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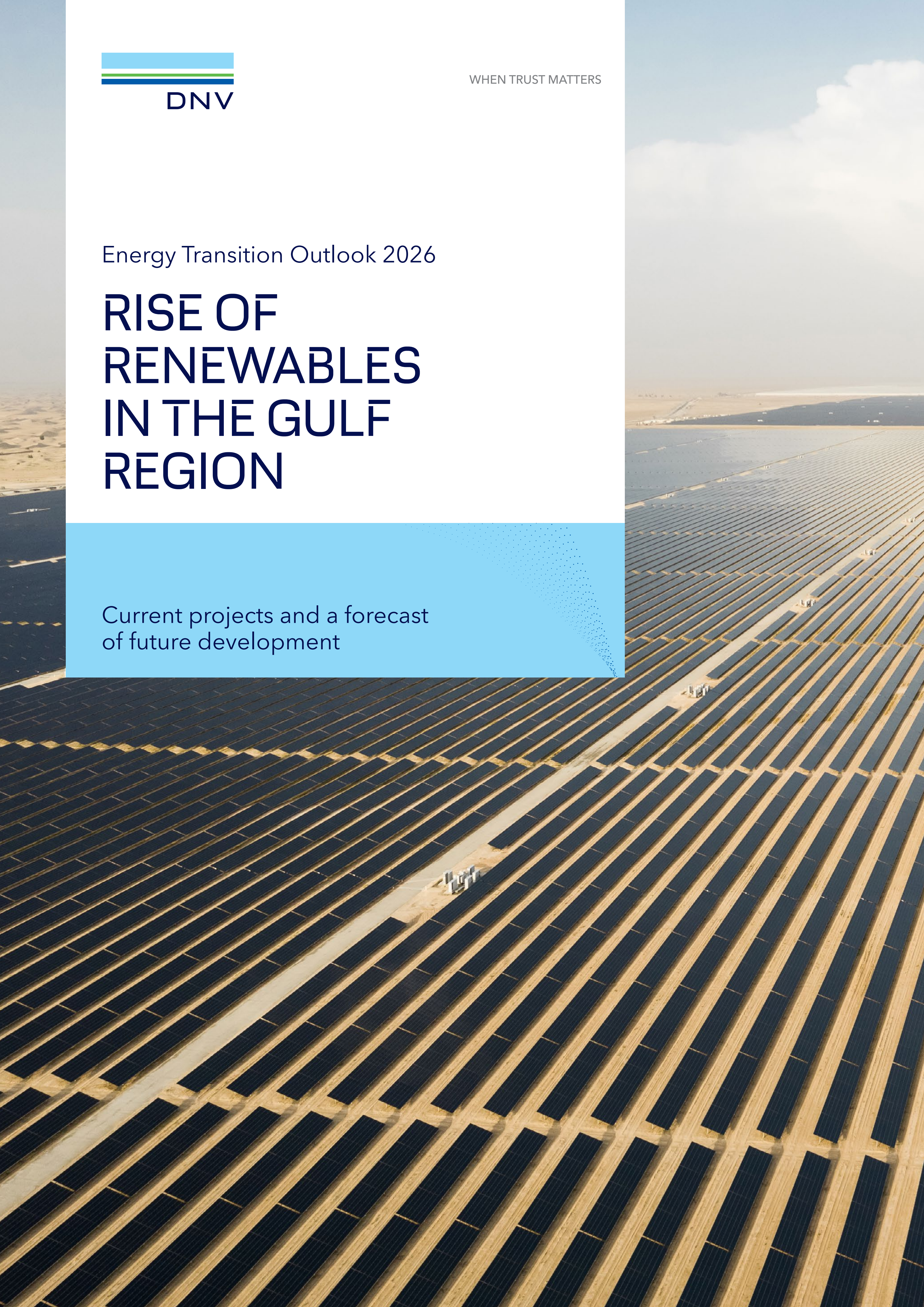
WHEN TRUST MATTERS

Energy Transition Outlook 2026

RISE OF RENEWABLES IN THE GULF REGION

Current projects and a forecast of future development



FOREWORD

A new age of electricity generation is dawning in the Middle East and North Africa (MENA). This will be driven by 860 GW of solar PV installed from now to 2040 and a further 2,200 GW of additional solar and wind installed between 2040 and 2060.

However, this increased generation will be matched by a rise in electricity demand such that renewable electricity will not displace gas-fired power until 2040. All demand sectors will grow following increasing GDP per capita, but cooling alone will contribute 30% of electricity demand growth to 2035 as temperatures rise and growing GDP broadens access to, and demand for, cooling.

The region's historical contribution to the global energy system has been driven by oil and gas exports, which have also formed the backbone of domestic consumption. Before 2020, it was importer countries that were responsible for most new solar and wind installations as they sought to reduce their fossil dependence. More recently, the steep decline in costs of solar, wind and battery technologies coupled with abundant resources and ambitious climate targets have driven wealthy fossil exporter nations to accelerate their renewable build-out. The same countries are also heavily investing in financing upcoming renewable expansion in neighbouring countries and the wider Middle East.

In this report we forecast future developments in MENA's energy transition and complement our findings with real-world cases drawn from a narrower Gulf-region.

Brice Le Gallo

Vice President & Regional Director

Southern Europe, Middle East, Africa and Latin America

HIGHLIGHTS

1 Variable renewable electricity generation to grow 14-fold by 2040 in MENA.

– This dramatic increase follows a ten-fold growth in variable renewable capacity in the same period. Solar PV is being chosen to meet rising electricity demand as it is the cheapest and quickest power source to install. New solar PV projects, including those co-located with storage, grow 12-fold to 2040. By 2060, 92% of electricity generation will be non-fossil, up from 14% in 2024. 35% of energy demand will be supplied by electricity, up from 17%.

2 Total electricity demand will triple by 2060 in MENA.

– Towards 2040 new demand will initially come mostly from buildings, in particular space cooling, and desalination, but from 2040 to 2060 demand growth will be driven by the switch to electric vehicles, an increase in AI data centres, and green hydrogen production. Electrification of manufacturing will increase throughout the period, partly because export markets require reduced carbon footprint on products.

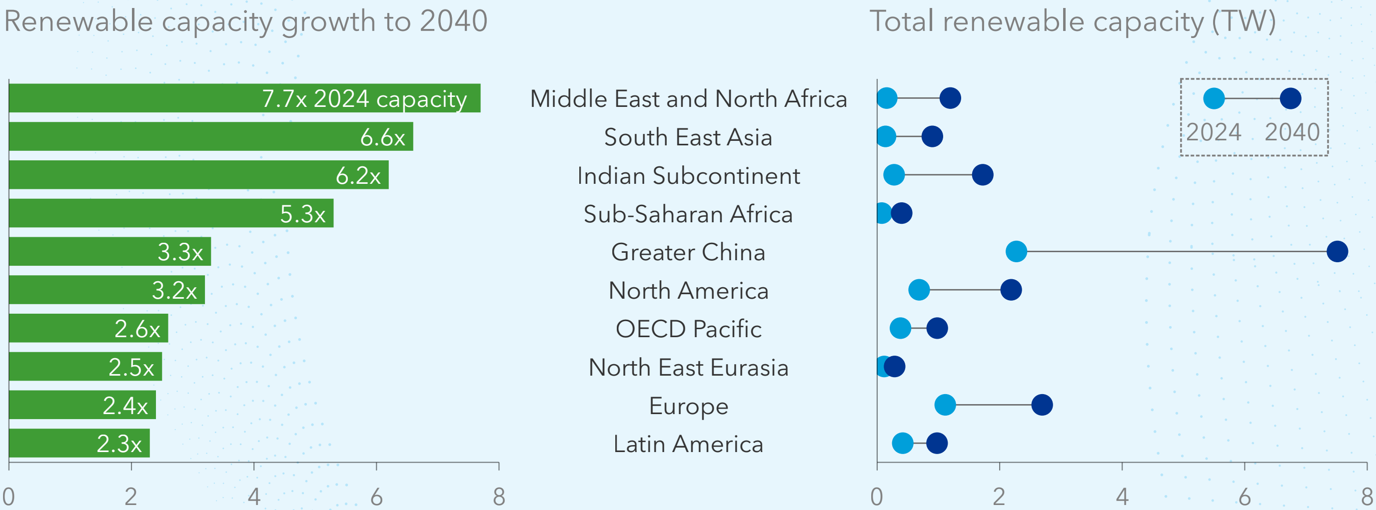
3 The existing modern grid is ready for renewable electricity expansion and demand growth.

– The Gulf region has a relatively new and robust grid which means that renewable growth is unlikely to be hampered by the kind of grid constraints affecting almost all other world regions. However, from 2035 onwards, even in the Gulf region, the grid could become a bottleneck if expansions and upgrades do not match renewable capacity growth.

4 The energy transition in MENA's power system starts only in 2040.

– The impressive build-out of renewable generation will be insufficient to meet the even faster growing electricity demand in the medium term. Only from 2040 onwards will renewable generation increase faster than new electricity demand, marking the tipping point of fossil-fired displacement.

MENA to have highest renewable capacity growth from low starting point



Includes wind, solar, hydropower, geothermal and bioenergy.
Historical data source: GlobalData (2025)

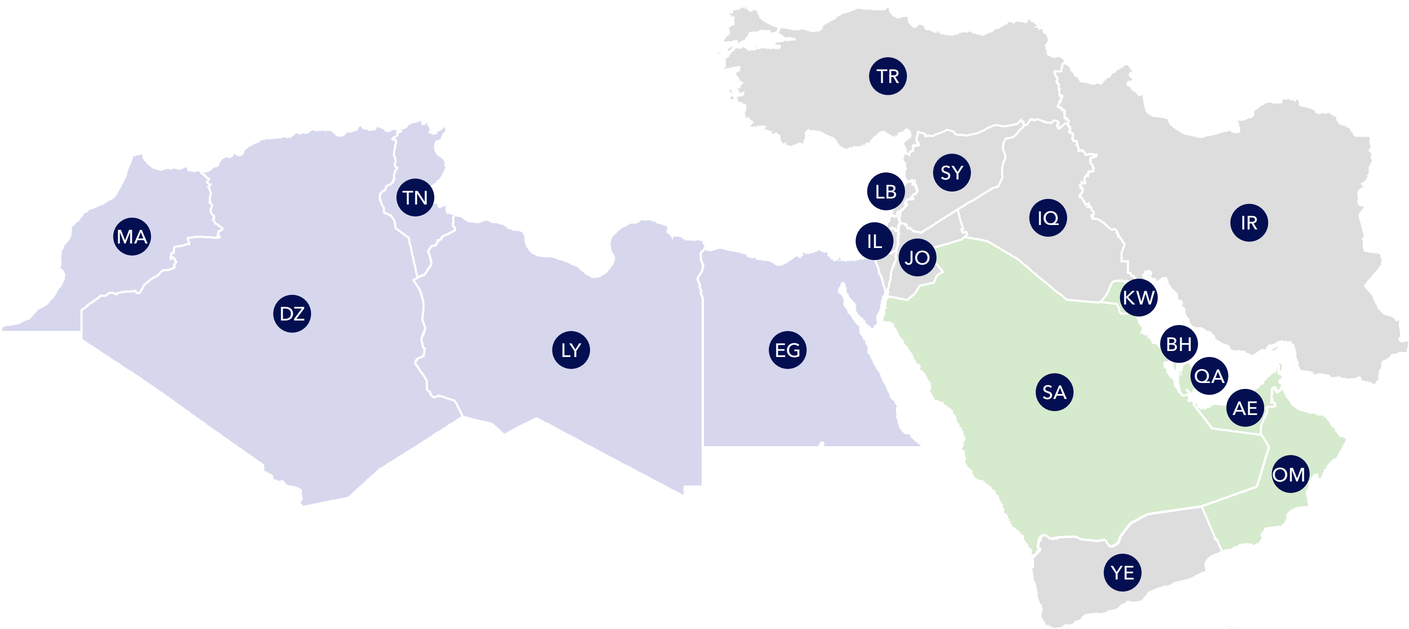
CONTENTS

INTRODUCTION

Our 2025 Global Energy Transition Outlook was launched in October 2025. That report is based on modelling the world as 10 connected regions. In this report we present and discuss results from one of these regions; the Middle East and North Africa (MENA), focusing on the increasing significance of renewable power. A parallel report on oil and gas decarbonization will be launched in February 2026. The global 2025 ETO extended the view in our forecast from 2050 to 2060 and this report continues to look to the 2060 horizon. Our guiding principles in the ETO publications are:

– Publishing a single 'most likely' forecast
– Emphasizing and exploring long-term dynamics rather than short-term imbalances
– Incorporating main policy trends; treating untested policy commitments with caution

Regional and sub-regional groupings
The ETO Middle East and North Africa region is divided into three sub-regions within this report and its figures. These sub-regions contain the following countries:



GCC (Gulf Co-operation Council)

- BH Bahrain
- KW Kuwait
- OM Oman
- QA Qatar
- SA Saudi Arabia
- AE United Arab Emirates

Other Middle East

- IR Iran
- IQ Iraq
- IL Israel
- JO Jordan
- LB Lebanon
- SY Syria
- TR Turkey
- YE Yemen

North Africa

- DZ Algeria
- EG Egypt
- LY Libya
- MA Morocco
- TN Tunisia

2 ENERGY SUPPLY

Renewable installations are accelerating in the Middle East and North Africa but won't be sufficient to meet even faster growing electricity demand.

Electricity

In 2024, electricity covered 17% of MENA energy demand and 86% of electricity generated was fossil-fired. Most of the fossil share was natural gas at 63%, while oil and coal contributed 17% and 6% respectively. The remaining 14% of the electricity mix is attributable to 5% hydropower, 4% solar PV, 2% each of nuclear and wind and small contributions of geothermal and bioenergy.

Middle East and North Africa's energy transition is less mature compared with Europe and even the global average (Figure 2.2), with fossils dominating electricity generation, which in turn accounts for a relatively low percentage of total energy demand. However, MENA's energy transition is now accelerating, and renewables capacity will double to 310 GW between 2024 and 2027. The region's transition is benefitting from more mature, cheaper clean technology due to technology learnings achieved elsewhere.

Renewables rise from low baseline

MENA electricity generation (PWh/yr)

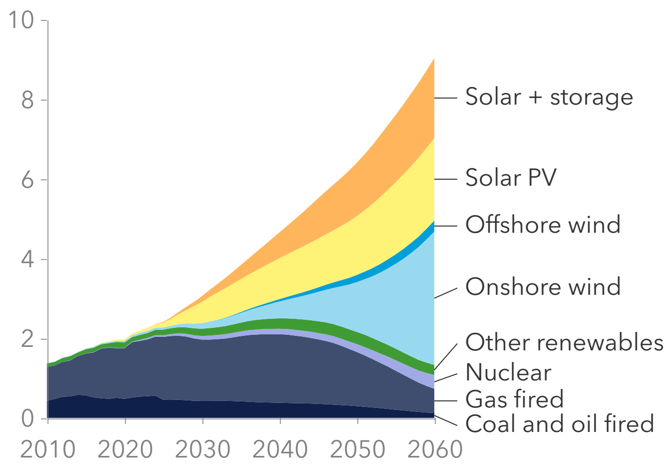


FIGURE 2.1 | Includes distributed generation.
Historical data source: IEA WEB (2025), GlobalData (2025)

However, MENA has yet to reach the point of additionality: when growth in non-fossil electricity generation outpaces growth in electricity demand. We forecast this milestone will be passed after 2040, and it is only then that the transition will truly begin.

Significant domestic oil and gas reserves are found in many countries in the region with some of the lowest extraction costs worldwide. Despite this, there is a motivation to transition away from domestic fossil consumption in producer countries to maximize hydro-carbon export income. Additionally, almost all countries across the region, including importer countries, subsidize domestic oil, gas and electricity consumption. These subsidies range from 2% of GDP in Qatar to 20% in Iran (IEA, 2025a) but are economically significant throughout. Reducing and replacing fossil consumption with domestic renewables both within and outside the power sector would see the GCC countries alone save 92 billion dollars annually, before accounting for the income gained from exporting the oil and gas rather than using it domestically.

Throughout our forecast, the region's share of renewable electricity generation will lag higher income and non-oil and gas exporting regions and, in 2060, the share of natural gas in the power mix will still be 7%, twice the global share of all fossil fuels. Nevertheless, by 2060, non-fossil generation will account for 92% of MENA electricity, a reversal of the current mix. Of this, solar and wind will contribute 45% and 40% respectively, nuclear will contribute 4%, hydropower 2% and bioenergy and geothermal 1% combined.

MENA lags global energy transition

Regional fossil and non-fossil generated electricity as a share of final energy (%)

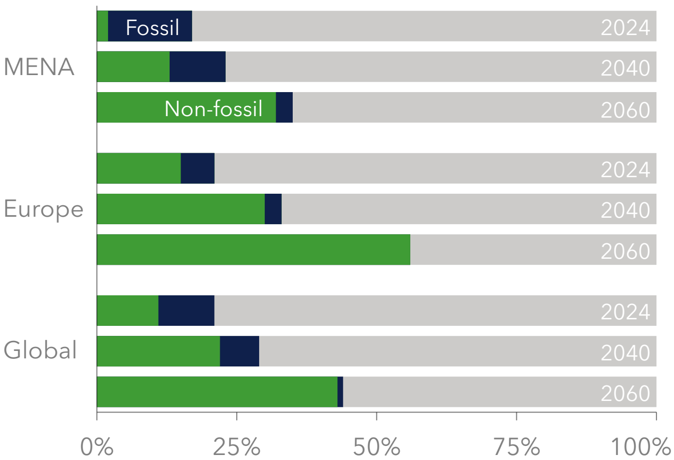


FIGURE 2.2 | Historical data source: IEA WEB (2025)

1 SUPPLY CASE

MASDAR; 1 GW Round-the-Clock solar+storage in the United Arab Emirates

MASDAR – also known as the Abu Dhabi Future Energy Company – is developing the world's first giga-scale 'round-the-clock' (RTC) renewable energy project, enabling 1 GW uninterrupted 24/7 electricity supply. MASDAR is one of the world's fastest growing renewable energy companies and this facility will combine a 5.2 GW solar plant with a 19 GWh battery storage system in Abu Dhabi, UAE.

Representing an investment of approximately US$6 billion and developed in partnership with the Emirates Water and Electricity Company (EWEC), the project will provide a continuous, reliable supply of clean power by using battery energy storage systems (BESS) to overcome the intermittency of solar generation. It is designed to deliver 1 GW of power on demand, day and night. Upon completion in 2027 it will be the largest of its kind in the world, covering an area the size of Manhattan and is expected to avoid carbon emissions by 5.7 million tonnes of carbon emissions annually, directly supporting the UAE's 2030 renewable energy targets. Its development will create over 10,000 jobs and new manufacturing and service facilities providing affordable, reliable, clean power to meet increasing energy demand from artificial intelligence (AI) and the digital economy.

The financing and permitting of large projects face fewer challenges than in other regions due to available revenues from oil and gas production and more limited public consultation. Large projects are developed and operated by state-owned enterprises such as MASDAR in the United Arab Emirates and ACWA Power in Saudi Arabia. These countries do not have liberalized electricity systems, and these SOEs are responsible for generation, transmission and distribution; they also set electricity prices. In other countries in the region, such as Egypt, renewable energy projects are built based on an FDI structure, but also there the dominant project developers are the Emirati and Saudi electricity companies.

The region is developing several large hydrogen projects based on dedicated renewables, most notably NEOM in Saudi Arabia. By 2035 21 GW of renewables capacity will produce 4 MT of hydrogen a year, 3% of global hydrogen demand.

Utility solar

Given the region's abundant solar resources and land availability, solar power is an obvious choice for electricity generation. Starting from a low baseline, this potential has begun to be realized. In 2024 there were 76 GW of solar capacity: 61 GW utility and 15 GW distributed, supplying 4% of the region's electricity. The capacity will double to 154 GW by 2026 and double again to 343 GW by 2029 by which time it will supply 19% of the region's electricity.

The region's solar build-out benefits from a unique geographical advantage: peak solar supply matches peak electricity demand, both daily and seasonally. This is due to the scale of space cooling demand and reduces the need for the shifting of solar electricity generation with batteries and the risk of significant generation curtailment.

However, the desert heat and dust adds engineering complexity. Solar panel efficiency reduces with module temperature and panels are 5-10% less efficient at 45 degrees (typical gulf summer conditions) compared to 25 degrees (IEA, 2025b). Dust also reduces efficiency and the optimal cleaning regimen in the region is often daily rather than monthly elsewhere. Robot cleaners are becoming increasingly common, particularly for megaprojects.

The average size of utility solar projects is increasing in the region, with 80% of projects due to be completed at the end of the decade larger than a one gigawatt, up from 20% of projects at gigawatt scale at the beginning of the decade. This shift is largely driven by falling module costs and rising interest in renewable development in the same period.

Utility projects are also increasingly co-located with battery storage, particularly larger projects, mirroring the global trend. This includes the first 'round-the-clock' solar and storage project which will have sufficient solar and storage capacity to supply 1 GW of baseload electricity. In 2024, 16% of solar capacity was co-located with storage, we expect this in increase to 50% by 2044.

GCC will be the sub-region with the highest solar additions from mid-decade

Utility additions and total installed capacity (GW)

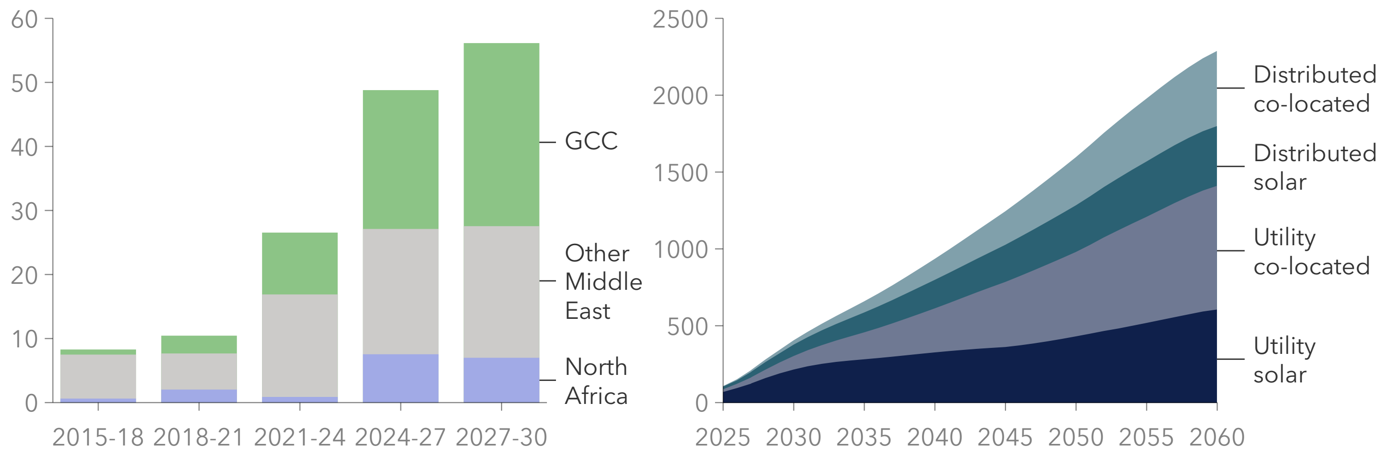


FIGURE 2.3 | Co-located refers to solar projects sited with storage.
Historical data source: GlobalData (2025)

Solar power has the lowest LCOE of all power sources. This cost reduction has been driven by the dramatic decline in module prices over the past decade due to excess production of Chinese modules. In MENA, modules now account for just 14% of solar CAPEX, 81% is from balance of system costs including installation labour and expertise and other equipment such as racking and inverters. The difference between the regional total CAPEX and the global ex-China average has been slowly declining; from 10% more expensive in 2017, it is now 7% higher.

Distributed solar

In the Middle East and North Africa, 19% of solar power was distributed in 2024 – well below the global average of around 30%. MENA is likely to reach that global proportion only by 2035. Distributed solar comprises residential and commercial rooftop solar and off-grid solar. In higher income countries in the region, such as the GCC countries, commercial rooftop solar is dominant while in post-conflict countries and countries with an unreliable grid, off-grid solar is dominant.

However, GCC countries, with the exception of Bahrain and Oman, do not currently allow net metering or net billing, the processes by which prosumers are compensated for selling power to the grid. The only mechanisms allowed for distributed solar are individual PPAs where companies with large rooftops, for example shopping malls, enter private agreements with distributed solar developers to build and maintain solar panel systems which then supply a portion of the building's energy

Solar PV projects are getting larger in MENA
Capacity and commissioning year (MW)

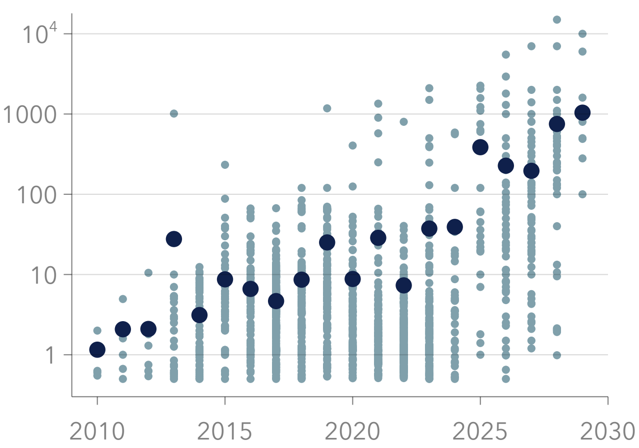


FIGURE 2.4 | Larger dots show annual mean capacity.
Historical data source: GlobalData (2025)

2 SUPPLY CASE

Abydos 2; 1 GW solar + 600 MWh storage in Egypt

The Abydos Solar and Storage Project, located in Egypt's Aswan Governorate, is a landmark renewable energy initiative spearheaded by AMEA Power through its special-purpose vehicle, Abydos for Renewable Energy (AFRE). The project comprises a 1 GW solar photovoltaic (PV) plant integrated with a 600 MWh battery energy storage system (BESS), making it the largest solar-plus-storage development in Africa and one of the most significant in the MENA region. Spanning approximately 20 km² of desert land, the facility is strategically positioned near Benban, a hub for solar energy projects.

Once operational in May 2026, Abydos is expected to generate 3,000 GWh annually. The project aligns with Egypt's Vision 2035, which targets 42% renewable energy in the national mix, and will create around 4,000 jobs during construction, delivering both climate and socioeconomic benefits.

3 SUPPLY CASE

Al Shuaibah; 2.6 GW solar in Saudi Arabia

The Al Shuaibah Solar PV Independent Power Plant is located about 80 km south of Jeddah in Makkah Province, Saudi Arabia. It consists of two sub-projects: ASB1 (600 MW) and ASB2 (2,060 MW), making it one of the largest solar projects in the Middle East with a combined capacity of 2.6 GW AC.

The project uses N-type bifacial monocrystalline silicon PV modules combined with single-axis tracking systems, which optimize solar absorption by following the sun's position. Over 5 million solar panels were installed across an area of approximately 54 km², supported by robotic cleaning systems and advanced digital automation for efficient operation.

Commercial operation was scheduled for February 2025 (ASB1) and November 2025 (ASB2). The project developer is ACWA Power, in partnership with Saudi Aramco and Badeel (Water & Electricity Holding Co.), under a 35-year BOO (Build-Own-Operate) PPA with the Saudi Power Procurement Company (SPPC). EPC services were provided by China Energy Engineering Group.

With an investment of approximately $2.37 billion, the project is expected to generate 282 billion kWh over 35 years. It supports Saudi Arabia's Vision 2030 goal of achieving 50% renewable energy in the power mix by 2030 and carbon neutrality by 2060.

This project strengthens Saudi Arabia's energy security, diversifies its energy mix, and positions the Kingdom as a global player in renewable energy deployment. It also creates thousands of jobs during construction and operation, driving local economic growth.

demand. This limits the expansion of distributed solar in key countries largely to commercial rooftop space.

In other countries, such as Jordan (EcoMena, 2025), wheeling is allowed, where the privately-developed distributed solar is situated elsewhere and the energy is transported to the demand location via an agreement with the grid operator.

State-run power and grid operators show some hesitancy in encouraging a similar expansion of prosumerism as seen elsewhere. Distributed generation does present challenges for managing grid stability and utility income, but can be an efficient way to increase renewables expansion and reduce peak demand.

Wind

While solar power is the obvious renewable energy solution for the region, wind is also beginning to pick up. Oman, Egypt, Morocco and Turkey have the highest wind resources, particularly for offshore wind. Turkey and Egypt already have significant wind capacities at 13 GW and 2 GW respectively, out of a regional total of 19 GW. Gulf countries further from the Indian Ocean have lower wind speeds, but Saudi Arabia has a significant onshore wind project pipeline of 3 GW due to come online before the end of the decade.

Wind power has had a slower start than solar because project development is more expensive and more complicated, and the low existing baseline makes rapid expansion more challenging due to limited expertise.

New wind projects in North Africa and GCC

Total wind additions (GW)

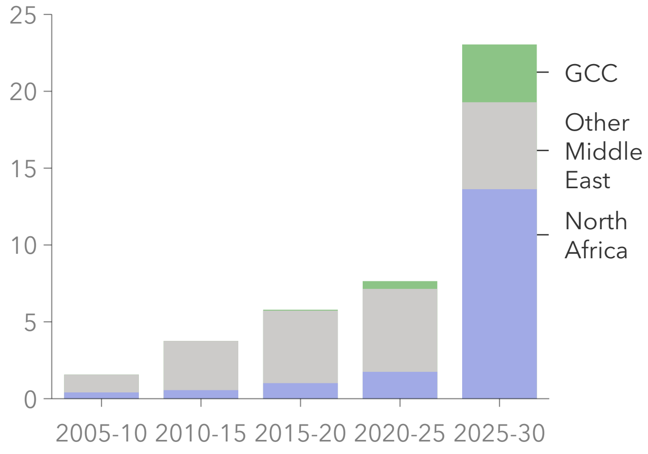


FIGURE 2.5 | Historical data source: Rystad (2025)

Wind resources in the region are generally more variable that in established wind power regions such as Northern Europe and South East Asia. Onshore wind's LCOE is currently only 8% higher than that of solar PV so we expect that as the project pipeline and expertise builds, the capacity will grow considerably, picking up particularly into the 2040s as factors accumulate and the LCOE of fixed offshore wind also declines.

We expect total installed wind capacity to triple every decade between 2020 and 2060. All wind capacity is currently onshore, but we do expect offshore wind capacity additions to begin in the early 2030s in Egypt and Oman. From the mid-2030s, around 10% of installed capacity will be offshore, including 2% floating offshore wind from the mid-2040s.

Onshore wind turbines in particular are also challenged by the desert heat and dust and require updated designs and maintenance regimens. The effect on efficiency is lower than for solar panels, in the region of 1-3% (Al Khayat et. al., 2021).

Wind power's time of generation is complementary to that of solar power, both diurnally and seasonally. Wind speeds are typically higher during the night, particularly in desert regions, which, coupled with daytime solar power and battery storage flexibility, can provide a baseline of renewable energy. Additionally, coastal monsoon winds are higher from May to September, aligning well with peak summer cooling demand.

Wind growth accelerates post 2040

Installed wind capacity (GW)

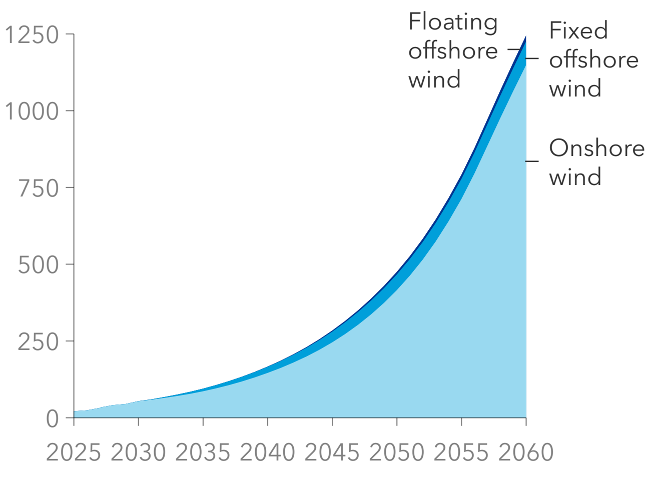


FIGURE 2.6 | Historical data source: GlobalData (2025)

4 SUPPLY CASE

Ibri III; 500 MW solar in Oman

The Ibri III Solar Power Plant is located in Al Dhahirah Governorate, some 300 km west of Muscat. It is Oman's first large-scale utility solar+storage project and a cornerstone of the country's renewable energy strategy.

The Ibri II Solar Plant was commissioned in 2021 and has an installed capacity of 500 MW. The plant covers 13.8 km² and is equipped with 1.5 million solar panels. It produces approximately 1,600 GWh annually, enough to power 40,000–50,000 homes and avoids 340,000–800,000 tonnes of CO_2 emissions per year.

The project is under development to expand with the Ibri III Solar & BESS Project which will have 500 MW solar capacity and a 100 MWh battery storage system, scheduled for commercial operation in Q1 2027. It will cut 505,000 tonnes of CO_2 annually and contribute 4% to Oman's renewable energy mix. The projects use advanced PV modules and single-axis tracking systems, supported by robotic cleaning to maintain efficiency in harsh desert conditions.

The Ibri projects represent investments of USD 400mn (Ibri II) and USD 300mn (Ibri III). They support Oman Vision 2040, aiming for 30% renewable energy by 2030 and net zero by 2050. These projects enhance energy security, attract foreign investment, create jobs, and diversify Oman's economy away from hydrocarbons.

5 SUPPLY CASE

Distributed solar in Jordan and Bahrain

Jordan has emerged as a regional leader in distributed solar adoption, driven by progressive regulations and high electricity costs. The Renewable Energy and Energy Efficiency Law (2024) introduced four on-grid mechanisms: Wheeling, Net Billing, Zero-to-Grid, and Buy-All/Sell-All, with wheeling being the most transformative.

Wheeling allows consumers – especially industrial and commercial entities – to procure solar PV systems off-site and transmit electricity through the national grid to offset their consumption. This model has enabled large-scale projects like the Madonah PV Plant (100 MW), designed to reduce energy costs for 87 industrial entities, and corporate systems such as the Jordan Islamic Bank's 2.7 MWp wheeling project. Wheeling supports land-use flexibility and energy independence, while incentivizing private investment in renewables. Jordan's distributed solar sector is further supported by dynamic tariffs and time-of-use pricing, encouraging daytime consumption when solar generation peaks.

Bahrain's distributed solar initiatives are primarily focused on rooftop PV systems for residential, commercial, and government buildings under its National Renewable Energy Action Plan (NREAP). The country targets 5% renewable energy by 2025 and 10% by 2035, with distributed solar playing a key role. Pilot programs include installations on schools, hospitals, and industrial facilities, supported by net metering and attractive financing schemes. These efforts aim to reduce reliance on natural gas, cut emissions, and diversify Bahrain's energy mix.

6 SUPPLY CASE

Zafrana; wind repowering in Egypt

The Zafrana wind farm, located on the Gulf of Suez, about 130 km southeast of Cairo, was originally commissioned between 2001 and 2010 in eight phases, with a total installed capacity of 545 MW. It was one of the first large-scale wind projects in the Middle East and North Africa and a milestone in Egypt's renewable energy journey.

As the existing turbines approach the end of their operational life, Egypt plans to repower Zafrana into a hybrid renewable energy facility combining 1.1 GW of wind power and 2.1 GW of solar PV, totaling 3.2 GW. This will be Egypt's first project to integrate both technologies at scale. The initiative is led by TAQA Arabia and Voltalia, under a memorandum of understanding with the Egyptian Electricity Transmission Company (EETC) and the New and Renewable Energy Authority (NREA).

Technical and environmental studies – including wind speed analysis, solar irradiation, bird migration, and geotechnical surveys – are underway, with completion expected by end of 2025. The first commissioning phase is targeted for 2028.

The repowered Zafrana site will generate over 2,300 GWh annually, enough to power 300,000 homes, while avoiding 1.1 million tonnes of CO_2 emissions per year. This project supports Egypt's Integrated Sustainable Energy Strategy 2035, aiming for 42% renewable energy by 2030, and aligns with the NWFE initiative to replace thermal generation with clean energy.

In the Gulf, the pace of adoption of distributed solar is accelerating thanks to increased cost savings of solar and battery storage. Our customers are choosing distributed solar through power purchase agreements or solar lease model across the UAE, Saudi Arabia, Qatar, Oman, and Bahrain. This approach delivers long-term price certainty, supports sustainability objectives, and helps future-proof their energy strategy. *Jeremy Crane, Group CEO of Yellow Door Energy*

Siting of wind projects needs to be more resource specific than solar and often further from cities and other demand centres. This adds some development complexity and necessitates grid availability and potentially expansion. As with solar, permitting and financing in GCC regions is straightforward when projects align with state ambitions and in the wider regions where procurement systems such as FIDs are well established.

Nuclear & hydropower

In 2024, nuclear power generated 1.6% of MENA's electricity. Given the strong project pipeline and supportive policies in key countries, we expect generation to nearly triple by 2034 and triple again by 2060. Currently, only Iran and the United Arab Emirates have nuclear capacity, the latter seeing a rapid expansion since 2020 to 5.3 GW in 2024. The country is targeting a 6% share of electricity generation by 2050, regionally we expect 3.5% in the same year. Egypt, Jordan, Saudi Arabia and Turkiye also have active plans to establish nuclear power, of these, only Turkiye and Egypt's first nuclear plants are at an advanced stage.

Several countries, including Jordan and Saudi Arabia may choose to wait and purchase small modular reactors (SMRs) instead of building conventional reactors; it remains unclear when SMRs will be available commercially, but certainly not before 2030.

Hydropower is currently the most significant renewable resource in the region, generating 5% of electricity demand in 2024. Nearly every country in the region has,

has had or plans to have hydroelectric power, but the largest capacities are in Turkey and Egypt. We expect the generation to remain stable while the share decreases owing to increasing total electricity supply. By 2060 only 2% of electricity will be from hydropower.

Nuclear pipeline is strongest in Middle Eastern countries outside of the GCC

Nuclear capacity and installations (GW)

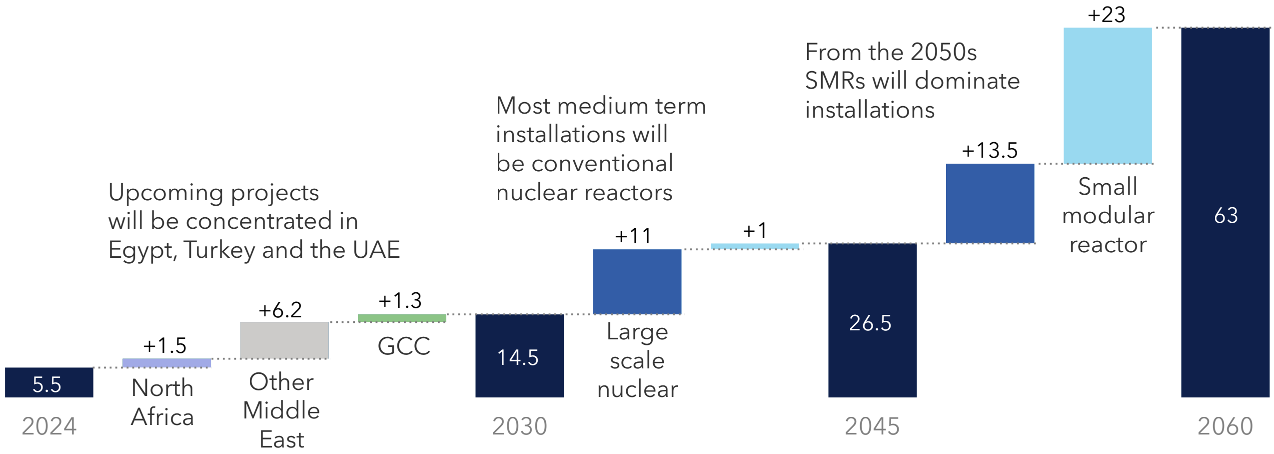


FIGURE 2.7 | Historical data source: GlobalData (2025)

3 GRID, STORAGE & FLEXIBILITY

Unlike in other regions, the grid system in the Middle East and North Africa will not slow new demand or supply development over the next decade, but grid build-out must continue to prevent bottlenecks further into the future.

Grid

The grid system in the Middle East is relatively modern in most areas, particularly the Gulf where electricity systems were established towards the end of the 20th century. However, similarly to most grids, it was designed to transport and distribute power from large gas power plants to cities and industrial zones. It was not designed for variable renewable generation, distributed generation or power storage, which will all play a significant role in the modern power system.

Transmission and distribution lines have grown 24% over the past decade, but we expect this growth to double over the next decade and grow a further 52% to 2034. While previous growth has been in line with the global average, future growth will be substantially higher.

Regional interconnectors have long been in use, and their usage is increasing with variable renewable generation (Figure 3.1). There are plans to build additional interconnectors to Europe via Greece and Spain to export power, and less mature plans to export power to the Indian sub-continent. In addition to the interconnectors, the Pan-Arab Electricity Market is an ongoing initiative to establish a common electricity market to enable cross border trade of electricity resources and expand flexibility.

Unlike almost all other regions, MENA has so far been less impacted by grid bottlenecks, both in terms of grid expansion and in project connection. Towards 2035, we expect that installed solar capacity will not be affected by grid bottlenecks and installed wind capacity will be 4% lower than without bottlenecks. This compares with a 16% reduction in solar capacity and an 8% reduction in wind capacity in Europe due to bottlenecks across that region. The near-absence of bottlenecks in MENA is mainly because renewables expansion is still at a relatively early stage, but as the region lacks domestic production for key components it still faces some supply chain delays.

Existing and proposed interconnections by 2035

Unit: MW

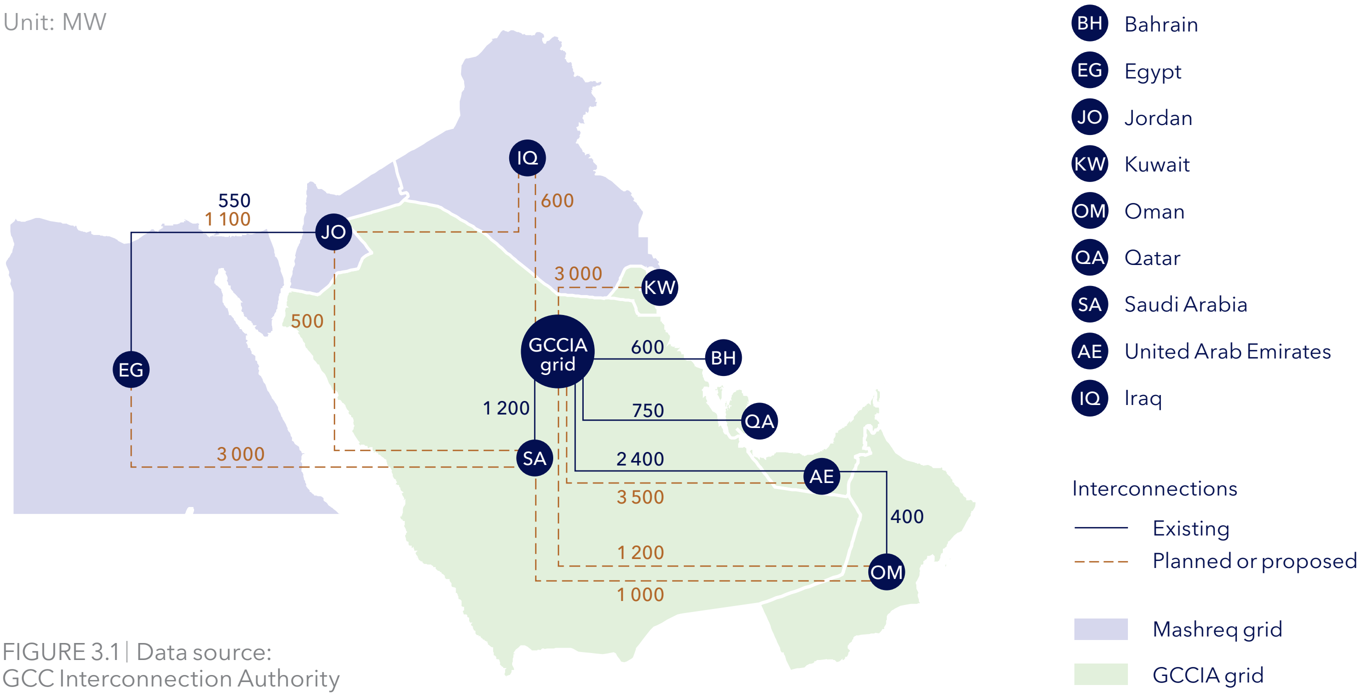


FIGURE 3.1 | Data source: GCC Interconnection Authority

1 GRID CASE

GCCIA

The Gulf Cooperation Council Interconnection Authority (GCCIA) owns and operates a regional high voltage transmission network, playing a crucial role in safeguarding energy security of its members and supporting sustainable development of the electricity supply. All six GCC member states are also members of the GCCIA. The present GCCIA network includes more than 900 km of 400 kV overhead lines, 50 km of submarine cable, seven 400 kV substations and the world's largest back-to-back high voltage direct current (HVDC) system.

In addition to facilitating market-driven power flows, GCCIA enables the sharing of operational reserves between its members, reducing CAPEX and OPEX costs as well as carbon dioxide emissions. Thanks to the flexibility provided by GCCIA, fewer dispatchable power stations, typically fossil-fired, are required compared to states acting alone. As the proportion of electricity generation from variable renewable energy in the region increases, the benefits of providing access to the least-cost generation and sharing emergency resources will become increasingly important. Up to March 2025, there were 2,800 instances of support provided via GCCIA, 50 of which are associated with renewable energy fluctuations.

An extension of the GCCIA network to Iraq is due for completion in Q2 2026. The transmission capacity from GCCIA to Iraq will be approximately 600 MW, potentially saving up to USD 175mn per year compared to locally produced power. Another project in planning is to increase the transmission capacity to UAE from 2,400 MW to 3,000 MW by Q1 2027. GCCIA is also planning to establish a direct connection to Oman with new 400 kV overhead lines, rather than connecting via the UAE network at 220 kV. In the longer term, GCCIA is exploring opportunities to extend its network with potential links to neighbouring countries such as Jordan, Egypt, and possibly, Syria.

The 1,800 MW back-to-back HVDC converter station at Al-Fadhili is a key component in the GCCIA network, providing fast and reliable controllable active power flow in response to emergency conditions and the capability to trade energy between grids operating at different frequencies. The control and protection equipment is undergoing a refurbishment, due for completion in 2026. In addition to the overhead lines and substations included in GCCIA's plans for the connection to Oman, the project relies upon a static synchronous compensator (STATCOM) to ensure grid stability. The STATCOM will also support the HVDC system.

Fossil flexibility replaced by battery storage

Short-term flexibility by technology (GW)

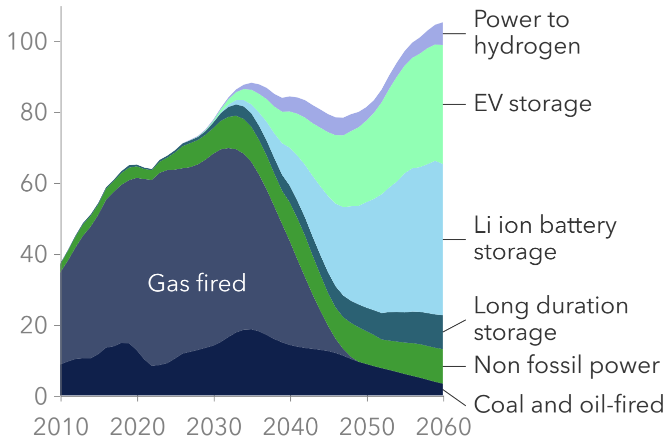


FIGURE 3.2 | Long duration storage includes pumped hydro storage.

Storage and flexibility

The Middle East and North Africa currently has only 36 GWh of storage capacity, just 1.4% of global capacity. Storage capacity will grow alongside projected growth in renewable generation to maintain grid stability and flexibility. We expect capacity to grow 10-fold to 2030, 100-fold to 2045 and reach 9500 GWh by 2060, by then 12% of global capacity.

Storage in the region is currently split between a marginal majority of pumped hydro and Li-ion co-located with solar PV. Already by 2025, co-located storage will overtake pumped hydro and will expand to 70% of storage by 2026. The share will gradually decrease even as capacity grows as long duration storage, standalone Li-ion and vehicle-to-grid storage increase, reaching a combined 45% of storage capacity by 2060.

Chinese production of Li-ion storage has brought down prices and is enabling installations. The size of batteries is also increasing, as seen in both utility and co-located projects and the duration of power provided is increasing in-line with the sizes, from 2-hour power provision dominating to 4 hours.

Thermal power plants currently provide 94% of short-term flexibility in the power system, but this role will gradually be replaced by battery storage, which also has a quicker response time. By 2045, batteries (including utility, co-located and EV vehicle-to-grid) will supply over half of short-term flexibility, the region reaches this milestone two years earlier than the world collectively.

MENA has a high peak to residual electricity demand ratio owing mainly to space cooling, which comprises half of peak electricity demand (IEA, 2025). Some of MENA's fastest growing demand sources; space cooling, desalination and EVs can be efficiently used in demand response programs to spread peak demand and benefit from peak solar supply. Improvements in AC unit and building efficiency can cool spaces better with less energy and store cooler temperatures for longer. Desalination plants can be ramped up during peak production and store excess water. EVs can function as batteries with vehicle-to-grid technology if smart charging is implemented.

> MENA's fastest growing demand sources can be efficiently used for demand response.

2 GRID CASE

Hatta Dam; pumped hydro storage in the United Arab Emirates

DEWA is the owner of both grid and electricity generation in Dubai and started building the Hatta Dam in 2019. It has been operational since early 2025 and takes advantage of surplus solar energy. This involves that transfer of surplus electricity from the Mohammed bin Rashid Al Maktoum Solar Park, or other solar parks, to Hatta to be stored as potential energy by pumping water to the higher reservoir of the dam. The water is released to the lower reservoir during peak demand hours, and together with frequency regulation, generates revenue for DEWA. The expected lifetime of the project is 80 years.

The lower reservoir is an existing hydropower dam, with the new reservoir constructed 150 m higher up. The storage capacity is 1500 MWh, implying a 6-hour delivery of power at the full capacity of two turbines at 125 MW each. In addition to this, the grid owner can draw on the existing hydropower dam to provide even more hydropower should peak loads require it.

Turnaround efficiency is close to 80% which has been found viable for this project. Ongoing improvements and cost reductions for battery storage will sharpen the competition for pumped hydro when considering future pumped storage projects.

4 ENERGY DEMAND

Primary energy in the MENA region will continue to be dominated by fossils well into the future: annual consumption of fossils in 2060 (48 EJ) will be only 15% lower than today (56 EJ). However, the rise of renewables curbs the increased use of fossils, especially after 2040 when fossils peak (64 EJ).

Energy demand will increase throughout forecast

Energy demand by carrier (TWh/yr)

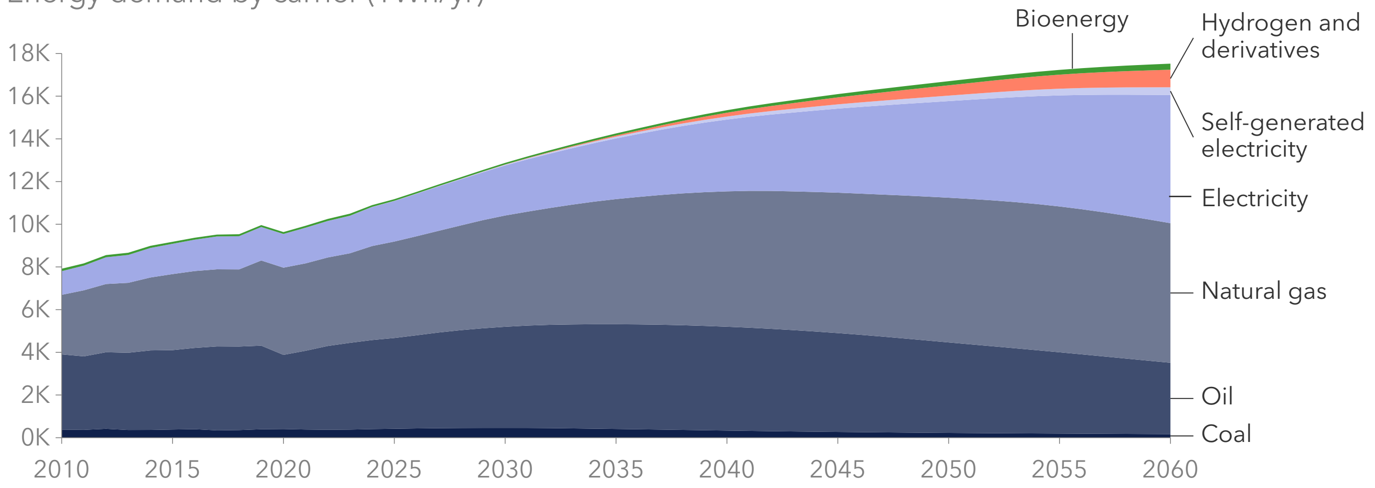


FIGURE 4.1 | Historical data source: IEA WEB (2025)

1 DEMAND CASE

Decarbonizing aluminium production and expanding renewable and clean energy development in Abu Dhabi

Today, generating the electricity required accounts for the majority of the global aluminium industries green-house gas emissions. Emirates Global Aluminium, TAQA, DUBAL Holding and EWEC are taking a major step to decarbonize EGA's aluminium production and expand renewable and clean energy development in Abu Dhabi.

EGA is selling its captive natural gas-fired power plant at Al Taweelah to TAQA and DUBAL Holding, and these engines are becoming part of the grid fleet. The plant will provide flexible power supply, supporting the continued integration of renewables and clean energy into the Abu Dhabi grid.

To meet its electricity needs, EGA has signed Abu Dhabi's largest-ever electricity supply agreements with EWEC and TAQA distribution, becoming the largest single grid customer. These agreements provide an increasing share from renewable and clean energy sources as EWEC's transformative solar electricity generation projects come online. EGA's power demand supports EWEC's continued optimization and utilization of solar generation assets.

EGA will vastly increase the proportion of its production that is CelestiAL solar aluminium and MinimAL low carbon aluminium produced using nuclear power to as much as almost half of EGA's total primary aluminium production by the end of 2028, depending on market demand.

CelestiAL solar aluminum. Photo: EGA

The share of fossils in the primary energy mix (incl. fossils used for electricity generation) reduces from 96% in 2024 to 59% in 2060, see Figure 4.1. It is in electricity generation that renewables are growing: the share of wind and solar in the power mix grows from 6% in 2024 to 85% in 2060 (and, correspondingly, the fossil share drops from 86% to 8%), Figure 4.2 shows how this change occurs over the forecast period. Over the same period, electricity generation grows by 280% and the split of this generation growth is shown already in figure 2.1 whereas the split of the demand increase is shown in Figure 4.3.

Fossils will supply 56% of total energy demand in MENA in 2060.

Renewables dominate electricity by 2060

Electricity generation (TWh/yr)

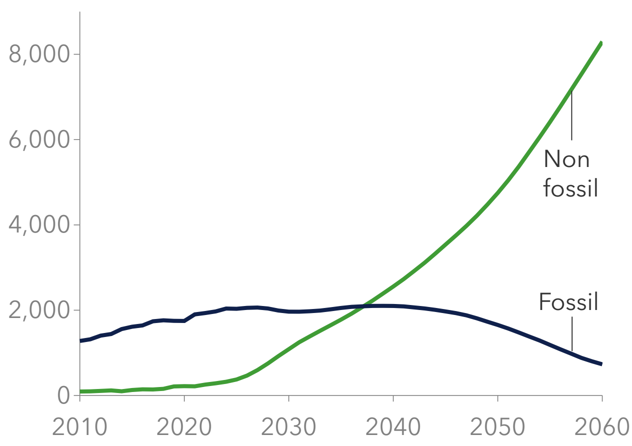


FIGURE 4.2 | Historical data source: IEA WEB (2025)

2 DEMAND CASE

Desalination in the United Arab Emirates, Saudi Arabia and Jordan

Desalination is a critical driver of electricity demand in the MENA region, where water scarcity and population growth necessitate large-scale projects. These new projects employ reverse osmosis (RO), which is significantly more energy-efficient than thermal (often fossil-based) methods, thus contributing to the green transition. Drivers include water security, decarbonization, and economic diversification.

The Al Taweelah RO IWP in Abu Dhabi is the world's largest reverse osmosis plant, producing 200 million imperial gallons per day (MIGD). Developed by ACWA Power and EWEC, it began operations in 2023 and integrates solar PV to offset part of its energy needs, reducing carbon intensity compared with thermal desalination. The plant operates under a 30-year purchase agreement (WPA) and consumes over 900 GWh annually, with solar expected to cover up to 55% of demand during its lifecycle.

Similarly, Hamriyah IWP in Sharjah, also led by ACWA Power, will deliver 410,000 m³/day using RO technology, with commercial operation expected in 2028. The project is backed by SEWA under a 30-year WPA and will consume approximately 3.2 kWh per m³, reflecting efficiency gains over thermal desalination.

In Saudi Arabia, the Jubail 3B IWP is a flagship project under Vision 2030. With a capacity of 570,000 m³/day, it is developed by an ENGIE-led consortium and incorporates 61 MW of solar PV, making it one of the most sustainable desalination plants globally. Electricity is sourced via a hybrid model: grid supply complemented by dedicated solar generation; supporting KSA's target of 50% renewable energy by 2030. The project operates under a 25-year WPA with SWPC, and its tariff is among the most competitive globally at $0.42/m³.

Jordan's Aqaba-Amman Water Conveyance Project further illustrates the growing trend of coupling desalination with renewable energy. Designed to deliver 851,000 m³/day and pump water through a 445 km pipeline, it will require 300 MW of solar PV to power its operations. Scheduled for completion in 2029, this project addresses acute water shortages while aligning with Jordan's renewable energy ambitions.

Ownership structures are typically PPP models, combining public authorities with private developers like ACWA Power and ENGIE. Electricity demand is substantial, with Al Taweelah alone consuming over 900 GWh annually. While most plants draw from the grid, future procurement strategies are increasingly favouring renewables with dedicated solar installations becoming common.

While electricity greens very impressively, it must be noted that electricity will cover only 34% of the total regional energy demand by 2060. That share is among the lowest electrification rates across all regions: ahead of only Sub-Saharan Africa and North-East Eurasia at the low end of regional electrification.

Manufacturing

In MENA, energy demand for manufacturing grows 56% from now to 2060. Natural gas is the main energy carrier covering this growing energy demand; its direct share increases from 56% to 62%. In addition, the indirect role of gas (via electricity generation) will remain significant all the way through to 2060, when gas will still be 8% of the energy mix. The demand for electricity in manufacturing will grow 130% but fossil-free electricity will still provide only 23% of the total manufacturing energy demand.

Among the manufacturing subsectors, the heaviest energy draw comes from base materials, requiring a stable 26-28% of manufacturing energy demand in the period. In the iron & steel subsector production will grow in the near term but then stabilizes until the early 2040s when production will start to grow again but only based on increased production from scrap metal. Following this, energy demand for iron & steel peaks in 2030 and stabilizes around 2045 . The region's high share of production by EAFDRI, 75% in 2045, facilitates use of hydrogen in the metal reduction to the extent that hydrogen will contribute with more than one third of the energy demand in 2050. Hydrogen's share will then be at the same level as natural gas where the share will have shrunk from 60% in 2030.

Desalination

In ETO we do not directly model the energy demand for desalination, but for the gulf countries desalination requires a significant share of the energy demand. As an example, 6% of the electricity consumption in KSA today is used for water desalination (World Bank, 2024) with most of the plants using fossil-based thermal methods. KSA has an ambition (Economy Middle East, 2025) to reduce energy intensity in this process by 30% (2019 to 2030) through a broader implementation of reverse osmosis (RO) plants. At the same time, water consumption in the GCC countries combined could grow up to 45% the next ten years (Aliewi, 2025) . Such growth increases the total energy demand beyond the efficiency gains achieved by the technology shift. However, the switch to electrically powered RO and the reduced grid emission factor of the electricity supply will reduce emissions due to desalination.

Buildings

We find that energy demand for buildings more than doubles from today to 2060 (Figure 4.4). This includes electricity growing from 1,100 TWh to 3,400 TWh (with AI centres included). Distributed solar will provide 10% of this electricity, helping to alleviate grid loads.

Rising electricity demand across all sectors

Change in annual electricity demand (TWh/yr)

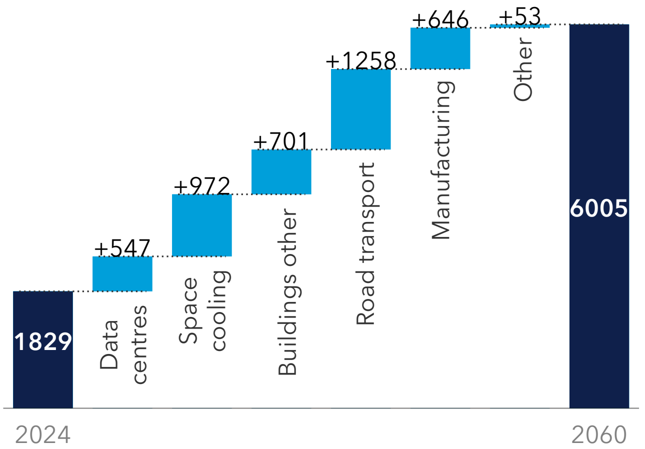


FIGURE 4.3 | Numbers may not sum due to rounding. Other also includes non-road transport demand.

EMSTEEL's 2024 decarbonization strategy targets a 40% reduction in steel emissions and 30% in cement by 2030, relative to its 2019 baseline, driven by energy-efficient technologies, 100% clean and renewable electricity, and a transition to alternative fuels. These actions are considered the backbone of EMSTEEL's pathway to Net Zero by 2050, fully aligned with the UAE's national target.

The strongest demand growth comes from cooling adding close to 1,000 TWh. Following that are AI/data centres where energy demand grows 550 TWh, or some 25% of the total electricity growth within buildings.

Cooling

Cooling consumes 9% (260 TWh) of the energy demand in buildings today. This includes residential and commercial buildings but does not include cooling needs of AI-/data centres (see below). Cooling needs will grow due to a rising, increasingly prosperous, population and expanding floorspace, coupled with a climate change-driven rise in the number of cooling degree days. As a result, MENA cooling demand grows to 21% (1,240 TWh) of buildings energy demand by 2060. Increased implementation of district cooling will lead to some energy optimization but also scaling of cooling, producing complicated effects that we have not modelled closely.

AI/Data centres

DNV has, since 2024, begun to model data centres as a distinct subcategory of energy demand. The global numbers show a steady growth of energy demand from data centers up to 2060, ending at 13% of the global energy demand from buildings. There are big regional differences with the highest share in North America (24%) and the lowest in Sub-Saharan Africa (5%). In 2060, the average for MENA is 9%, amounting to 563 TWh (Figure 4.5). That implies enormous growth from the present demand of 15 TWh/yr, rising to 150 TWh/yr in 2040, before rapid acceleration thereafter. Given the stated ambitions and project pipelines, we believe that the lion's share of this consumption will take place in the gulf countries. Our model results indicate an additional electricity supply, for gulf countries, of more than 100 TWh in 2040 and more than 400 TWh (of 540 TWH in MENA) in 2060.

Appliances and lighting

The combined increase in living standards and population growth results in a doubling of MENA energy demand for appliances and lighting, rising to 1,900 TWh for the MENA region in 2060 as more people will buy not only more appliances but an ever-increasing range of appliances.

Transport

Road transport is the dominant demand sub-segment for transport in MENA, at around 80% of transport energy demand throughout our forecast period. The uptake of EVs is at 4% of new passenger vehicles sale today, and over the next 20 years will climb to 90% as indicated in Figure 4.6. This progression may vary in the gulf countries, which we have not modelled separately. Higher GDP/capita in the gulf could drive a faster uptake of clean tech in transport; conversely, subsidies on petroleum products works against the change.

We observe many initiatives on railways in the region but find that they have marginal effect on the total regional demand, at only 0,2% of transport energy demand throughout the period.

Buildings energy demand doubles by 2060

Buildings energy demand (PJ/yr)

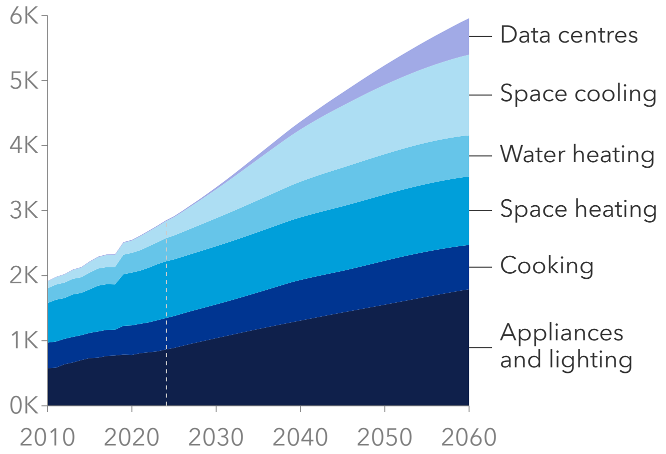


FIGURE 4.4 | Dashed line represents 2024. Historical data source: IEA WEB (2025)

AI energy demand grows rapidly

Data centre energy demand (TWh/yr)

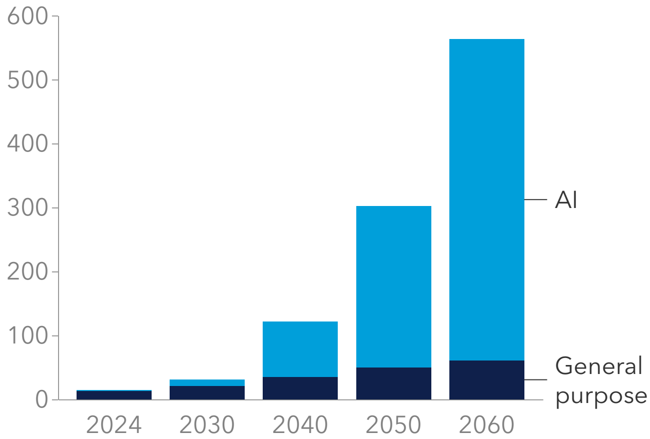


FIGURE 4.5 |

3 DEMAND CASE

AI/Data centres in the United Arab Emirates, Saudi Arabia and Jordan

The rapid expansion of AI and cloud services is driving unprecedented electricity demand in many regions, including MENA. In the UAE, Khazna Data Centers is leading hyperscale development, targeting 1 GW of IT load by 2030 across multiple countries. Its facilities integrate solar PV and biofuel backup systems, with renewable PPAs signed through EWEC to ensure low-carbon sourcing. Similarly, G42, in partnership with Microsoft, is building a sovereign AI cloud infrastructure in Abu Dhabi, adding 200 MW of capacity. The project leverages long-term renewable PPAs and advanced cooling technologies to reduce energy intensity.

In Saudi Arabia, Humain and DataVolt are developing AI-focused data centers with a pipeline exceeding 1 GW, supported by partnerships with NVIDIA for high-performance computing. These facilities are designed to source electricity from dedicated solar and wind farms, aligning with Vision 2030's decarbonization goals. Morocco is positioning itself as a regional AI hub through the Tetouan AI Campus, a $500 million investment expected to deliver 386 MW of IT load by 2026. Electricity will be sourced from Noor Solar Complex and Koudia Wind Farm, ensuring a near-zero carbon footprint. The project reflects Morocco's ambition to attract global tech firms while leveraging its renewable energy leadership.

These developments employ liquid cooling and AI-driven energy optimization, improving power usage effectiveness. Drivers include sovereign AI strategies, cloud adoption, and economic diversification. Ownership is primarily private, but projects often involve strategic partnerships with public entities for land and grid access. They could also benefit from government incentives for digital infrastructure and renewable integration. Electricity procurement relies on renewable PPAs and hybrid models, signaling a shift toward sustainable digital infrastructure. The competitiveness of all the projects will hinge not only on sustainable energy content and cost, but also innovation, e.g. the use of curtailed or stranded energy sources, or the synergistic use of waste heat to drive co-located desalination.

EVs dominate in car sales by 2035

Share of EVs and PHEVs in passenger vehicles

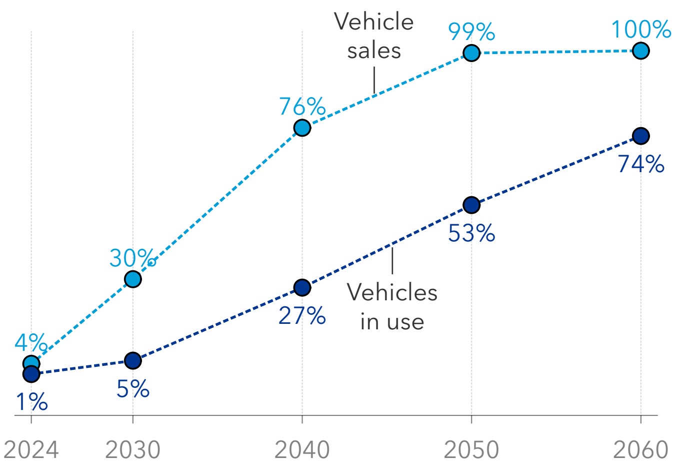


FIGURE 4.6 |
Historical data source: IEA Global EV Outlook (2025)

4 DEMAND CASE

Battery manufacturing for EVs in Saudi Arabia and Morocco

Morocco and KSA

Surging EV adoption is transforming industrial electricity demand across the MENA region, driven by large-scale battery gigafactories and lithium processing facilities. In Morocco, Gotion High-Tech is investing $6.4 billion in a gigafactory in Kenitra, designed for 20 GWh annual demand, scaling to 100 GWh by 2030. To power this facility sustainably, ACWA Power will develop a 500 MW wind farm and a 2,000 MWh battery storage system, representing an $800 million investment dedicated to the gigafactory's operations. This renewable-plus-storage solution ensures near-zero carbon electricity supply and positions Morocco as a strategic supplier for Europe under the EU Battery Regulation.

Beyond gigafactories, the EV supply chain is expanding into lithium processing, adding significant electricity demand. In Saudi Arabia, EV Metals Group (EVM) is developing a Lithium Chemicals Plant in Yanbu, with an initial capacity of 50,000 tonnes per annum (tpa) of lithium hydroxide, scaling to 150,000 tpa by 2030. The facility will secure power allocations from the Saudi Ministry of Energy and integrate renewable energy where feasible, supporting Vision 2030's industrial diversification. Similarly, in the UAE, Titan Lithium is investing $1.36 billion in a processing plant at KEZAD, Abu Dhabi, spanning 290,000 sqm and designed to process 150,000 tonnes of lithium annually. This project will rely on grid electricity supplemented by solar PPAs, reinforcing the UAE's ambition to become a regional EV hub.

These projects represent a hybrid demand-supply model: while primarily demand-side, they increasingly integrate dedicated renewable generation and storage to meet sustainability targets. A single 40 GWh gigafactory can consume hundreds of GWh annually, mainly for electrode processing and cell assembly. Drivers include global EV adoption, European regulatory pressure, and national decarbonization strategies. Ownership is private, but various fiscal and operational incentives in the form of land allocation, tax breaks, access to favourable financing and state involvement are all critical enablers. By coupling advanced battery technology and lithium processing with renewable sourcing, Morocco, UAE, and KSA are positioning themselves as competitive players in the global EV supply chain while contributing to the green transition.

> The key is strategical positioning in the global supply chain for green transition by EV, clean hydrogen and other.

5 **DEMAND CASE**

NEOM; hydrogen production from dedicated renewables in Saudi Arabia

The NEOM Green Hydrogen Project is designed to be the world's largest clean hydrogen and ammonia facility. Located in Oxagon, the industrial hub of NEOM on the Red Sea in northwest Saudi Arabia, the project will use around 4 GW of dedicated solar and wind to power 2.2 GW of electrolysers, producing up to 600 t/day of clean hydrogen, converted into about 1.2 Mt/year of clean ammonia for export. The project, at a total value of USD 8.4 billion, is being financed with USD 6.1 billion non-recourse financing from 23 local, regional and international banks and financial institutions.

Construction reached roughly 80% completion in early 2025, with full completion targeted by Q4 2026 and commercial operations and ammonia exports expected from Q1 2027. The scheme is fully export-oriented, with ammonia offtake under a 30-year long-term contract to Air Products, effectively de-risking merchant price exposure while enabling competitive delivered costs to European and Asian markets. The project is clearly supply-driven and relies on dedicated generation rather than grid-connected renewables, which is central to its additionality and credentials for clean production. In other words, additional local energy demand to provide clean hydrogen for export and use.

NEOM's plant integrates proven alkaline electrolysis (thyssenkrupp nucera), large-scale air separation, ammonia synthesis and dedicated renewables and grid infrastructure, demonstrating how commercially bankable technologies can be deployed at unprecedented scale to drive down LCOH and accelerate the green transition. For Saudi Arabia and the NEOM developers, the project supports Vision 2030, diversifies export revenues beyond oil, creates a new industrial value chain and avoids up to 5 $MtCO^2$/year compared with grey alternatives.

The key project drivers are first-mover advantage in global clean ammonia trade, leveraging exceptional solar and wind resources and access to large tracts of land and competitive capital. The joint-venture structure involves predominantly private-sector actors, although NEOM itself is ultimately backed by Saudi sovereign capital, sitting at the intersection of public and private interests.

Oxagon, the industrial hub of NEOM on the Red Sea in Saudi Arabia.

5 POLICY

This report explores the greening (via renewable generation) and growth (existing and new sources of demand) of electricity supply in the Middle East and North Africa, with a particular focus on Gulf countries. From a policy perspective, our main finding is that policies are more clearly defined and executed on the supply side of the equation than on the demand side.

Supply-side policies are derived from the NDC pledges on the renewable share of grid electricity generation as shown in Figure 5.1. UAE targets 14-20 GW capacity and 30% of electricity from clean sources by 2030. For UAE, the implied growth in renewables to match the NDC targets is feasible but demanding, requiring stronger growth than is presently the case (IRENA, 2024). The KSA targets include 50% of electricity from renewables by 2030, requiring 130 GW of installed capacity. At present, renewables in the KSA are growing strongly. In 2025, an

Net zero and related targets in the Gulf region

Country	Net-Zero	Renewable energy	Emission reduction
Jordan	N/A	**31%** of electricity, **14%** in the energy mix, **50%** in electricity capacity by 2030	**31%** emission reduction relative to BAU by 2030
Kuwait	2060	**30%** of peak load by 2030, **40%** by 2040, **50%** by 2050	GHG reduction of **7.4%** by 2035 compared to BAU
Bahrain	2060	Solar & wind capacity of **255** MW by 2025 and **710** MW by 2035, reach **20%** of energy mix by 2035	**30%** GHG reduction by 2035 relative to BAU
Qatar	N/A	**18%** of electricity and **4** GW of capacity by 2030	**25%** GHG reduction by 2030 relative to BAU
United Arab Emirates	2050	Federal: **30-32%** (14-20 GW) by 2030 and **44%** by 2050 Dubai: **25%** by 2030, **75%** by 2050	**23.5%** by 2030, **60%** by 2040, **100%** by 2050 (vs 2019). Also **47%** by 2035 per NDC update
Egypt	N/A	**42%** renewable electricity by 2040	N/A
Saudi Arabia	2060	Expand solar to ~**130** GW by 2030, **50%** of electricity by 2030	**278** $MtCO_2eq$ reduction by 2030 relative to BAU
Oman	2050	**30-40%** of electricity by 2030, **60-70%** by 2040, **100%** by 2050	**21%** GHG reduction by 2030

Targets
- Net-Zero
- Renewable energy
- Emission reduction

— GCC countries

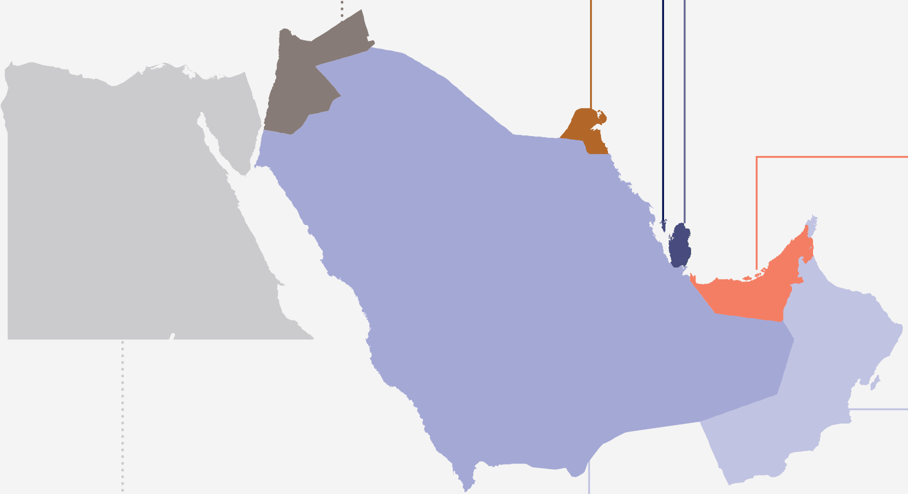


FIGURE 5.1 |

agreement was signed for a megaproject comprising 7 portfolio projects of wind and solar, reaching a cumulative 15 GW installed capacity. The use of tenders, tax-related exemptions, and allocation of government-owned land all help trigger megaprojects. Even so, the ambitious 2030 goal will require even bigger commitments in the next few years, as described by IRENA. Our ETO results find that one third of the electricity generation in the MENA region will come from renewables by 2035. That strong growth will put additional pressure on the grid and new investment in the grid, particularly within the GCC countries, will be needed from 2035 onwards. The oil-rich countries have the financial capacity to progress faster than the regional average. However, we see equally strong ambitions in other MENA countries: Jordan aims for a renewable electricity share of 50% by 2030, Morocco for 52% by 2030, Turkey for 65% by 2035, and Egypt for 42% by 2040. ETO results for MENA, see Figure 5.2, indicates that in the long run MENA will overshoot present targets.

Change and transition in energy demand

While renewable generation benefits widely from policies such as subsidies, tax incentives, land access, and so on, policies stimulating demand for clean energy are sparser across the region (San Filippo, 2024). Europe and China are examples of regions using a carbon price to push for lower emissions. Bahrain decided early in 2025 to implement a carbon tax, becoming the first country in the Gulf region with such an initiative (Zawya, 2025). The tax is mentioned in the coming state budget, but its fiscal effects are not quantified. In nearby Turkey, an Emissions Trading System (ETS) is set to be introduced in 2026, covering 44% of emissions (from the energy and manufacturing sectors). Indirectly, emissions from industries in the Gulf region will need to comply with regulatory frameworks outside of the region, like CBAM (EU) that require, for example, lowered carbon footprints for metals exported to Europe. Compliance may be achieved via renewables PPAs for the industrial actor to document a cleaner supply chain for its electricity.

Demand response schemes are generally not in place for buildings and industry across MENA (Ren21, 2025ab). The vertical integration of the power sector ensures operational stability but have had limited interest of facilitating demand response to optimize grid utilization, steer demand and incentivize additional generation (KAPSARC, 2025). Further roll-out of renewables can be achieved by modifying these rigid models to be more dynamic (eg. hourly price signals and acceptance of distributed PV to sell to the grid. Another aspect is approval processes, these can be time-consuming and require long timelines processes (MESIA, 2025).

When it comes to emission reductions, ETO results show that the targets set will not be reached for MENA (Figure 5.2).

MENA to miss emission targets but achieve renewable generation targets

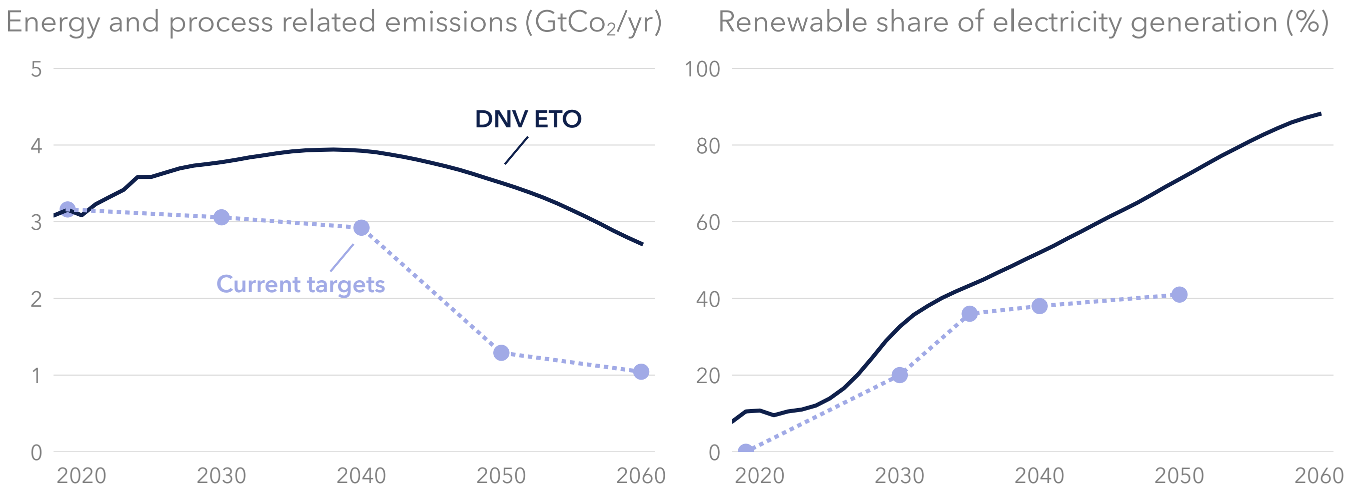


FIGURE 5.2 | Country targets normalised by share of GDP.
Historical data source: GlobalData (2025),DNV analysis

REFERENCES

STUDY

Al Khayat, M., Al-Rasheedi, M., Gueymard, C.A., Haupt, S.E., Kosovic, B., Al-Quattan, A., Lee, J.A. (2021). Performance analysis of a 10-MW wind farm in a hot and dusty desert environment. Part 2: Combined dust and high-temperature effects on the operation of wind turbines. *ScienceDirect* https://www.sciencedirect.com/science/article/abs/pii/S2213138821004719

EcoMena: *The Progress of Solar PV Sector in Jordan in 2024*. 21 January 2025. https://www.ecomena.org/progress-of-solar-pv-sector-in-jordan/

IEA (2025a). *The Future of Electricity in the Middle East and North Africa*. https://www.iea.org/reports/the-future-of-electricity-in-the-middle-east-and-north-africa#overview

IRENA (2025). *Delivering on the UAE Consensus: Tracking progress toward tripling renewable energy and doubling energy efficiency by 2030*. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Oct/IRENA_COP30_GRA_Tracking_the_UAE_Consensus_2025.pdf

KAPSARC (2025). *Demand Response Programs: Concepts, Benefits, and Opportunities for the GCC Region*. https://www.kapsarc.org/our-offerings/publications/demand-response-programs-concepts-benefits-and-opportunities-for-the-gcc-region/

MESIA (2025). *Solar outlook report 2025*. https://mesia.com/report/solar-outlook-report-2025/

REN 21(2025a). *Renewable energy in buildings – key facts for 2024*. https://www.ren21.net/gsr-2025/sectors/buildings/

REN21 (2025b). *Renewables in industry – key facts for 2024*. https://www.ren21.net/gsr-2025/sectors/industry/

San Filippo, A., Vermeersch, M., Benito, V.B (2024). Energy transition strategies in the Gulf Cooperation Council countries. *Energy Strategy Rewiews,* September 2024. https://www.sciencedirect.com/science/article/pii/S2211467X24002219

World Bank (2024). *Navigating the water challenge in the GCC*. https://documents1.worldbank.org/curated/en/099002211272487299/pdf/IDU-4b5501f1-f71f-45c9-87fa-509e7f3f0b80.pdf

Zawya (2025): Move to introduce new taxes in Bahrain. *Zawya*, 14 April 2025. https://www.zawya.com/en/economy/gcc/move-to-introduce-new-taxes-in-bahrain-tb92jfnd

CASES

Energy supply

MASDAR, UAE: https://masdar.ae/en/renewables/our-projects/rtc

Abydos, Egypt: https://www.ameapower.com/amea-power-and-partners-advance-landmark-solar-and-battery-storage-project-to-strengthen-egypts-energy-security/

Al Shuaibah, KSA: https://www.acwapower.com/en/projects/shuaibah-pv-ipp/

Ibri III, Oman: https://www.greentechnewsme.com/oman-signs-deal-for-ibri-iii-solar-project-to-accelerate-renewable-energy-transition/

Jordan ; Renewable project: https://dar.com/work/project/100-mw-photovoltaic-plant-in-madonah,-jordan

Bahrain ; National Renewable Energy Action Plan : https://www.sdgs.gov.bh/Goal/?ID=hSirOimZ58WUkA7gF7p9Rw==

Zafrana, Egypt: https://www.taqa.com.eg/news-details.php?newsid=41

Grid storage & flexibility

GCCIA: Bayt Magazine (2025). GCCIA – the hidden force behind Gulf's green energy success story, 20 March 2025. https://baytmagazine.com/gccia-the-hidden-force-behind-gulfs-green-energy-success-story/

Hatta pumped hydro, UAE: https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2025/02/clean-energy-export-from-hatta-to-dubai-to-begin-next-april

Energy demand

EGA : https://www.ega.ae/en/sustainability/net-zero

EMSTEEL: https://www.emsteel.com/sustainability-strategy/

NEOM: https://www.oecd.org/content/dam/oecd/en/about/programmes/cefim/green-hydrogen/NEOM-case-study.pdf

Al Taweelah: https://acwapower.com/en/projects/taweelah-ro-desalination-iwp/

Sharja: https://www.acwapower.com/news/acwa-power-and-sewa-sign-deal-for-sharjahs-first-independent-water-project/

Jubail 3B: https://engiemiddleeast.com/wp-content/uploads/Jubail-3B-case-study-2025.pdf

Aqaba-Amman: https://www.greenclimate.fund/project/fp288

Khazna: https://khaznadatacenters.com/

Microsoft: https://www.reuters.com/world/middle-east/microsoft-g42-announce-200-mw-data-centre-capacity-expansion-uae-2025-11-05/

DataVolt : https://data-volt.com/about/

Tetouan : https://oecd.ai/en/dashboards/policy-initiatives/ai-hub-tetouan-5979

Gotion gigafactory: https://constructionreviewonline.com/6-5-billion-moroccos-gotion-gigafactory-construction-to-commence/

EV Metals Group: https://www.evmetalsgroup.com/lithium-chemicals-plant-new/

Titan Lithium: https://www.lithiumtitan.com/uaes-titan-lithium-to-build-1-4bln-lithium-processing-plant-in-kezad/

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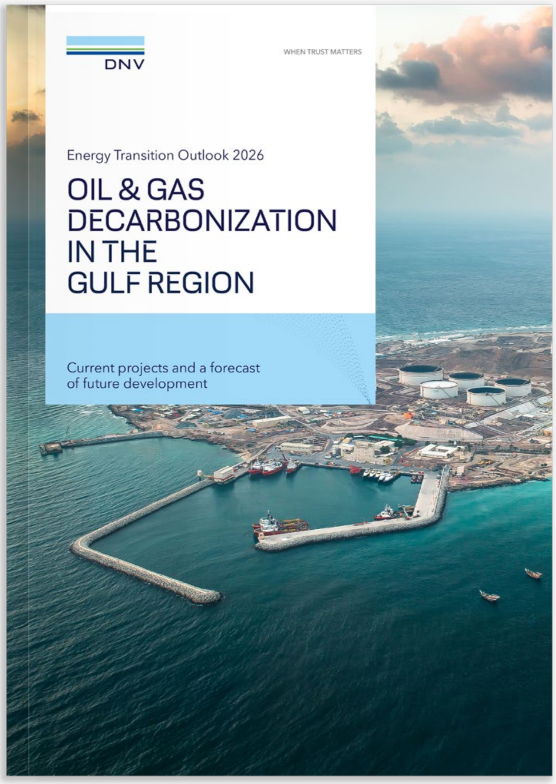

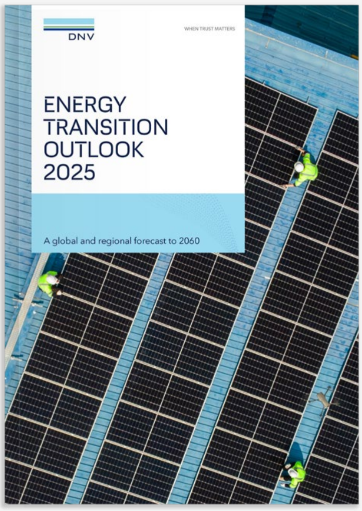

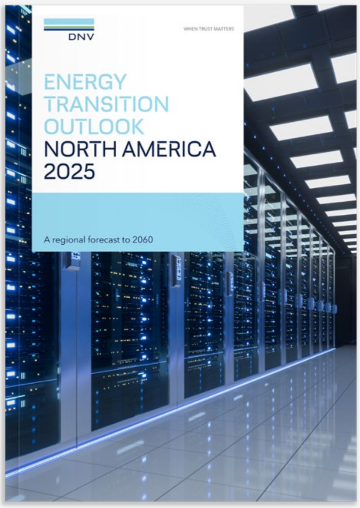

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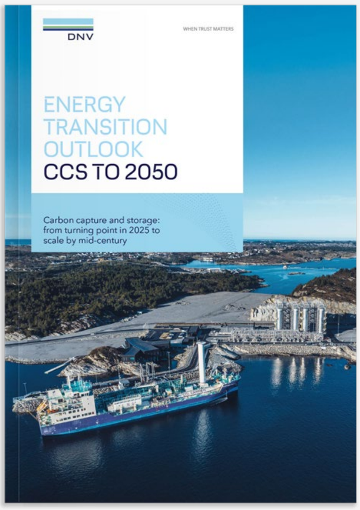

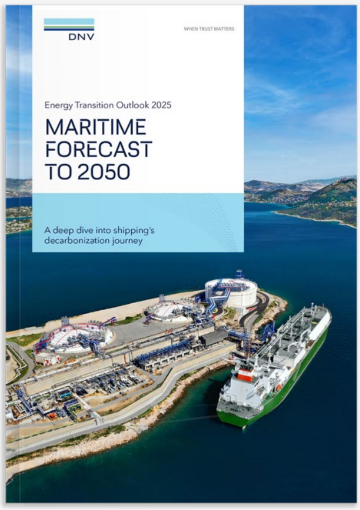

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Historical Data:
Historical data sources are used in the ETO model and results up to and including 2024. The primary databases used are the International Energy Agency's World Energy Balances© OECD/IEA 2025, GlobalData and Rystad Energy. The resulting work has been prepared by DNV and does not necessarily reflect the views of the listed organizations.

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