrastructure constraints.

Hydrogen is a technology priority across the MENA region

Hydrogen is an emerging clean energy carrier that can be produced from various primary energy sources and used for multiple applications. It serves as a flexible fuel that can be converted efficiently into electricity through fuel cells or burned for high-temperature heat, supporting power generation and industrial processes with near-zero emissions when produced via low-carbon methods such as electrolysis powered by renewables (green hydrogen) or fossil fuels coupled with carbon capture (blue hydrogen). Hydrogen is also a key feedstock for producing synthetic fuels, ammonia, and methanol, which are vital for decarbonizing sectors that are hard to electrify, such as shipping, aviation, steelmaking, and chemicals. Its high energy density and ability to be stored and used in various forms enable hydrogen to play a central role in facilitating just transitions, enhancing energy security, and enabling global trade in renewable energy.

Green hydrogen, produced through electrolysis powered by renewable energy, dominates the regional narrative and accounts for more than 85 percent of announced capacity (IRENA, 2024). Several Gulf producers, however, are pursuing blue and low carbon hydrogen as a transitional step, leveraging existing gas resources and carbon capture and storage infrastructure to accelerate early production while renewable capacity scales. This dual-pathway model reflects pragmatic sequencing in which blue hydrogen anchors initial export revenue streams, while green hydrogen is expected to deliver long-term decarbonization alignment.

Hydrogen is a technology priority across the MENA region. As of 2025, 17 countries have initiated hydrogen related activities through dedicated strategies, pilot projects, or memoranda of understanding. These strategies typically position hydrogen as both an economic diversification tool and a low-carbon industrial feedstock for future export industries. National roadmaps commonly set multi-decadal horizons, targeting between 5–10 million tons of clean hydrogen production by 2040, aligned with broader 2050 net-zero frameworks (IEF, 2022; IEA, 2024).

Policy and institutional integration are advancing, yet implementation remains uneven. Only six national NDCs explicitly reference hydrogen (UNFCCC Registry, 2025), underscoring the ongoing evolution of national ambitions beyond formal climate commitments. Meanwhile, more than 60 hydrogen and ammonia projects have been announced across the region (Future Fuels MENA, 2025), though several have encountered delays linked to financial, regulatory, and infrastructure bottlenecks. Together, these developments mark a transition from policy formulation to early-stage execution, reflecting both the region's strategic intent and the practical hurdles of building a new energy export ecosystem.

Translating ambition into delivery through infrastructure and financial readiness

The viability of clean hydrogen in the MENA will ultimately depend on the region's ability to convert its natural cost advantage into bankable, export-ready projects. Competitiveness begins with production economics: MENA's abundant solar and wind resources, extensive land availability, and existing industrial and port infrastructure collectively position it among the lowest-cost hydrogen producers globally. Feasibility studies and industry analyses for Gulf states such as the UAE and KSA suggest that green hydrogen production costs could reach around USD 1.7-1.8/kg by 2030, and with favorable conditions might approach the USD 1.5-2/kg range. This compares favorably with the USD 3-4/kg (or more) often projected in European or Asian markets. (IRENA, 2022, IEA, 2023, and BloombergNEF, 2023). Further optimization through integrated renewable-to-hydrogen clusters and shared transmission corridors can reinforce this cost edge.

Yet competitive production alone does not guarantee investment. The next prerequisite is securing long-term offtake agreements with creditworthy buyers. Predictable demand from industrial consumers, utilities, and energy-trading partners, particularly in Europe, East Asia, and emerging regional markets, is essential to underpin revenue stability and unlock debt financing. MENA producers are increasingly negotiating Memoranda of Understanding (MoUs) and pre-contractual frameworks with buyers in Germany, Japan, and the Netherlands to establish hydrogen and ammonia corridors supported by certification schemes compliant with the EU's Renewable Energy Directive (RED III) and the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) (Reuters, 2025; Ammonia Energy, 2022; H2 Diplo, 2023). These offtake arrangements are not only commercial instruments but also critical signals that validate export potential and enable the creation of standardized supply chains.

Hydrogen project financing in the MENA region currently relies heavily on state-backed entities, sovereign funds, and bilateral partnerships, with concessional finance from institutions such as the World Bank, European Bank for Reconstruction and Development, and International Finance Corporation playing a growing role.

To strengthen the financing ecosystem, countries are increasingly exploring blended-finance structures that combine public and private capital to de-risk investments. Tools such as carbon contracts for difference (CCfDs), sustainability-linked loans, and green hydrogen guarantees are being studied to reduce capital costs and improve investor confidence. In parallel, robust certification frameworks, including those recognized by major importing markets and international partnerships (e.g., EU RED III and IPHE guidelines) will be important to support market access where relevant. Ultimately, unlocking hydrogen finance in MENA depends on aligning three pillars: competitive production costs to attract buyers, long-term offtake agreements to ensure revenue certainty, and credible governance and certification frameworks to mobilize international climate finance.

Key flagship projects in the region

Saudi Arabia
NEOM Green Hydrogen Project

The world's largest green hydrogen plant powered by 4 GW of solar and wind energy. It will produce 1.2 million tons of green ammonia annually, equivalent to 600 tons of hydrogen per day. The USD 8.4 billion project will cut around 5 million tons of CO_2 emissions per year (ACWA Power, 2024).

Algeria, Tunisia, EU
SouthH_2 Corridor project and ALTEH2A

Algeria and Tunisia are developing the SouthH_2 cross-border hydrogen corridor with the European Union. The project will connect Algerian and Tunisian hydrogen production to European markets, targeting >4 Mtpa of green hydrogen by 2030 (Federal Ministry for Economic Affairs and Energy, 2024). In November 2025 the Algeria to Europe Hydrogen Alliance - ALTEH2A was launched by companies from Algeria, Germany, Italy, and Austria seeking to utilize SouthH_2 for transport of green Algerian hydrogen to the EU.

CCUS

Key highlights

CCUS adoption is accelerating yet unevenly, nine MENA countries reference CCUS in their NDCs with a few moving toward structured implementation

Infrastructure planning is emerging as a focus, some countries are assessing storage potential or planning shared CCUS hubs, signaling a shift from isolated pilots to coordinated industrial systems

Policy frameworks remain largely qualitative, three countries set quantified capture targets, reflecting early-stage readiness and the need for clearer measurement frameworks

Enabling conditions will determine scale, advancing regulation, financing instruments, and data transparency are essential to unlock the region's capture potential by 2035

The MENA region is increasingly integrating CCUS into its industrial and climate transition. The region also possesses substantial geological storage potential, underpinned by depleted hydrocarbon reservoirs and deep saline formations that provide favorable conditions for long-term CO_2 sequestration. Although deployment remains at an early stage, the past five years have seen a marked acceleration in planning and pilot development.

Carbon management is a central component of the regional transition

CCUS is a technology that captures CO_2 emissions from large point sources such as power plants, cement factories, and industrial facilities, preventing their release into the atmosphere. Once captured, the CO_2 can be utilized in various industrial processes, such as enhanced oil recovery and synthetic fuel production, or stored permanently in deep geological formations. CCUS enables the decarbonization of hard-to-abate sectors while supporting the continued use of existing energy infrastructure, making it a vital component of pathways toward net-zero emissions and sustainable industrial development.

Nine MENA countries reference CCUS in their NDCs, while another two have initiated national strategies or pilot programs that incorporate the technology within their climate activities (UNFCCC NDC Registry, 2025). This engagement reflects a growing recognition that CCUS is essential to maintaining industrial competitiveness while advancing national emission reduction goals. CCUS is increasingly embedded alongside renewables, hydrogen, and efficiency measures, signaling that carbon management is a key pillar of regional climate action (IEF, 2021).

Despite CCUS momentum, explicit capture targets remain limited. Three countries define quantified CCUS objectives or identify specific annual capture capacities, while most frame CCUS as a future or conditional measure (UNFCCC NDC Registry, 2025). This reflects the capital-intensive, system-level nature of CCUS, which requires coordinated development of capture, transport, and storage infrastructure. As a result, countries are prioritizing feasibility studies, capacity building, and infrastructure planning as prerequisites for scale-up.

From concept to infrastructure planning: a technology gaining traction

The profile of CCUS across MENA has evolved from theoretical discussion to coordinated industrial planning. Some of the MENA countries are now conducting assessments of carbon dioxide storage potential and evaluating options for capture, transport, and utilization infrastructure. This growing activity signals increasing confidence in the technical feasibility and long-term relevance of CCUS within national decarbonization portfolios.

The region is adopting a CCUS hubs-based model that emphasizes collective action. The concept of shared CCUS hubs is emerging as a preferred pathway to scale, connecting multiple emitters to common pipelines and storage systems. This approach enables economies of scale, reduces costs, and facilitates the participation of private developers. It also supports cross-border collaboration by linking industrial centers with neighboring areas that possess suitable geological storage capacity. Such regional integration creates opportunities to develop a carbon management network that extends beyond individual national boundaries.

CCUS is now embedded in several long-term low-emission development frameworks that treat carbon capture as part of their climate action measures. These frameworks emphasize the role of CCUS not only in reducing industrial emissions but also in enabling new markets for carbon reuse and removal. The steady growth of pilot projects, feasibility programs, and policy references reflects a technology that is maturing from concept to implementation.

According to recent regional reviews and industry projections, the MENA carbon-capture pipeline could reach up to ~35 million tons of CO_2 per annum by 2035, depending on realization of currently announced projects (DII, 2025; Carbon Capture MENA whitepaper, 2024). This could mark a significant leap forward for the region, positioning it among the leading emerging markets for carbon management.

Scaling deployment requires strong regulation, finance, and data systems

Despite visible progress, large-scale deployment remains constrained by structural barriers. Only a limited number of MENA economies have introduced legal frameworks for carbon dioxide transport, storage rights, and long-term liability. The absence of standardized MRV systems increases uncertainty and slows private investment. Establishing clear governance mechanisms and licensing processes will be critical to unlock larger projects and ensure environmental integrity.

Financing remains the most significant challenge. CCUS projects are capital intensive, often requiring USD 40–120 per ton of annual capture capacity. Revenue and risk allocation structures vary across projects and depend on a mix of factors, including project design, end-use applications, and policy and market context. While international institutions and regional development banks are supporting early-stage readiness efforts, sustained growth will depend on national incentives such as credit guarantees, contracts for difference, and eligibility within green finance frameworks.

Data availability is another crucial enabler. Comprehensive geological surveys and shared regional databases are needed to map storage potential and identify viable infrastructure corridors. Harmonized monitoring and verification standards would facilitate cross-border projects and enable participation in international carbon markets under Article six of the Paris Agreement. Building these technical and institutional foundations will determine how quickly CCUS can move to large-scale and fully integrated carbon management systems (IEF 2024; IEF 2025; IEA 2024; IISD 2023).

Key flagship projects in the region

Saudi Arabia
Jubail CCS Hub

A large-scale industrial hub that will capture and store up to 9 million tons of CO_2 per year by 2027. It aggregates emissions from industrial sources in Jubail Industrial City. The initiative supports KSA's goal of becoming a global leader in carbon management (The CCUS Hub, 2025).

United Arab Emirates
Al Reyadah CCUS project

Operational since 2016, the Al Reyadah project captures about 800,000 tons of CO_2 each year from UAE Steel Arkan and transports it to ADNOC's onshore fields for permanent storage and enhanced oil recovery, making it the world's first commercial CCUS plant in the steel industry (Abu Dhabi Media Office, 2023).

Bahrain
Carbon Capture and Storage Mega-project

Bahrain is exploring a "mega-project" Carbon Capture and Storage (CCS) hub based on a depleted onshore gas reservoir capable of storing 10-12 million tons of CO_2 per year for up to 50 years (PE Media Network, 2023).

Qatar
Ras Laffan CO_2 Capture Facility

Operational since 2019, it captures about 2.2 million tons of CO_2 annually, with plans to reach 5 million tons by 2030. It is the region's largest integrated CCUS project and a model for industrial-scale deployment (MEED, 2025).

Kuwait
National CCS Hub

A planned multi-sector carbon capture and storage network led by Kuwait Petroleum Corporation. It forms part of a USD 110 billion energy transition portfolio aimed at achieving net-zero by 2050. The hub will capture CO_2 from refineries, petrochemicals, and power generation (Times Kuwait, 2025).

Electrification

Key highlights

Nine MENA countries reference electrification in their NDCs, primarily in the sector, indicating early momentum with limitations on quantified targets

Expansion of charging networks, grid capacity, and green finance will determine how fast electrification becomes accessible and sustainable

Governments are embedding electrification in mobility and energy plans through subsidies, tax incentives, and financing schemes to wide-scale accelerate adoption

Operational electric bus and metro fleets across key cities in the region are cutting emissions and demonstrating the feasibility of large-scale electrification

Electrification is transitioning from a nascent policy concept to a tangible driver of decarbonization in MENA. The region has already demonstrated the feasibility of large-scale deployment through electrified public networks, charging-infrastructure expansion, and industrial power-system upgrades.

Electrification emerges as a new frontier of climate ambition

Electrification refers to the process of replacing fossil-fuel-based technologies with systems powered by electricity, ideally from low or zero-carbon sources. It is increasingly recognized as a cornerstone of long-term decarbonization, enabling cleaner transport, more efficient industry, and a progressive shift toward integrated energy systems (IPCC, 2022). Globally, electrification of end-use sectors is accelerating, supported by falling renewable energy costs and rapid advances in battery energy storage and grid technologies (IEA, 2023).

Across countries, electrification efforts have been most visible in the transport sector, where electric mobility and mass-transit systems are being introduced or scaled. More recently, electrification is also appearing in industrial operations, ports, and other end-use applications, although uptake remains uneven and at varying stages of maturity (IEF, 2024). Overall, electrification is emerging as a component of broader mitigation strategies, with progress shaped by sectoral readiness, infrastructure and critical mineral availability, and national circumstances (IEF, 2024; 2025).

Ambition is growing but remains uneven across countries

Electrification features in nine of the MENA NDCs, either through explicit commitments to electric vehicles (EVs) or hybrid electric fleets, or through broader references to “green mobility” and public modernization (UNFCCC NDC Registry, 2025). The submissions do not specify quantified EV targets, focusing on enabling measures such as infrastructure expansion, technology development, or policy frameworks.

The limited number of NDC featuring electrification reflects differences in market readiness, data systems, and institutional maturity across the countries. Several countries with advanced infrastructure now embed electrification into long-term and industrial strategies, while others are at earlier planning stages.

Beyond the NDCs, a growing number of national strategies and investment programs are advancing electrification as a central pillar of the energy transition. Electric mobility has become the most visible front of progress, with governments expanding charging infrastructure, introducing fiscal and regulatory incentives, and localizing vehicle assembly and component manufacturing. A recent assessment of e-mobility readiness ranked two MENA countries among the world's top ten, underscoring the region's accelerating policy and infrastructure momentum (Technical Review Middle East, 2024). Large cities are deploying electric bus fleets, electrified metro systems, and low-emission zones as part of wider urban mobility plans, while fleet transition initiatives are being extended to logistics and municipal.

In parallel, emerging programs are exploring electrification in industrial operations, ports, and cooling systems, reflecting growing recognition of electrification's role not only in emission reduction but also in industrial modernization and technological upgrading. Together, these developments signal an emerging regional ecosystem, anchored in but gradually extending to new frontiers of electrified infrastructure and clean-energy integration.

The path forward: key enablers for scaling electrification

The continued expansion of electrification across the MENA region will depend on the strength of its enabling environment, bringing together policy, infrastructure, and finance under a unified vision for sustainable growth. Many governments have already introduced policy and fiscal incentives to accelerate adoption, including subsidies for electric vehicles, exemption from import tariffs, and low-interest financing for public and private fleet conversion. These measures are gradually improving the cost competitiveness of electric mobility and signaling a transition toward low-emission systems.

Infrastructure and grid planning are key enablers that determine the accessibility and reliability of electrification for citizens and businesses. Several countries have expansion plans for national charging networks, integrating electric mobility infrastructure into urban and land-use plans. Financing and institutional coordination will also shape the pace and scale of deployment. Public–private partnerships and green finance instruments are increasingly mobilizing investment for both and industrial electrification projects. Incorporating electrification goals within public procurement and government fleet renewal programs is helping to build stable market demand, in turn attracting long-term investment. Together, these enablers demonstrate how MENA countries are beginning to move from fragmented pilot initiatives to coherent national ecosystems.

Key flagship projects in the region

Qatar
Doha E-Bus and Metro Integration

Qatar operates one of the region's largest electrified public systems, with approximately 787 electric buses integrated with metro and tram networks. The Lusail Bus Depot, powered by 4 MW of solar energy, is the world's largest e-bus charging hub. In 2025 the Qatar Ministry of Transport noted that 73-74% of the public bus fleet had been electrified.

Jordan
Electric Vehicle Network

Jordan's automotive market is undergoing a dynamic transformation, driven by a remarkable surge in EV adoption. EVs now account for a 55 percent share of Jordan's total vehicle imports, and local uptake has grown significantly, from just 800 EVs in 2016 to over 150,000 by April 2025 (International Trade Administration, 2025).

Low Carbon Hydrocarbons

Key highlights

Twelve MENA countries reference natural gas or alternative fuels in their national commitments (e.g., biofuels), showcasing fuel switching as one of the region's decarbonization tool

Gas is replacing heavier fuels across power, industry, and households, delivering lower emissions and higher efficiency

Clear fuel standards, storage, and distribution networks are needed to turn qualitative plans into measurable outcomes

Projects in gas-fired power generation and Liquefied Petroleum Gas (LPG) expansion already show low carbon hydrocarbons can cut emissions while improving reliability and affordability

Low-carbon hydrocarbons are expected to remain a core part of the region's energy mix through the 2030s, acting as both a stabilizer for power systems and a revenue base for export diversification.

Alternative fuels are reshaping the region's pathway to decarbonization

Low-carbon hydrocarbons refer to fuels and production processes that maintain the reliability and energy density of conventional hydrocarbons while significantly reducing greenhouse-gas emissions across their life cycle. This category includes biofuels, synthetic fuels, and gaseous fuels. It also encompasses measures to reduce methane emissions and eliminate routine gas flaring, alongside efficiency improvements in extraction, refining, and combustion processes.

Natural gas is one of the predominant low-carbon hydrocarbon options used across the region. When used for power generation, it emits roughly 40–50 percent less CO_2 than coal and 20–30 percent less than oil, while offering operational flexibility that supports system reliability and demand balancing (IEA, World Energy Outlook, 2024; IPCC, AR6 Working Group III, 2022). In energy systems with diverse demand profiles and growing variable generation, these attributes position natural gas as a key component of the power mix, contributing to affordability, reliability, and emissions intensity reduction.

Across MENA, the direction of change is clear: countries are progressively moving from high-emission fuels toward lower emission ones. The review of national climate plans shows that twelve countries reference alternative fuels (e.g., biofuels) or natural-gas transitions, yet none include quantified substitution targets. The commitments are largely qualitative, highlighting generic ambition rather than defined targets.

Beyond national submissions, governments are embedding low-carbon hydrocarbons into energy-sector reforms and national energy-transition strategies. Many are expanding natural-gas generation, developing liquefied natural-gas (LNG) infrastructure, and promoting compressed natural gas (CNG) in transport. Emerging initiatives also target the production of sustainable aviation fuels (SAF) to decarbonize aviation, leveraging existing refining infrastructure and growing renewable hydrogen capacity. While SAF remains nascent, it marks an important diversification of the region's fuel portfolio toward lower-emission energy carriers. Collectively, these measures are framed as transitional, enabling countries to reduce carbon intensity while progressively scaling renewables and electrification.

Deployment reflects pragmatism rather than rapid transformation

The MENA region's deployment of lower-carbon hydrocarbons is best described as pragmatic scaling. Governments are prioritizing solutions that provide immediate reliability and cost savings while gradually reducing emissions intensity. In power generation, gas-fired combined-cycle plants have replaced older, oil-based units, improved system efficiency and cutting per kilowatt-hour emissions.

In household energy, LPG and clean-cooking programs are expanding to reduce biomass use, a transition supported by international financing and development institutions. In industry and transport, co-firing and blending programs are emerging, introducing hydrogen or bio-methane into existing gas networks.

These examples show that adoption is driven less by technological breakthroughs and more by incremental substitution that fits current infrastructure and market conditions. Overall, the trend signals that MENA countries are advancing emissions intensity reductions through gradual, system-aligned changes that build on existing energy infrastructure.

Enablers that can turn incremental progress into systemic change

The next phase of progress depends on policy coherence, infrastructure readiness, and investment incentives. Clear policy signals, such as standards for fuel quality, blending ratios, and emission intensity benchmarks, can provide certainty for investors and energy companies. Inclusive dialogue and collaboration on the IEF platform focused on global best practice helps establish transparent standards to accelerate private investment and technology transfer deploying low carbon solutions faster in a wider range of market settings.

Infrastructure remains a key enabler, as it defines the capacity of countries to produce, transport, and trade low-carbon fuels at scale. Gas interconnections, LNG terminals, and industrial ports equipped for alternative fuels are prerequisites for regional market development. The presence of these facilities determines not only where low-carbon fuels can be used but also how quickly they can reach commercial scale. For shipping and heavy transport, dedicated bunkering infrastructure and harmonized safety regulations remain essential for large-scale fuel transition (IRENA, 2023).

Financing instruments will also shape the pace of transition. Expanding access to green industry funds, concessional finance, and results-based mechanisms can reduce the cost of switching and encourage regional production of alternative fuels. Development institutions are already supporting cleaner-fuel projects, signaling growing confidence in the sector's long-term potential (World Bank, 2024).

Key flagship projects in the region

Algeria
Natural Gas
Expansion Program

A national plan to sustain gas exports while improving efficiency and reducing flaring. The program expands output to maintain over 200 billion cubic meters per year of natural gas production by 2030. It anchors Algeria's role as a reliable low-carbon energy supplier to Europe (Middle East Observer, 2025).

Iraq
Gas-to-Power
and Flaring Reduction Program

An integrated initiative converting flared gas into electricity through new processing and power facilities. The program will recover over 1 billion cubic feet of gas per day by 2030. It improves national power security while cutting millions of tons of CO_2 emissions annually (TotalEnergies, 2025).

Oman
Marsa LNG project

TotalEnergies and OQEP launched a 1 Mt/year low-carbon LNG facility which will be powered by a 300 MW solar plant. The all-electric design cuts emissions intensity by about 90 percent compared to conventional LNG. The project will also establish the Middle East's first LNG bunkering hub (TotalEnergies, 2025).

Qatar
North Field Expansion
Project

A multi-phase expansion of its LNG export capacity under the "North Field Expansion" umbrella, raising output from about 77 million tons per annum (Mtpa) to as much as 142 Mtpa by 2030 (an ~85 percent increase) (Middle East Council on Global Affairs, 2025). Qatar is ranked as the second-largest exporter of LNG worldwide, contributing to the transitional decarbonization of countries in Europe and Asia.

Saudi Arabia
Liquid Displacement Program

KSA's Liquid Fuel Displacement Program aims to replace over one million barrels per day of liquid fuel consumption by 2030 by shifting utilities, industry and agriculture toward gas and electricity (Arab News, 2023; The Energy Info, 2024). Four gas-fired power stations totaling 5.6 GW have commenced operations, supporting a roadmap of 42 GW capacity by 2030 (The Energy Info, 2024).

Natural Sinks

Key highlights

All MENA countries include actions on reforestation, mangroves, or land restoration, yet only nine define measurable targets

Programs now emphasize integrated landscape management, combining forestry, soil conservation, and coastal protection for long-term carbon and resilience benefits

Success in arid settings requires native species, efficient water use, and local stewardship, which drive higher survival rates and shared economic value

Adoption of satellite monitoring, blue-carbon accounting, and results-based funding is turning natural sinks into verifiable climate assets

Natural sinks will remain central to the region's climate strategy given the abundance of arid and coastal ecosystems with high restoration potential, supporting carbon removal while enhancing biodiversity and ecosystem resilience.

Restoring land and coasts to remove carbon and build resilience

Natural sinks are ecosystems that remove and store CO_2 through biological processes. In practice, this means afforestation and reforestation, mangrove and coastal wetland restoration, rangeland and soil-carbon measures, and urban greening. Globally, the land sink removes roughly one-third of annual anthropogenic CO_2 emissions while oceans remove about one quarter, underscoring why land and coasts matter in every mitigation pathway (IPCC AR6 WG1, 2021). Mangroves and other "blue carbon" habitats are especially powerful because they store very high carbon densities in biomass and soils and provide storm and erosion protection (IPCC SRCCL, 2019; IUCN, 2023). Beyond carbon sequestration, mangroves deliver significant adaptation and resilience co-benefits that are particularly relevant for coastal and arid contexts. Mangrove ecosystems reduce wave energy, stabilize shorelines, and limit coastal erosion, lowering exposure to storm surges and sea-level rise while protecting critical coastal infrastructure and settlements. They also support fisheries productivity, biodiversity, and livelihoods, strengthening food security and local economies in vulnerable coastal areas. In water-stressed regions, mangroves contribute to sediment trapping and water quality improvement, while their restoration often represents a cost-effective nature-based solution compared to hard coastal defenses. These adaptation benefits enhance the overall value proposition of mangrove protection and restoration, beyond their role as carbon sinks.

All MENA NDCs mention at least one natural-sink action, most commonly tree planting, watershed rehabilitation, or mangrove protection. Only nine countries present quantified objectives in trees, hectares, or expected CO_2 outcomes. This indicates that the quantification of natural sink targets remains an area for improvement for majority of MENA countries.

Deployment is accelerating through pragmatic, locally adapted pathways

The region's implementation pattern is pragmatic and resource-aware. Tree-planting and forest-landscape restoration are scaling where land is available and water-smart species can survive in arid conditions. Coastal programs are expanding mangrove nurseries and tidal-creek re-wetting, often as part of national adaptation plans because they lower flood risk and protect fisheries.

Rangeland actions focus on grazing management and native shrub re-establishment, which raise soil-carbon stocks while improving pastoral livelihoods. Urban initiatives add street trees and shelterbelts for heat mitigation and air-quality benefits.

Two deployment trends stand out. First, countries are moving from scattered plantings to integrated landscape programs that bundle forests, watersheds, and agriculture into one results framework. Second, monitoring is improving via remote sensing and plot inventories, enabling programs to move from "trees planted" to verified carbon and ecosystem outcomes (IPCC AR6; FAO landscape restoration guidance, 2022).

Enablers and opportunities that turn intent into durable carbon

Natural-sink outcomes depend on ecology, institutions, and finance working together.

- **Policy and institutions:** Clear land-tenure and stewardship rules, biosecurity standards, and long-term maintenance budgets prevent reversal risks. Alignment with national adaptation plans and disaster-risk strategies increases co-benefit funding and political durability (IPCC AR6, 2021).
- **Water and species selection:** In arid climates, success hinges on native, drought-tolerant species, water-harvesting micro catchments, and assisted natural regeneration that leverages existing seed banks rather than relying only on nurseries (FAO Dryland Forestry, 2021).
- **Measurement and verification:** Robust MRV draws on satellite data, permanent plots, and soil sampling with conservative baselines and leakage accounting. Blue-carbon projects require sediment-core methods and hydrological monitoring to assure permanence (IUCN Blue Carbon Handbook, 2023).
- **Blended approaches are gaining traction:** Public budgets, climate funds, and results-based payments for verified sequestration. Emerging blue-carbon finance is supporting mangrove restoration where tenure and MRV are sound (UNEP, 2022).
- **Community partnerships:** Long-term survival is highest where programs provide local livelihoods through agroforestry, nontimber products, and eco-tourism. Governance that shares benefits reduces deforestation pressure and raising the probability that carbon stays stored (IPCC SRCCL, 2019).

Natural sinks will remain a pillar of MENA mitigation and adaptation through 2030 and beyond. Most countries already recognize and budget for natural sinks; a growing subset now sets measurable goals and is building MRV and finance to back them. By prioritizing native species, water-smart design, durable tenure, and rigorous monitoring, MENA can turn tree-planting and coastal projects into long-lived carbon assets that also protect communities from heat, drought, dust, and storm surge.

Key flagship projects in the region

Lebanon
Forest restoration through the "40 Million Trees Program"

Lebanon's national reforestation plan targets restoring 20 percent forest cover by 2030. The "40 Million Trees Program" has planted native species across degraded slopes, combining erosion control, biodiversity corridors, and community nurseries (FAO, 2024).

Comoros
Community-led forest and mangrove recovery

Comoros has restored over 6,000 hectares of forest and mangroves since 2018 through FAO and UNEP supported programs. Local cooperatives manage nurseries and replant native species to curb erosion and enhance fisheries, linking ecosystem recovery with climate adaptation (UNDP, 2024).

United Arab Emirates
100 million mangrove initiative

Abu Dhabi launched a national mangrove restoration strategy targeting the planting of 100 million mangrove trees by 2030, supporting its climate-change and biodiversity goals (Environment Agency Abu Dhabi, 2024). In one key phase, they deployed drones to seed over one million mangroves across ~196 sites and advancing towards a longer-term goal of restoring up to 10,000 hectares and 27.3 million trees over five years (Dendra, 2024).

Bioenergy

Key highlights

Twelve MENA NDCs mention bioenergy, yet more countries have active projects, showing faster on-ground progress than policy recognition

Operational waste-to-energy and biogas initiatives are already cutting emissions, improving waste management, and expanding clean energy access

Agriculture-based economies prioritize bioenergy as part of their climate commitments, while urban centers focus on waste-to-energy for landfill diversion and methane reduction

Progress requires stronger policy alignment, waste infrastructure, feedstock systems, and reliable grid connections to support commercial deployment

Bioenergy and waste-to-energy are moving from peripheral technologies to recognized pillars of sustainable infrastructure in the MENA region. Nevertheless, on the back of the relatively limited biomass quantities, the overall contribution to the decarbonization efforts remains secondary

Bioenergy emerges as a secondary but rising pillar of decarbonization

Bioenergy refers to the production of energy from biological and organic materials such as agricultural residues, food waste, and wastewater sludge. When combined with modern waste-to-energy technologies, it enables both resource recovery and emissions reduction, offering a dual benefit for energy diversification and circular economy development. Although still limited compared with solar and wind, bioenergy and waste-to-energy solutions are gaining visibility in the MENA region as practical mitigation tools that address waste management, methane emissions, and energy security (UNFCCC NDC Registry, 2025).

The region's growing waste generation and reliance on landfilling create a clear opportunity for energy recovery. Urban populations are expanding, and solid waste volumes are expected to double by 2050 (Middle East Sustainability & Waste, 2024). At the same time, agriculture and food processing remain significant economic sectors that produce large volumes of organic residues. Converting these waste streams into usable energy can contribute to emission reduction and improve the resilience of national energy systems.

Policy recognition remains limited but is growing through waste-sector reforms

Twelve of the 22 MENA countries reference bioenergy or waste-to-energy in their NDCs (UNFCCC NDC Registry, 2025). In most of these submissions, bioenergy is positioned within the waste or wastewater sector rather than as a core renewable-energy source. Although explicit references remain limited, national waste management and circular economy programs across several MENA countries are embedding energy recovery as a standard practice. These programs, often managed by municipal or environment ministries, have become the main drivers of waste-to-energy deployment even when NDCs do not yet quantify the contribution.

Implementation momentum is driven by country-specific circumstances

Bioenergy deployment is prominent in MENA countries with agriculture-intensive economies, where abundant crop residues, livestock waste, and agro-industrial by-products offer reliable feedstock for energy generation. These resources provide a natural foundation for biogas and biomass energy production, especially in rural areas where access to modern energy systems remains limited. This link between bioenergy and agricultural productivity creates additional co-benefits by improving waste management in farming regions, reducing open burning, and providing decentralized sources of heat and power for irrigation, food processing, and rural electrification.

In contrast, MENA countries with more urbanized economies and limited agricultural activity are advancing waste-to-energy solutions that target municipal solid waste and landfill emissions. In these contexts, Waste-to-Energy serves as the primary form of bioenergy deployment, focusing on landfill diversion, methane capture, and energy recovery from non-recyclable waste fractions. This distinction reflects the region's diverse resource base: agricultural economies prioritize biological feedstock utilization, while industrial and service-oriented economies focus on urban waste streams as their main renewable-energy feedstock.

Investment pipelines for bioenergy projects are expanding, supported by new regulatory frameworks and public–private partnership models that prioritize landfill diversion and methane capture. Governments are increasingly mandating waste treatment before disposal, which naturally accelerates demand for energy recovery technologies. As a result, the sector is witnessing the emergence of dedicated operators, specialized financing instruments, and standardized technical guidelines to ensure long-term sustainability.

The next phase: key enablers for scaling bioenergy through integrated planning

Scaling bioenergy and waste-to-energy will depend on stronger policy integration, dedicated financing, and inter-ministerial coordination. Setting quantified national capacity targets and including bioenergy within renewable-energy strategies would provide the visibility needed to attract investment.

Financial mechanisms are evolving to address the high capital intensity of waste-to-energy facilities. Public–private partnerships, green-bond instruments, and carbon-credit schemes under Article six of the Paris Agreement can play an important role in bridging financing gaps (World Bank, 2023). Governments are also beginning to integrate waste-to-energy within national public-procurement frameworks, ensuring consistent project pipelines and bankable feedstock supply.

Key flagship projects in the region

Qatar
Biogas and Waste-to-Energy Plant, Mesaieed

Qatar's Domestic Solid Waste Management Centre (DSWMC) in Mesaieed is one of the largest integrated waste treatment facilities in the region, processing ~2,200 tons of municipal waste daily. The complex combines recycling, composting, and waste-to-energy operations within a single site (Qatar News Agency, 2025).

Egypt
Biogas Recovery from Sludge Treatment

A wastewater-to-energy project at the Gabal El-Asfar treatment plant in Cairo. It recovers biogas from sludge digestion to supply on-site combined heat and power (Acciona, 2025). The system provides up to 70 percent of the facility's electricity demand from renewable sources (Smart Water Magazine, 2021).

United Arab Emirates
Dubai Waste Management Center

The world's largest single waste-to-energy facility converting 5,666 tons of waste per day into power. It produces 200 MW of clean electricity. The plant processes up to 45 percent of Dubai's current municipal waste generation (Dubai Holding, 2021).

Nuclear Energy

Key highlights

One of the MENA NDCs explicitly references nuclear power and seven signal interest through national programs, regulatory development, or cooperation agreements

The region's growing electricity demand and regulatory progress create a platform for nuclear to provide reliable baseload

Progress is concentrated where regulators, financing models, and long-term agreements are in place, while most countries remain in preparatory or feasibility phases under International Atomic Energy Agency (IAEA) newcomer programs

Flagship initiatives such as the El Dabaa in Egypt and the UAE Barakah Nuclear Power Plant are building technical capacity, positioning MENA to scale safely

Nuclear energy in the MENA region is an emerging low-carbon option being developed by a few countries to diversify power generation and reduce emissions, though its deployment remains limited and concentrated in early-stage programs.

Reliable clean power capable of operating in parallel with rapid renewable energy expansion

Nuclear energy generates electricity and heat from fission with near zero operational emissions and high reliability. Globally, nuclear energy generates around 10 percent of total electricity (IEA, 2024), while in the MENA region it contributes approximately 2 percent (World Nuclear News, 2018). By 2050, the share of nuclear could grow to 6–12 percent if all new planned reactors are completed, but as of 2025, nuclear is still a niche component of the MENA power mix (World Nuclear News, 2018).

In the regional policy landscape, only one of the reviewed NDCs explicitly mention nuclear energy. Outside NDCs, seven of the countries signal interest through national programs, regulatory development, or cooperation agreements. This indicates that nuclear is recognized but not yet target driven in most national climate submissions, while several governments are building the enabling foundations in parallel.

Balancing growing electricity demand with nuclear playing a role

Electricity demand in MENA is projected to grow by 3-6 percent annually from 2020 to 2030, placing pressure on systems to secure reliable, low-carbon capacity that complements fast-expanding solar and wind deployment (Middle East Institute, 2024). While nuclear power's share of global electricity generation has gradually declined as renewables scale more rapidly, total nuclear output continues to rise, reaching a record 2,657 TWh in 2023, with global fleet utilization above 80 percent and new builds underway in emerging markets (World Nuclear Association, 2025). This demonstrates that despite its shrinking share, nuclear remains one of the few proven zero-emission generation, an increasingly strategic asset for MENA economies seeking to balance energy security, affordability, and decarbonization as demand accelerates.

At the same time, structural and economic realities limit the technology's scalability across most MENA countries. High upfront capital requirements, often exceeding USD 5,000–12,000 per kW, and complex licensing and safety frameworks constrain access to nuclear technologies, particularly for smaller economies (Our World of Energy, 2024; World Nuclear Association, 2023). Limited grid size and system flexibility in several countries also make the integration of large baseload units technically challenging, as small or isolated grids cannot absorb multi-gigawatt reactors without risking instability. Capacity constraints in nuclear-skilled labor, waste management, and regulatory institutions further reinforce these barriers.

As a result, near-term prospects are likely to remain concentrated in countries with the necessary scale, grid infrastructure, and institutional maturity, such as UAE and Egypt, where projects can deliver high-availability, low-carbon power with predictable operating costs. For smaller systems, modular or distributed clean-energy solutions may represent a more feasible path toward decarbonization.

What unlocks scale: practical enablers that convert interest into bankable projects

A strategic and political decision to pursue nuclear energy represents the foundational enabler for program development. Such commitment at the highest policy level establishes long-term direction, ensuring institutional coordination, regulatory alignment, and financial continuity throughout the multi-decade implementation cycle.

Policy and regulatory clarity is equally critical. Establishing independent regulatory authorities, enacting modern nuclear legislation, and aligning with IAEA safety and security standards build investor confidence and reduce project development timelines. International experience underscores that transparent governance, and well-defined institutional roles are prerequisites for successful newcomer programs.

An enabling financing framework is also essential. Large-scale nuclear projects require access to long-tenor, low-cost capital, while small modular reactors (SMRs) are better suited to modular deployment and phased investment. Blended finance instruments, export credit facilities, and long-term power purchase agreements can lower the weighted average cost of capital, which is a decisive factor in reducing levelized electricity costs for capital-intensive technologies.

Effective system integration, access to technology, and infrastructure readiness further underpin success. Comprehensive planning for grid adequacy, fuel supply chains, waste management, and workforce development should be initiated early. Integrating nuclear energy into national power systems enhances overall stability and enables nuclear to complement variable renewables by providing firm low-carbon generation and ancillary services consistent with net-zero transition pathways.

Finally, regional collaboration can accelerate readiness and efficiency. Engagement through IAEA cooperation platforms, regional SMR initiatives, shared training programs, and joint supply-chain development strengthens technical capacity, promotes standardization, and minimizes duplication of effort across participating countries.

Outlook for the next decade: measured expansion with system

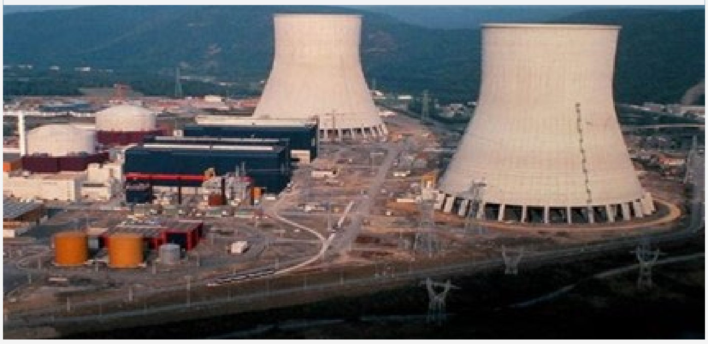
Global energy outlooks point to a gradual expansion of nuclear capacity, driven mainly by rising electricity demand and the need for reliable, dispatchable power (IEF, 2025). Nuclear energy is increasingly considered in relation to grid stability and energy-intensive uses such as industry and desalination (IEA, 2024). The IAEA notes that nuclear has avoided tens of gigatons of CO_2 historically and can provide at scale the three low-carbon energy vectors that matter for deep decarbonization: electricity, heat, and hydrogen (IAEA, 2025).

For MENA, this points to a measured but strategic role. Near term, nuclear can supply firm clean capacity to support rapid renewable build-out and rising electrification. Medium term, SMR options may open pathways for smaller grids, industrial heat, desalination, and clean hydrogen, provided regulatory maturity and financing frameworks advance in step with technology readiness.

Key flagship projects in the region

Egypt
El Dabaa Nuclear Power Plant

Egypt is its first large-scale civilian reactor project, totaling 4.8 GW across four units. Construction began in 2022, with the first reactor expected by 2028. Once operational, it will supply about 35 TWh of clean power annually, avoiding roughly 14 million tons of CO_2 per year (NS Energy, 2020).



United Arab Emirates
Barakah Nuclear Power Plant

The first operational nuclear power plant in the Arab world, featuring four reactors totaling 5.6 GW. The facility supplies 25 percent of the UAE's electricity demand with zero emissions. It eliminates roughly 22.4 million tons of CO_2 each year (ENEC, 2024).

Technological Carbon Dioxide Removal

Key highlights

Three of the MENA countries reference engineered carbon removal in their NDCs, and none have set quantified targets, which reflected early policy awareness but limited institutional readiness

Abundant storage formations, renewable power, and industrial capacity position MENA to become a competitive hub for large-scale carbon removal

Advancing Technological Carbon Dioxide Removal (Tech CDR) will depend on national frameworks, financing mechanisms, R&D, and MRV that differentiate permanent removals from conventional CCS and enable market integration

Implemented projects, such as mineralization and Direct Air Capture (DAC) pilots in the Gulf, show technical feasibility and strong regional geology but remain at demonstration scale with high unit costs

Tech CDR is still at the exploratory and pilot stage in MENA, but its relevance to long-term climate goals is growing rapidly. With abundant geological storage potential, advanced industrial capacity, and access to competitive renewable energy, the region is strategically positioned to scale these technologies.

Tech CDR as an emerging pillar of Net-Zero strategies

Tech CDR refers to engineered processes that capture and remove CO_2 from the atmosphere or from biogenic and industrial sources, with the goal of reducing the overall concentration of carbon in the carbon cycle. Unlike CCUS, which primarily captures emissions at the point of release to prevent them from entering the atmosphere, Tech-CDR focuses on removing carbon that has already been emitted or is part of natural carbon flows. Captured CO_2 can be permanently stored in geological formations, minerals, or long-lived materials, or reused in industrial applications such as synthetic fuels, building materials, or chemical production. By enabling both removal and circular use, Tech-CDR plays a role in achieving net-negative emissions and long-term climate stabilization (IPCC, 2023; IEA, 2024).

Key Tech CDR pathways include Direct Air Capture with Storage (DACCS), Bioenergy with Carbon Capture and Storage (BECCS), and mineralization or enhanced weathering, each relying on technological systems rather than natural sinks. These methods are energy and resource intensive but can be advantageous for delivering verifiable and permanent carbon removal, which is critical for offsetting residual emissions from hard-to-abate sectors such as cement, steel, and aviation.

Ambitions and commitments are emerging but remain non-quantified

Three of the MENA countries have acknowledged carbon removal technologies within their NDCs, referencing Direct Air Capture or similar approaches as areas of exploration. However, none have defined quantified targets or storage capacities, reflecting an early stage of engagement focused on assessing feasibility rather than setting binding commitments.

Beyond national commitments, a similar share of countries is showing interest through research collaborations, feasibility studies, or pilot initiatives that explore geological storage, mineralization, or early DAC applications. Together, these efforts indicate that Tech CDR has entered the regional climate policy discourse, albeit at an exploratory level and without formal integration into mitigation accounting. This limited representation is consistent with global trends, where engineered removals are still emerging as a distinct policy category and where national inventory systems often lack the methodologies to measure and report durable carbon removal.

Technological complexity explains limited deployment

The limited use of Tech CDR in MENA stems from the high technical and financial demands of these emerging technologies. Removing carbon directly from the air requires advanced equipment, continuous energy supply, and specialized materials that are still expensive and available only in limited quantities.

Most systems also need reliable access to renewable electricity, water, and suitable geological formations for permanent storage, which adds complexity to project design. Other carbon removal methods, such as BECCS and mineralization, face additional challenges. BECCS depends on large and sustainable sources of biomass, which are difficult to secure in arid and resource constrained environments. Mineralization requires specific rock types and infrastructure that can safely transport and inject CO_2 underground.

These combined technical, logistical, and cost barriers make Tech CDR technically feasible but not yet commercially viable. As a result, governments continue to prioritize proven mitigation measures, such as renewables, CCUS, hydrogen, and energy efficiency, before moving toward large-scale carbon removal.

Strategic advantages position the MENA region for future leadership

Despite low adoption today, the region holds a strong comparative advantage for scaling engineered removals in the future. MENA countries possess abundant geological storage potential in saline aquifers and depleted oil and gas fields, low-cost renewable power that can supply the substantial energy required for DAC systems and established industrial expertise in handling gases and operating large-scale infrastructure.

Integrating Tech CDR within existing carbon-management and hydrogen clusters could enable shared pipelines, infrastructure, and storage facilities; reducing overall costs and accelerating commercialization. The combination of these resources' places MENA in a unique position to become a global testbed for durable carbon removal, once technology costs decline and regulatory mechanisms mature.

Over the next decade, MENA’s role in the carbon removal space will depend on its ability to move from pilot projects to structured programs supported by dedicated policy frameworks and research investments. Building readiness will require: (1) National strategies that define the role of CDR within climate action (2) Research partnerships between regional institutions and global technology developers (3) Infrastructure planning that links potential CDR sites with required water supply and CO_2 and storage networks (4) Regional cooperation platforms through organizations to develop shared standards, monitoring methodologies, and financing models.

Key flagship projects in the region

Oman
Direct Air Capture and In-Situ Mineralization Pilot

Oman hosts one of the world's first integrated DAC and mineralization projects, operated by 44.01 in collaboration with Air Capture. The pilot removes CO_2 directly from ambient air and injects it into ultramafic rock formations in the Al Hajar Mountains, where it is permanently mineralized into solid carbonates (Oman Observer, 2023).

Saudi Arabia
KAPSARC Direct Air Capture Pilot

A research-driven DAC unit operating under extreme desert conditions at KAPSARC in Riyadh. It explores low-energy CO_2 capture technologies suited for arid climates. The project contributes to KSA's ambition to lead in carbon removal innovation (Seneca ESG, 2025).

Adaptation priorities

Water Security

Key highlights

Water scarcity is a structural challenge for MENA's development, amplified by climate change and rising demand

Efficiency and technology are central to future adaptation, driving a shift from supply expansion to smarter water use

Key regional challenges addressed

- Water scarcity
- Desertification
- Technical & capacity gap
- Weak & fragmented utilities
- Climate & natural risk

MENA water stress landscape – severity and dynamics

Water scarcity is a defining climate and development challenge for the MENA. The region receives very limited rainfall, has few perennial rivers, and depends heavily on non-renewable groundwater and desalination to meet essential needs. Average renewable water availability stands at roughly 480 cubic meters per person per year, which is around ten times lower than the global average (World Bank, 2023). This places MENA well below the internationally recognized water scarcity threshold of 1,000 cubic meters per person, meaning that limited water availability has become a structural, rather than seasonal, constraint shaping long-term economic and social development. In practice, agriculture, municipal, and industrial needs increasingly rely on costly alternatives such as desalination, groundwater extraction, or water imports.

The pressures extend beyond environmental limits. More than 80 percent of the region's population lives in areas of extreme water stress, and eleven of the world's 17 most water-stressed countries are in MENA (Middle East Policy Council, 2024). Expanding urban populations, industrial activity, and rising living standards continue to increase demand on an already overstretched resource base.

Climate change is projected to intensify these pressures, with rising temperatures, shifting rainfall patterns, and prolonged drought cycles that could reduce water availability by 30-50 percent by mid-century (EcoMENA, 2025). The World Bank further estimates that water scarcity could lower regional GDP by 6-14 percent by 2050 (World Bank, 2024).

As a result, water security has become a cornerstone of regional adaptation planning. Reliable and affordable access to water underpins stability across multiple sectors, including energy, health, and urban development. Reflecting this recognition, all NDCs now include explicit measures on water efficiency, non-conventional supply, and integrated resource management, signaling a collective regional commitment to transforming water scarcity from a development constraint into a driver of climate resilience.

Water scarcity pathways and responses

Adaptation Pathway	Possible Measures
Expansion of non-conventional water supply	• Deployment of low-carbon desalination technologies • Utilization of brackish groundwater resources • Stormwater capture and storage • Managed aquifer recharge to enhance groundwater reserves
Demand management and water efficiency	• Large-scale installation of smart metering and monitoring systems • Reduction of non-revenue water through leakage detection and repair • Implementation of tiered water tariffs and incentive-based pricing • Awareness and behavioral change campaigns for efficient consumption • Adoption of efficiency standards for domestic, industrial, and municipal use
Integrated basin and aquifer management	• Conjunctive use of surface and groundwater resources • Artificial recharge during wet periods • Protection and restoration of wetlands and other natural recharge zones • Establishment of basin-level governance and allocation frameworks
Decentralized and local-scale solutions	• Rainwater harvesting at household and community level • Decentralized wastewater treatment facilities • Localized industrial and commercial water recycling initiatives
Digitalization and climate-smart innovation	• Use of remote sensing for monitoring water stress, leakages, and availability • Data-driven planning and decision-support systems for resource optimization (e.g., demand forecasting)

Strategic outlook and pathways

Over the coming decade, the MENA region's progress on water adaptation will depend on coupling supply expansion to improving efficiency and leveraging technology. Desalination capacity has grown rapidly, and the next phase of progress will come from efficient management of water consumption and losses across cities, industries, and households.

Water efficiency will remain the most direct and impactful measure. Upgrading distribution networks to minimize leakage, expanding smart metering, and setting consumption benchmarks can improve system efficiency, enhance water productivity, and reduce energy use and associated emissions, while maintaining reliable service levels. Public building and housing retrofits are also demonstrating that reduced consumption can be achieved without affecting service quality.

Technological advancement is emerging as a key enabler of water resilience. Smart sensors, AI-based forecasting, and digital monitoring systems are improving the efficiency and reliability of water infrastructure, allowing utilities to anticipate demand, detect leaks in real time, and optimize operations.

Awareness and behavioral change will be essential to sustain these efforts. Public campaigns, education programs, and digital tools that help consumers track and manage usage are reinforcing a culture of conservation and collective responsibility.

Together, these measures mark a regional shift toward a culture of efficiency and innovation, where technology and behavioral change work hand in hand to safeguard scarce water resources. Embedding these practices will define the region's next phase of adaptation, moving from managing scarcity to building sustained resilience.

Agriculture and food security

Key highlights

Resilience and food security depend on optimizing water, soil, and energy inputs to sustain agricultural productivity under varying climate conditions

Digital tools and modernized logistics are shifting the region toward more adaptive and efficient food systems

Key regional challenges addressed

- Climate & natural risk
- Desertification
- Water scarcity
- Weak & fragmented utilities
- Rapid urbanization

Agriculture at a crossroads: from vulnerability to adaptation

Agriculture remains a critical economic and social sector in many MENA countries, supporting rural livelihoods, domestic supply chains, and food systems. Yet in aggregate, the region exhibits significant vulnerability to external food supply shocks and climate pressures due to constraints on productivity, water scarcity, and land degradation.

A key indicator of regional vulnerability is grain import dependence. Across the MENA region, approximately 45 percent of total grain for food and feed is imported (Frontiers, 2023), reflecting a structural reliance on external markets to meet domestic demand. This high level of dependency exposes national food systems to fluctuations in global commodity prices and supply chain disruptions. In several arid economies, the share of imported food exceeds 75 percent, and in some cases reaches over 90 percent (FAO, 2023), underscoring the limited capacity of domestic production to meet growing consumption needs. At the same time, not all MENA countries respond the same way. Some segments of the Levant and North African region maintain relatively stronger agricultural production capacity, though often still challenged by water constraints and yield gaps. In contrast, Gulf states have limited arable land and thus high import reliance for agricultural staples.

Climate change interacts with existing pressures on agriculture and food security in the MENA region. Rising temperatures, more frequent droughts, and deteriorating soil quality are projected to reduce yields and further narrow the margin for domestic self-sufficiency. Under current trajectories, net food import dependency could reach around 50 percent by 2050, up from approximately 39–45 percent (GlobAgri, 2023).

Agriculture in MENA is constrained primarily by the availability of water, arable land, and suitable climatic conditions rather than by market demand. As a result, the region's food security and economic stability will increasingly depend on its ability to adapt.

Agriculture and food security pathways and responses

Adaptation Pathway	Possible Measures
Climate-smart and efficient farming systems	• Adoption of precision and deficit irrigation techniques • Expansion of controlled-environment agriculture such as greenhouses, hydroponics, and vertical farming • Promotion of low-till or no-till practices to conserve soil carbon and moisture
Resilient crop and livestock production	• Development of drought, heat, and salinity-tolerant crop varieties • Diversification of cropping systems to reduce reliance on vulnerable staples • Conservation of adaptive and indigenous genetic resources through national seed and gene banks
Sustainable land and soil management	• Implementation of agroforestry, reforestation, and erosion control to combat desertification • Promotion of sustainable grazing and rotational land-use systems • Land-use planning to balance expansion with ecosystem protection
Climate-resilient value chains and innovation	• Enhancement of post-harvest storage, cold chains, and logistics • Expansion of agro-processing and value-added production • Promotion of agri-tech entrepreneurship and innovation partnerships
Food security and safety systems	• Strengthening of national food reserves and emergency stockpiles • Implementation of robust food safety, quality, and traceability standards • Diversification of import sources and development of regional supply corridors • Reduction of food waste to reduce import dependency, mainly through improved supply chains and consumer awareness programs

Strategic outlook and pathways

The next phase of agricultural adaptation in MENA will focus on enhancing productivity and resilience under tightening water and climate constraints. Future progress will depend on improving the efficiency, sustainability, and climate readiness of agricultural systems.

Technology adoption is expected to accelerate, particularly through the integration of data-driven and climate-smart practices. Digital tools, AI-based forecasting, and climate information services will enable farmers to manage inputs more efficiently and anticipate climate risks. Expanding access to affordable technology, financing, and advisory services will be key to translating innovation into system-wide resilience gains.

Food system modernization will complement these on-farm advances. Investments in cold-chain logistics, food processing, and storage are reducing post-harvest losses and improving the stability of local supply chains. Strengthening food safety and quality control systems will further enhance public health outcomes and export competitiveness.

Finally, sustainable consumption and nutrition will emerge as an integral part of adaptation. Promoting dietary diversity, embedding change management to institutionalize food waste prevention and reduction, and raising public awareness on sustainable consumption can collectively reduce pressure on agricultural systems while supporting healthier communities.

Taken together, these measures mark a shift from reactive responses to proactive, climate-smart food systems that integrate innovation, efficiency, and sustainability.

Biodiversity and ecosystems

Key highlights

Healthy terrestrial ecosystems sustain agriculture, regulate water and soil systems, buffer communities against climate stress, and anchor the region's cultural and natural heritage

Embedding ecosystem restoration into national policies, supported by technology and community incentives, will transform biodiversity protection into a long-term resilience strategy

Key regional challenges addressed

- Climate & natural risk
- Desertification
- Water scarcity
- Rapid urbanization

Biodiversity and ecosystems: from vulnerability to adaptation

Terrestrial ecosystems across the MENA are under growing stress from climate change, land degradation, and unsustainable land use. The region's arid and semi-arid zones already support fragile biodiversity systems, where vegetation cover plays a crucial role in stabilizing soils, regulating water flows, and supporting rural livelihoods. Increasing temperatures, recurrent droughts, and shifts in precipitation patterns are accelerating vegetation loss and desertification, leading to habitat fragmentation and declining ecosystem productivity.

MENA's biodiversity is highly specialized and adapted to extreme environments, with unique flora and fauna evolved to survive under heat, drought, and water scarcity. However, this ecological specialization also makes it particularly vulnerable to incremental environmental change. According to the World Bank, 89 percent of land in MENA is classified as dryland (World Bank, 2023), and roughly 50 percent of terrestrial ecosystems are now affected by degradation or overexploitation (EcoMENA, 2025). Unsustainable grazing, deforestation, and poorly managed land conversion continue to drive the loss of vegetation cover and topsoil, compounding the impacts of climate variability.

According to Leadley et al. (2022), three-quarters of terrestrial ecosystems have already been significantly altered, and projections indicate that, without decisive adaptation, biodiversity loss will continue to increase through mid-century (IIS, 2022). Reduced vegetation cover diminishes soil fertility and carbon sequestration potential, while also weakening natural barriers that protect against floods, dust storms, and sand encroachment, hazards already intensifying in parts of North Africa and the Arabian Peninsula.

Recognizing these interlinkages, ecosystem resilience is now emerging as a central pillar of climate adaptation in the region. All NDCs across MENA include ambitions related to afforestation, rangeland rehabilitation, or integrated land management (UNFCCC Registry, 2025). Countries are increasingly prioritizing nature-based and ecosystem-centered approaches to adaptation, acknowledging that healthy terrestrial ecosystems are a prerequisite for sustainable water, food, energy, and climate security.

Biodiversity and ecosystems pathways and responses

Adaptation Pathway	Possible Measures
Ecosystem conservation and protection	• Management of terrestrial protected areas and ecological corridors to safeguard native flora and fauna • Implementation and enforcement of land-use zoning • Control of invasive species and protection of endangered habitats • Integration of biodiversity safeguards in environmental impact assessments
Ecosystem restoration and rehabilitation	• Reforestation and afforestation with native drought-tolerant species and restoration of natural flora and fauna habitats • Rehabilitation of degraded rangelands and forested areas through sustainable grazing and soil restoration • Promotion of community-led restoration programs
Sustainable land and resource management	• Implementation of integrated land management to balance agricultural, pastoral, and ecological uses • Adoption of soil conservation techniques and erosion control • Regulation of grazing intensity and rotational grazing practices • Mainstreaming ecosystem services valuation in land-use policy decisions
Knowledge, monitoring, and innovation	• Deployment of Geographic Information System (GIS) tools to monitor vegetation cover and habitat change • Research and pilot projects on drought-resilient vegetation and ecological restoration techniques • Use of data analytics and modeling to guide adaptive land management
Ecosystem resilience and financing mechanisms	• Creation of dedicated national programs to finance land restoration and reforestation projects • Introduction of incentive programs to reward conservation efforts • Design of financing tools such as restoration funds or well-regulated offset programs to channel investment into ecosystem recovery

Strategic outlook and pathways

The coming decade will determine whether MENA's terrestrial ecosystems can maintain their capacity to support livelihoods and buffer environmental shocks. The priority is shifting from fragmented reforestation or conservation projects to large-scale, integrated landscape restoration. Expanding vegetation cover through native species, stabilizing degraded soils, and improving rangeland management will provide co-benefits for carbon sequestration, water regulation, and rural resilience.

Efficiency and integration will define this transition. Ecosystem adaptation is increasingly being embedded into agricultural, forestry, and land-use policies rather than managed as a standalone agenda. This mainstreaming will strengthen ecological connectivity and make adaptation more cost-effective by combining productivity and conservation objectives.

Innovation and monitoring will play a critical role. Advances in remote sensing, satellite mapping, and data analytics are enabling countries to track vegetation health, predict degradation trends, and prioritize restoration investments more effectively. Public access to reliable ecosystem data will enhance progress and attract international finance for land restoration.

Finally, community participation and incentives will be essential for sustaining progress. Engaging local communities through stewardship programs and restoration-based livelihoods will ensure that ecosystem recovery delivers tangible social benefits.

Coastal and Marine Protection

Key highlights

Rising sea-levels due to climate change presents economic and social challenges to the region's 55,000 km long coastlines, where critical dense cities and valuable assets (e.g., desalination plants) are concentrated

Robust planning, coastal management, and both engineered, and nature-based defenses are crucial towards shifting from a responsive state to coordinated prepared adaptation

Key regional challenges addressed

Climate & natural risk	Water scarcity	Rapid urbanization

MENA coastal climate landscape: Severity and dynamics

Coastal regions are economic lifelines for the MENA region, which home major ports, desalination plants, tourism hubs, and stretch across dense cities, yet they face accelerated relative sea-level rise (RSLR), erosion, salinization, storm flooding, and land subsidence. Within the region, coastlines stretch across 55,000 km, where a substantial share of the population and assets are clustered, magnifying the expected economic losses from flooding, infrastructure damage, and land loss without rigorous adaptation measures in place (Discovery UCL, 2021).

The MENA region is considered one of the most vulnerable regions to rising sea levels (WEF, 2019). Across MENA basins, the Arabian Gulf shows an average sea-level rise of about 3 mm per year (1993-2020), with recent basin-wide estimates around 4 mm per year, reflecting a rise 15-30 percent higher than satellite-era global means (MDPI, 2021), while the Mediterranean coasts project rises of ~0.15-0.33m by 2050, and 0.63-1.01m by 2100, relative to 1995-2014 (MedECC, 2018).

These trends translate into region-specific pressures. The Mediterranean Basin is a climate hotspot, with accelerating RSLR, increasing frequency of extreme sea levels, and widespread shoreline retreat that threatens ports, networks, and cultural heritage sites along North Africa and the Levant (Union for the Mediterranean, 2024). Within the Arabian Gulf and Red Sea, warming seas and gradual rise heighten chronic tidal flooding and salinity intrusion risk for coastal aquifers and for critical water security assets, including desalination intake and discharge systems. The World Bank's regional diagnostics reports that MENA's exposure to sea level rise is expected to be ~0.36 m in a 1.5°C world and ~0.6 m in a 4°C world and emphasize the high protective value of nature-based systems, including mangroves and reefs, in reducing waves and storm surges (World Bank, 2025).

Coastal protection is increasingly recognized across MENA as essential to safeguarding ports, desalination hubs, tourism waterfronts, and dense urban districts, which reflect assets that anchor economic continuity, public safety, and water security. In response, a growing number of NDCs and national strategies are moving to codify higher design standards, risk-based zoning, and hybrid gray-green defenses, signaling a shift from reactive disaster response towards proactive and long-term coastal resilience.

Coastal and marine protection pathways and responses

Adaptation Pathway	Possible Measures
Climate robust coastal planning, zoning, and building codes	• Adopt region IPCC AR6[1)] sea level allowances and elevation margins • Introduce coastal setback lines and rolling easements • Mandate elevation and flood proofing for new builds • Enforce disclosure of RSLR and subsidence in permitting • Embed coastal multi-hazard maps (e.g., wave run-up) in land use plans
Engineered defenses (gray) with adaptive standards	• Upgrade seawalls, revetments, and breakwaters to higher return periods • Construct surge barriers and tide gates at harbor entries in vulnerable areas • Retrofit port and airport perimeters • Elevate critical substations, pumping stations, and control rooms
Nature-based buffers (green)	• Restore and expand mangroves, saltmarshes, dunes, and beach ridges • Deploy living shorelines and reef restoration to attenuate waves • Integrate nature-based features with hard structures to reduce overtopping; hybrid coastal defenses are referred to as gray-green
Implement delta and sediment management	• Regulate groundwater abstraction • Restore sediment pathways where feasible • Raise and maintain ring dikes and embankments on subsidizing polders
Strengthen critical coastal asset resilience	• Protect desalination plants with elevated intakes and surge-tolerant outfalls • Elevate refinery and utility pipe racks and critical control systems • Protect fuel and chemical storage with berms and cutoff walls • Raise quay decks and yard levels on expansion

1) IPCC AR6 is the Intergovernmental Panel on Climate Change's Sixth Assessment Report (2021-2023), which is a scientific assessment that synthesizes the state of knowledge on climate science, providing consensus projections that inform national standards; Sea-level allowances refer to designed buffers derived from AR6 local sea-level projections, where the amount of elevation above water levels are detailed so that assets maintain a set target (acceptable) flood probability. The reporting cycle for the IPCCs seventh assessment report is ongoing IPCC AR7 is currently expected to be released in 2029.

Strategic outlook and pathways

The next phase of coastal adaptation in MENA calls for a transfer from one-off responsive site fixes towards coordinated and proactive risk-based programs. This translates to safeguarding essential services, managing shorelines and ecosystems as protective structures, and embedding sea-level allowances into planning and design.

Continuity of essential services is the most immediate lever. Protecting desalination hubs and coastal intakes and outfalls, power substations and control rooms, and the perimeters of ports and coastal transit corridors prevents local flooding from cascading into citywide disruptions. Elevation, flood proofing, surge control at chokepoints, and engineered work best when delivered as corridor packages with clear operations and maintenance roles.

Shoreline stability reduces the physical loads that defenses must withstand and lower lifecycle costs. Treating sediment as a managed resource through regional sediment budgets, predictable nourishment cycles, dune rebuilding, and sand bypassing at ports keeps beaches and barriers functioning as the first line of defense, Scaling hybrid solutions such as mangroves, saltmarshes, reefs, and living shorelines alongside engineered structures supports attenuation of waves, curbing overtopping, and extend asset life.

Together, these steps mark a regional shift from reactive repairs to proactive, adaptive resilience. Over the coming decade, the region should prioritize safeguarding lifelines including desalination plants, ports, and coastal transit corridors. Shorelines and ecosystems should be managed as protective assets, using sediment plans and hybrid gray-green defenses. Clear milestone targets such as protecting bulk of critical coastal utilities to defined return periods plus allowances, establishing embankment raise schedules in subsiding deltas, and completing initial nourishment and hybrid defense segments across priority waterfronts will sustain progress and momentum.

Urban Resilience

Key highlights

As climate impacts intensify, integrated spatial planning and climate-responsive design will be key to sustaining livable cities

Smart infrastructure, digital monitoring, and participatory planning are enabling cities to move from reactive crisis management to proactive climate resilience.

Key regional challenges addressed

Rapid urbanization	Water scarcity	Weak & fragmented utilities	Climate & natural risk

Urban planning: from vulnerability to adaptation

Urbanization in the MENA region is accelerating at an unprecedented pace, reshaping the region's social, economic, and environmental landscape. By 2050, nearly 70 percent of the world's population will live in cities, up from just over 55 percent today (UN Habitat, 2023). This rapid expansion has created new economic opportunities but also significant planning and service delivery challenges. Many urban areas are growing faster than infrastructure networks can expand, straining electricity grids, adaptation systems, housing, and essential public services.

The physical form of cities in MENA, often characterized by dispersed growth patterns, high energy demand, and limited public transport, exacerbates these challenges. Urban sprawl increases the cost of providing reliable water, electricity, waste management, and mobility, while high population densities in older urban centers amplify pressure on aging networks. In several cases, informal settlements on city peripheries lack adequate housing quality, drainage, and access to basic utilities, increasing the vulnerability of low-income populations to service disruptions.

Climate change adds a further layer of complexity by amplifying the operational and maintenance burden on urban systems. Higher temperatures, fluctuating energy demand, and extreme weather events can overload power and cooling networks, while more frequent infrastructure shocks accelerate wear on transport, waste, and public utility systems. These effects make urban planning a key lever for adaptation, not through resource management alone, but through integrated infrastructure planning, reliable service delivery, and resilient urban design that can sustain functionality under stress.

Recognizing this, cities across the region are beginning to embed climate resilience into their master plans, building codes, and infrastructure strategies. Majority of NDCs in MENA reference urban adaptation priorities, including energy-efficient housing, resilient transport, and digital infrastructure management (UNFCCC Registry, 2025). The emerging approach views urban planning as a critical bridge between adaptation, development, and service equity, ensuring that as cities grow, they remain accessible, livable, and capable of withstanding future shocks.

Urban resilience pathways and responses

Adaptation Pathway	Possible Measures
Integrated and climate-responsive urban planning	• Embed climate risk mapping in masterplans and zoning codes • Promote compact, mixed-use, and transit-oriented development to reduce exposure and energy intensity • Restrict settlement expansion in hazard-prone areas (e.g., wadis)
Resilient infrastructure systems	• Upgrade infrastructure networks with climate-resilient design standards • Retrofit aging assets and critical facilities to improve durability under heat and extreme weather • Introduce decentralized or backup systems for energy and service continuity
Equitable access and basic service reliability	• Extend safe and affordable electricity, sanitation, and waste services to underserved areas • Integrate adaptation priorities into upgrading programs through improved drainage, green infrastructure, and tenure-secure housing
Digitalization and predictive urban management	• Use GIS platforms and smart sensors to monitor infrastructure stress and guide maintenance • Deploy early-warning systems for urban flooding, power failures, and heat hazards
Governance and financing for resilient cities	• Establish municipal units dedicated to urban resilience planning • Integrate climate-resilience criteria into infrastructure investment and Public Private Partnership (PPP) frameworks • Mobilize climate finance and blended capital for infrastructure retrofitting and city-wide adaptation projects

Strategic outlook and pathways

Urban resilience in MENA is transitioning from reactive measures to a structured phase of resilience planning, where urban systems are redesigned to manage long-term climate and operational stresses. As cities expand, their capacity to deliver reliable, climate-resilient services will define the region's broader adaptation trajectory. Across the region, cities are gradually shifting from fragmented, project-based adaptation efforts toward integrated resilience planning that aligns infrastructure, land use, and governance with long-term climate and development goals (UN Habitat, 2023).

Infrastructure modernization will remain a central pathway for adaptation. Investments in power, energy security and reliability, transport, and waste systems are increasingly incorporating redundancy, digital control, and flexible design to sustain operations during climate shocks. Retrofitting aging infrastructure and high-density districts to achieve resilience and efficiency is equally vital, particularly in coastal and arid urban zones where exposure to heat extremes, flooding, and water scarcity is intensifying.

Technology and digital management are becoming core enablers of urban adaptation. Advanced data platforms, predictive maintenance systems, and digital twins are allowing municipalities to monitor urban assets in real time, model risk scenarios, and prioritize resilience investments. By linking asset condition, hazard exposure, and service delivery data, these tools enable cities to target adaptation spending to the most vulnerable areas, enhancing both the cost-effectiveness and impact of resilience measures.

Finally, accessibility defines the social dimension of resilient urban transitions. Ensuring that all residents, especially those in underserved areas, have equitable access to electricity, sanitation, mobility, and waste services is essential to sustain adaptation outcomes. Embedding resilience criteria into urban expansion, housing upgrades, and municipal service planning can deliver immediate improvements in quality of life while reducing long-term vulnerability.

If pursued cohesively, these measures can position MENA as a global model for urban resilience in arid environments, where adaptation is a guiding principle for infrastructure development, spatial planning, and service delivery.

Disaster Risk Reduction

Key highlights

With over 60 percent of the MENA region's population living in cities, resilience planning is now essential to protect growth corridors

Progress in the region depends on moving from scattered projects to risk-based programs that embed climate risk in planning, while closing early-warning gaps where coverage is 59 percent, and only 23 percent operate at full capability

Key regional challenges addressed

- Climate & natural risk
- Water scarcity
- Weak & fragmented utilities
- Technical & capacity gaps
- Rapid urbanization

MENA resilience planning landscape: Severity and dynamics

Resilience planning sits at the junction of climate risk, disaster planning, and development of policy in MENA's rapidly urbanizing corridors. The region faces compounding hazards, including heat, droughts, flash floods, coastal flooding, and sand and dust storms, with high concentration of people and valued assets exposed in cities, coasts, and governance arrangements that often span multiple authorities. About 61 percent of the MENA region's population is considered urban as of 2024 (UN ESCWA, 2025), and residents in coastal Gulf and Red Sea cities face heightened exposure to sea-level rise, coastal flooding, saltwater intrusion, and extreme heat events (World Bank, 2022). These risks are amplified by rapid urbanization and dense infrastructure development along low-lying coastlines, increasing vulnerability of housing, utilities, and transport networks to climate-related hazards. Intergovernmental Panel on Climate Change's (IPCC) Mediterranean assessment flags dense coastal urbanization and limited cross-jurisdictional coordination as persistent constraints to adaptation effectiveness, underscoring the need for basin-wide planning approaches (IPCC, 2023).

Warning capacity and risk information remains uneven. Global monitoring shows that multi-hazard early warning systems (MHEWS) are expanding, yet coverage in the MENA, as defined by the World Meteorological Organization (WMO), is about 59 percent and most national services operate at Basic or Essential capacity, with only ~23 percent at Full/Advanced, which are limitations that weaken end-to-end performance from hazard detection to community responses (WMO, 2025). In 2024, just over half of countries worldwide indicated they have MHEWS in place, highlighting a continuing global implementation gap that is mirrored in parts of MENA (UNDRR and WMO, 2024). UNDRR's Regional Assessment Report for the MENA region (2024) further highlights systemic, transboundary risks, data gaps, and institutional fragmentation that impede coherent resilience planning (UNDRR, 2024).

From a development perspective, the World Bank's flagship report on adaptation finds that resilience outcomes are maximized when rapid economic growth, climate-resilient development, and targeted adaptation measures are pursued in tandem (World Bank, 2020). For the case of MENA, that translates into institutionalizing resilience planning across public investment and service delivery while closing capability gaps in MHEWS and mobilizing finance where the region remains the smallest recipient of climate funds, so plans are executable at scale (World Bank, 2024).

Resilience risk reduction pathways and responses

Adaptation Pathway	Possible Measures
Urban and sector resilience plans and policy integration	• Map lifelines and single points of failure citywide • Embed heat, flood, and surge scenarios into operating procedures • Use zoning to steer new growth from high-hazard cells • Define service-level targets and phased retrofit roadmaps for assets
Risk informed governance and planning	• Adopt a whole-of-government adaptation process including risk screening, prioritization, and monitoring aligned with international standards • Mandate risk appraisals in spatial plans, infrastructure programs, & permits • Clarify mandates across municipal, provincial, and national levels • Tie annual budgets to priority risks and monitored outcomes
Early-warning (EW) to early action	• Close gaps across risk knowledge, observation, dissemination and response • Integrate alerts with social protection and emergency finance releases • Run drills and last-mile communications for at-risk communities
Data, risk analytics, and monitoring	• Maintain shared hazard, exposure, & vulnerability baselines across agencies • Track losses and near-misses to update priorities annually • Apply WMO quality control and metadata standards to observing networks
Financing and risk transfer	• Embed climate criteria in public investment management and appraisal • Prioritize no-regret measures with strong benefit-cost evidence • Embed climate resilience clauses in PPP contracts

Strategic outlook and pathways

MENA's progress on resilience planning increasingly hinges on translating initiatives into coherent, risk-informed portfolios that can be implemented across planning, operations, and financing functions, in line with nationally determined priorities. Governments may choose to adopt structured adaptation planning approaches that integrate risk assessment, prioritization, and delivery, drawing on context-appropriate methodologies rather than prescriptive or externally defined standards.

Countries may place emphasis on geographies and assets where exposure and economic concentration are highest, such as urban areas and critical service corridors. Urban and sector resilience planning can support the identification of critical lifelines and potential points of vulnerability, inform maintenance and capital investment decisions, and enhance preparedness through continuity planning and response protocols. Strengthening the link between early warning systems and early action remains an important consideration for reducing losses, alongside land-use and zoning approaches that limit future exposure to high-risk areas.

Resilience outcomes can be further enhanced when improvements in multi-hazard early warning systems are complemented by nationally defined social protection and emergency response mechanisms, enabling timely and funded responses to climate-related shocks.

Delivery hinges on disciplined data and monitoring, and financing and risk transfer. Share risk baselines and operational dashboards allow agencies to measures avoided losses and defend budgets, while blended finance and risk-transfer instruments provide liquidity for shocks and incentives for prevention. Regional platforms under UNDRR's MENA Region processes and basin-level forums for the Mediterranean and Gulf can pool analytics, procurement, and training; reducing unit costs and building a consistent playbook across borders (UNDRR, 2025).

Means of implementation

Means of Implementation

The means of implementation form the practical foundation of climate action represent the systems and instruments that enable countries to translate ambition into measurable progress. In the MENA region, the key pillars of implementation include financing, technology development and transfer, capacity building, policies and regulations (including carbon markets and Article six), and international cooperation. Together, these elements provide the structural and institutional pathways through which national commitments are transformed into results.

Financing

Financing lies at the heart of climate implementation. Across MENA, the focus has shifted from isolated project funding to building integrated financial ecosystems that connect climate ambition with long-term economic diversification.

The scale of transformation required in energy, water, transport, and industry demands hundreds of billions in investment over the coming decade. The World Bank has already delivered USD 6.3 billion in climate financing for MENA between FY2021– 2023, with a goal to exceed USD ten billion by 2025 (World Bank, 2024). To channel capital effectively, countries are developing green finance frameworks and sustainable-finance taxonomies.

Momentum is also visible in capital markets. Sustainable bond issuance reached USD 16.7 billion across the Middle East in the first nine months of 2024, while the MENA and Turkey region now hosts about USD 4.8 billion in outstanding green bonds and sukuk (ESG MENA, 2024). Central banks are steering the banking sector toward climate-responsive lending and ESG integration, reinforcing investor confidence and aligning with the landscape of global monetary system.

Despite this progress, the region still captures only 6.6 percent of global climate-finance flows, with nearly 70 percent directed to mitigation rather than adaptation (Middle East Institute, 2024), highlighting the need for greater balance, accessibility and geographic representation. Multilateral and regional institutions are helping close this gap through concessional resources, guarantees, and technical assistance, while national funds and sovereign vehicles are increasingly co-investing with international partners. Together, these efforts position MENA not just as a beneficiary but as an emerging architect of global climate-investment flows. Building on this momentum, the COP29 and COP30 Presidencies have launched a joint initiative through the UNFCCC that sets a collective ambition to mobilize USD 1.3 trillion per year by 2035 for climate action in developing countries, underscoring both the scale of the challenge and the evolving role of the region in shaping the global finance architecture (Carbon Brief, 2025).

Regional approaches and initiatives include:

National climate investment frameworks

Integrate climate priorities into fiscal and development planning to support resource allocation and investment.

- UAE embeds climate finance in its Third NDC and has set up the Green Climate Finance Center (GCFC) to accelerate development of climate finance frameworks
- Jordan integrates climate risks into public investment management under its Third NDC (2025)

Green financing frameworks and capital-market instruments

Mobilize private capital through **green bonds, sukuk, and sustainable-finance regulations.**

- KSA launched a Green Financing Framework for sovereign green bonds and sukuk
- Kuwait's National Bank of Kuwait (NBK) issued a USD 500 million green bond (NBK, 2024)
- Bahrain introduced ESG rules to enable future green issuances (Green Central Banking, 2023)

Dedicated climate funds and blended-finance mechanisms

Leverage concessional and private finance for high-impact mitigation and adaptation projects.

- The Green Climate Finance (GCF) has committed readiness funding of USD 30.4 million across 37 programs in MENA (GCF, 2024)

Cross-border financing platforms

Pool regional resources to co-finance shared infrastructure and technology corridors.

- A proposed EU-MENA investment facility for energy infrastructure and interconnection, supporting cross-border electricity and hydrogen corridors linking MENA and Europe (Energy Partnership, 2025)

Technology development and transfer

Technology development and transfer are emerging as a cornerstone of MENA's climate transition and a key driver of sustainable economic diversification. The region is shifting from basic technology importation toward co-development, localization, and value-chain integration, embedding innovation into national visions and industrial strategies.

Public programs and partnerships are central to scaling regional technology capacity. Egypt's Climate Technology Centre, supported by UNIDO, is strengthening national research and industrial capabilities for adaptation and clean-energy applications, while Oman's Hydrom initiative provides an institutional framework for coordinating hydrogen-related R&D, project development, and technology partnerships (UNIDO, 2024; Hydrom, 2025). In North Africa, Morocco's OCP Innovation Hub focuses on applied research in water-efficient fertilizers and green hydrogen derivatives, complementing the country's national industrial decarbonization roadmap (OCP Group, 2024). Similarly, Jordan's Green Growth Plan integrates R&D incentives for renewable-energy and circular-economy technologies, supported by development partners (GIZ, 2023).

Localization is gaining momentum as MENA economies work to capture greater value within global low- emissions supply chains. Egypt and Morocco are expanding local assembly for wind turbines, solar modules, and hydrogen-equipment components, while KSA and Oman are developing domestic capabilities for electrolyzer manufacturing and carbon-capture systems (IRENA, 2024; World Future Energy Summit, 2025). These co-development initiatives are supported by targeted industrial policies and joint ventures with international firms, enabling technology transfer through embedded know-how, demonstration projects, and supply-chain integration. The result is a more distributed innovation landscape across the region, reducing import dependence while building regional manufacturing competitiveness.

The MENA region is also benefiting from multilateral frameworks that facilitate access to technology and knowledge. The World Economic Forum's Low-Carbon Hydrogen Alliance and the UNFCCC's Technology Mechanism are key enablers of R&D cooperation, demonstration finance, and regulatory alignment (WEF, 2023; UNFCCC, 2025).

Capacity building

Human and institutional capacity form the backbone of durable climate action in MENA. The region is shifting from ad hoc training to integrated systems that embed climate competencies across education, governance, and labor markets. Leaders increasingly recognize human capability as a strategic asset for competitiveness and long-term resilience (UNDP, 2023; ESCWA, 2024).

Education and workforce development: Climate literacy is being mainstreamed into national curricula and technical programs. Qatar's Vision 2030 integrates sustainability education through the Qatar Foundation (Qatar NDC, 2021), while Tunisia's NDC (2022) promotes vocational training in water and agriculture to enhance local resilience.

Institutional and professional capacity: Governments are strengthening expertise across ministries through targeted programs in climate economics, MRV, and sustainable finance. Egypt's National Adaptation Plan includes multi-year training for officials on project appraisal and MRV (Egypt Updated NDC, 2022), while Lebanon's NDC (2025) prioritizes institutional reform and data management.

Youth and community empowerment: Youth programs such as KSA's Youth Green Initiative and the UAE's Youth Climate Delegates engage early-career professionals in policy and COP negotiations (KSA NDC, 2021; UAE MoCCAE, 2023). In North Africa, civil-society networks supported by regional organizations like RCREEE and 4C Morocco are training community leaders to implement local adaptation projects, enhancing social and climate resilience (RCREEE, 2023; 4C Morocco, 2024).

Policies and regulations (including Article six and carbon markets)

The MENA region has undergone a marked shift in its approach to climate policy, evolving into structured economy-wide frameworks. Governments are now moving beyond high-level strategies toward concrete regulatory and economic mechanisms that align national development with long-term emission-reduction and resilience objectives. The focus is visible across three complementary categories of policy instruments: Economic, Regulatory, and Complementary instruments, each accelerating the region's transition toward low-emissions and climate-resilient growth.

Economic Instruments: Incentivizing Low Emissions Investment

Economic tools are increasingly being deployed to reshape incentives, correct market distortions, and direct both public and private capital toward activities that support the implementation of national climate plans. Across the region, in alignment with national priorities and circumstances, fiscal policies are adopted to incentivize investments and activities in support of low emissions and climate resilient development.

Concessional loans, green credit lines, and dedicated public-sector funds are being scaled up to support renewable energy, energy efficiency, and sustainable projects. International climate finance and development bank facilities are complementing these national mechanisms, helping to crowd in private investment.

Carbon markets are emerging as a central pillar of this transformation, creating tradable units that monetize verified emission reductions and direct finance toward mitigation projects. Several countries are developing voluntary frameworks, while others are preparing compliance systems that could link with global carbon markets. Article six of the Paris Agreement provides the overarching framework for such cooperation, enabling the transfer of internationally recognized mitigation outcomes (ITMOs) between countries. This mechanism allows MENA states to attract results-based finance, leverage cross-border partnerships, and enhance transparency through standardized MRV systems (IEF, 2024).

Regulatory Instruments: Enabling Performance, Transparency, and Market Readiness

Regulatory instruments are evolving to support performance improvement and transparency across key sectors, including power, industry, transport, and the built environment. Updated building codes promote green materials and passive-cooling designs, while vehicle-efficiency and fuel-quality standards aim to reduce emissions from mobility.

Performance benchmarks for stricter permitting systems are improving oversight of industrial processes, cooling systems, and waste management. Collectively, these regulatory instruments create a predictable operating environment, support bottom-up action by public and private actors and lay the groundwork for voluntary carbon markets and climate finance mobilization in support of nationally defined pathways.

Complementary Instruments: Aligning Systems and Increasing Transparency

Alongside fiscal and regulatory frameworks, governments are adopting complementary measures that integrate climate objectives into broader economic governance. Public spending guidelines are being revised to prioritize sustainable infrastructure, while some countries are opting for national budgeting systems and are beginning to incorporate climate-tagging and expenditure tracking. Central banks and financial regulators are issuing guidance on sustainable finance frameworks and risk-management practices to leverage the financial sector in support of climate goals.

At the same time, information-based instruments are enhancing transparency and accountability. Sustainability reporting for large corporations, and standardized greenhouse-gas inventories are becoming more prevalent. Public access to data on emissions, water use, and resource efficiency is improving, enabling evidence-based policy evaluation and investor confidence. These measures are complemented by capacity-building programs and national awareness campaigns that strengthen institutional understanding and public engagement.

International cooperation

International cooperation remains a cornerstone of the MENA's climate implementation, connecting national ambition to global systems of finance, technology, and knowledge. Given the region's shared resource systems and interconnected economies, dialogue and collaboration is essential to scale investment, accelerate technology transfer, and strengthen adaptive capacity.

The region engages through a broad network of international and regional institutions that provide both finance and technical assistance. Multilateral funds such as the Green Climate Fund, Global Environment Facility, and Climate Investment Funds support mitigation and adaptation pipelines aligned with national climate priorities. Regional development banks and sovereign funds co-finance infrastructure and clean-energy projects, increasingly through blended-finance arrangements that leverage private capital. Nevertheless, the region keeps facing difficulties in accessing climate finance, where many countries are under economic strain.

Regional coordination platforms such as the League of Arab States, the Arab Ministerial Council for Electricity, and the Regional Centre for Renewable Energy and Energy Efficiency act as connective frameworks for policy harmonization, capacity building, and knowledge exchange. Partnerships with international organizations including the International Energy Forum, European Union, United Nations Development Program, United Nations Environment Program, Food and Agriculture Organization, or Deutsche Gesellschaft für International Zusammenarbeit and similar economic diplomacy and technical assistance platforms strengthen institutional readiness and adaptation planning, ensuring that global methodologies are adapted to local realities.

Voluntary South–South and triangular cooperation is expanding, with MENA countries engaging as collaborative partners in knowledge exchange and joint initiatives, including cooperation between regional research centers and counterparts in Africa, Asia, and Latin America on desert agriculture, water reuse, and renewable energy integration.

Finally, participation in Article six cooperative approaches and global partnerships such as the NDC Partnership and the Partnership for Market Implementation is reinforcing regional integration into international carbon markets and results-based finance systems. These collaborations ensure that the region's perspectives inform the evolving design of global carbon governance while expanding access to cooperative implementation opportunities.

Conclusion

MENA has reached an important stage in advancing their climate ambitions. The region has moved from planning to tangible implementation, integrating climate action into national strategies, investing in climate technologies, and establishing new foundations for climate resilience. The results are visible across sectors: renewable energy deployment is accelerating, efficiency standards are improving, hydrogen and carbon capture initiatives are taking shape, and regional institutions are building - and operationalizing – the frameworks needed to sustain long-term action, including through enhanced dialogue and collaboration on the IEF platform. Together, these actions reflect a shared regional determination to align economic diversification with global sustainability objectives.

MENA's commitment is evident in its approach to managing carbon holistically through the rapid deployment and scaling of the Circular Carbon Economy framework. Countries across the region are expanding renewables, improving efficiency, developing hydrogen value chains, advancing carbon capture and storage, introducing nuclear energy, implementing advanced cooling solutions, and investing in both nature-based and technology-based carbon removals. These technologies are no longer peripheral to national agendas but are becoming core components of economic diversification, energy security, and resilience. The result is a pragmatic development pathway that reflects regional realities while supporting global GHG emission ambitions.

At the same time, further progress depends on strengthening technology transfer, knowledge sharing, regional cooperation, and enhancing implementation capabilities. Several areas present opportunities for improvement and alignment. Expanding regional collaboration on data transparency, measurement and verification, and climate governance can enable more coherent and comparable action, including by leveraging existing data collaboration frameworks such as JODI. Integrating energy systems and cross-border infrastructure will accelerate renewable deployment and grid stability, while more cohesive nationally determined policy and regulatory environments can attract private investment at scale. Strengthening access to climate finance, enhancing institutional capacity, and investing in research and education will help ensure that the region's climate goals translate into measurable outcomes. In this sense, the next phase of MENA's climate journey is one of dialogue consolidation, coordination, and scaling.

Delivering this vision will require strong partnerships between governments, technology developers, and investors. The region's future progress depends on collective action to build integrated power grids that connect renewable energy across countries, to establish green hydrogen corridors that link regional and international markets, to develop high-integrity carbon markets that enable transparent crediting and trading, and to expand carbon capture and storage hubs that decarbonize industrial clusters. Beyond mitigation, there is also a shared opportunity to co-invest in regional resilience and adaptation programs that strengthen water, food, and urban systems under climate stress. These collaborative platforms can anchor MENA's leadership in the global transition while driving economic diversification, technological innovation, and knowledge exchange.

The region's progress demonstrates that climate action, energy security, and economic development are mutually reinforcing. By continuing to expand technology deployment, strengthen cooperation, and scale Circular Carbon Economy solutions, MENA can position itself as a model for sustainable growth within emerging economies, and beyond globally. The path forward lies in outreach and collaboration, building practical partnerships, fostering innovation, and ensuring that regional progress contributes directly to climate and energy market stability. Through these efforts, MENA is shaping a new narrative, one defined by leadership in climate solutions, resilience in the face of energy market volatility and change, and shared prosperity for the generations ahead.

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