

DMCC

THE FUTURE OF TRADE

SPECIAL ENERGY EDITION

**ENERGY MARKETS,
TRADE AND TRANSITION**

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EXECUTIVE SUMMARY

This publication serves as the first in-depth DMCC thought leadership report on the global and regional energy sector. Building on unique business insights and analysis from leading experts in the field, this Future of Trade special edition delves into the central forces shaping the world of energy today – from market trends and prices, oil and gas movements, the rise of low-carbon and renewable energy technology, and the global energy transition. It looks at the main drivers of the transition assessing through the use of cutting-edge modelling techniques, different scenario pathways and their outcomes. In particular, this report looks at the role of the MENA region, and specifically the UAE, evaluating the emergent competitive advantages in this highly dynamic landscape.

The main findings of this report:

The global energy sector remains in a period of flux, with high oil prices and supply constraints creating uncertainty in markets and for consumers. Meanwhile major industry players, including international and national oil companies, continue to navigate the energy transition with major investments in clean energy technologies. Competitive advantages are crystallising at the regional level, namely in the Middle East, which benefits from abundant natural energy reserves and a favourable policy climate. Despite clear challenges, there are considerable growth opportunities in key energy market segments, especially clean hydrogen and low-carbon technology spaces.

ADDITIONALLY:



The Middle East remains one of the few areas worldwide that continues to boast strong upstream oil and gas as well as energy transition advantages.



Low-cost, low-carbon resources in the Gulf continue to provide significant competitive advantages when it comes to upstream investment, which will grow as markets become even more carbon conscious.



Key regional players such as Saudi Arabia and the UAE have signalled strong support for renewables which will be sustained in the coming decade and beyond COP28.



The UAE continues to lead the Middle East in installed capacity for renewable and low-carbon forms of energy, though Saudi Arabia is expected to make considerable gains in this category towards the middle of the decade.



Major hydrogen projects continue to advance and will likely place the Middle East among the most prolific of global hydrogen-producing regions.



Efforts to drive a booming, export-oriented hydrogen industry in the region remain achievable, strategically positioning major trade hubs like Dubai, but will take time to come to fruition.



In the absence of global hydrogen demand in the short term, domestic consumption of hydrogen will be channeled towards decarbonisation of key industrial sectors.



GLOBAL OIL MARKET DYNAMICS AND OUTLOOK

THE 'NEW NORMAL' OF \$80+ PER BARREL

- **WHILE THE OIL MARKET IN 2023 HAS SEEN EXTREME VOLATILITY AND RISING QUESTIONS AROUND DEMAND, \$80+ PER BARREL IS STILL THE MULTI-YEAR VIEW**

As the world continues to navigate the uncertainty of the 2023 oil market, one thing that is abundantly clear is what was once considered the \$60/bb-\$70/bb range is no longer the yardstick for pricing. Despite the near-term concerns that have cast a shadow of volatility and questioned demand, the multi-year view confidently points towards \$80+ per barrel.



Short-term outlook and key variables: The immediate future of oil prices hinges on the resilience of the macroeconomic environment and the actions taken by central banks around the world. While these factors weighed on the oil market in the first half of 2023, the second half expects to consolidate an upswing in demand, albeit with supply restraints poised to counterbalance any potential weaknesses and keep prices afloat.



Demand and supply balancing act: A shift from an average of approximately 101 million b/d was witnessed in the first half of the year, with an average of over 102 million b/d expected to consolidate in the latter half of the year. Although there is still a degree of uncertainty, particularly concerning China, an overall improvement in demand is anticipated.



Supply side support: The major OPEC+ members' voluntary production cuts coupled with Russia's unilateral reduction of 500,000 b/d are primed to bolster prices. The OPEC+ group, with a preference for at least \$80/bbl, will need the cooperation of the wider macroeconomic environment.

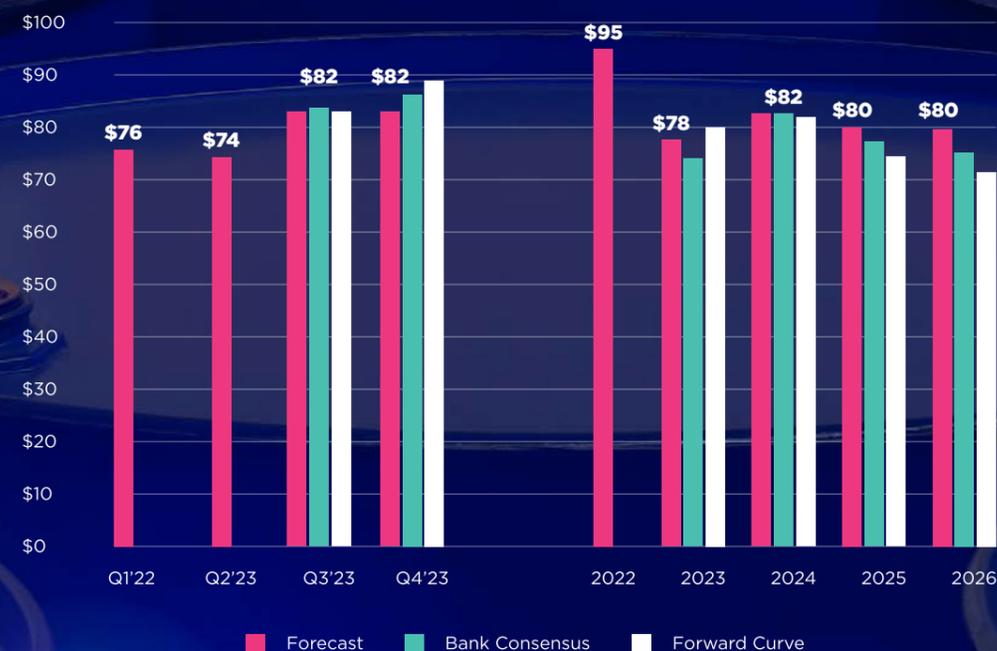


Beyond 2023: Looking further ahead, the outlook for oil demand remains robust, and a limited supply pipeline is poised to sustain prices of at least \$80/bbl.

BRENT PRICE FORECAST VS. CONSENSUS VS. FORWARD CURVE (\$/BBL)



WTI PRICE FORECAST VS. CONSENSUS VS. FORWARD CURVE (\$/BBL)



Source: Energy Intelligence

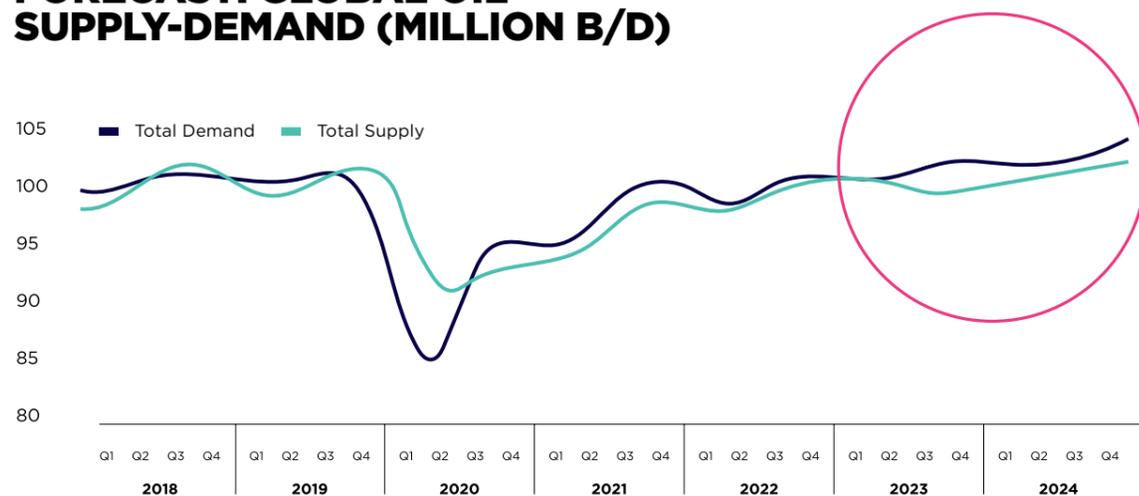
OIL MARKET BALANCES: TIGHTENING EXPECTED AMID MACRO UNCERTAINTY

While economic questions continue to linger, the prospect of demand recovery persists as OPEC+ cuts counter macro unknowns.

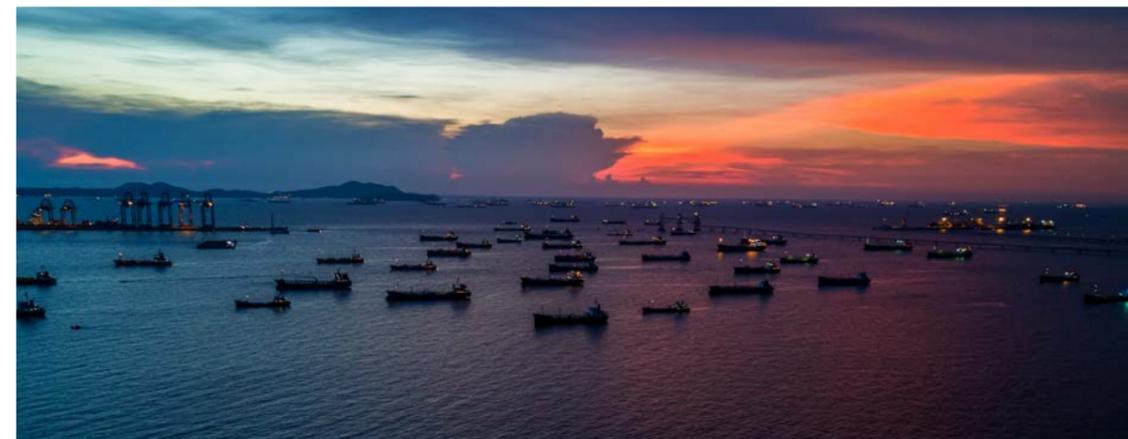
The surprise OPEC+ cuts introduced a potential supply buffer that can counterbalance the demand backdrop, offering support to prices, if not a push towards higher territory. A scenario of \$80+/bbl is likely to prevail, though prices surpassing the \$85-\$90/bbl range may prove elusive and challenging to sustain.

Russia and Saudi Arabia will play a pivotal role in shaping supply dynamics moving forward, with uncertainty surrounding Moscow's next 500,000 b/d reduction and the duration of Saudi Arabia's voluntary 1 million b/d cut.

FORECAST: GLOBAL OIL SUPPLY-DEMAND (MILLION B/D)



Source: Energy Intelligence



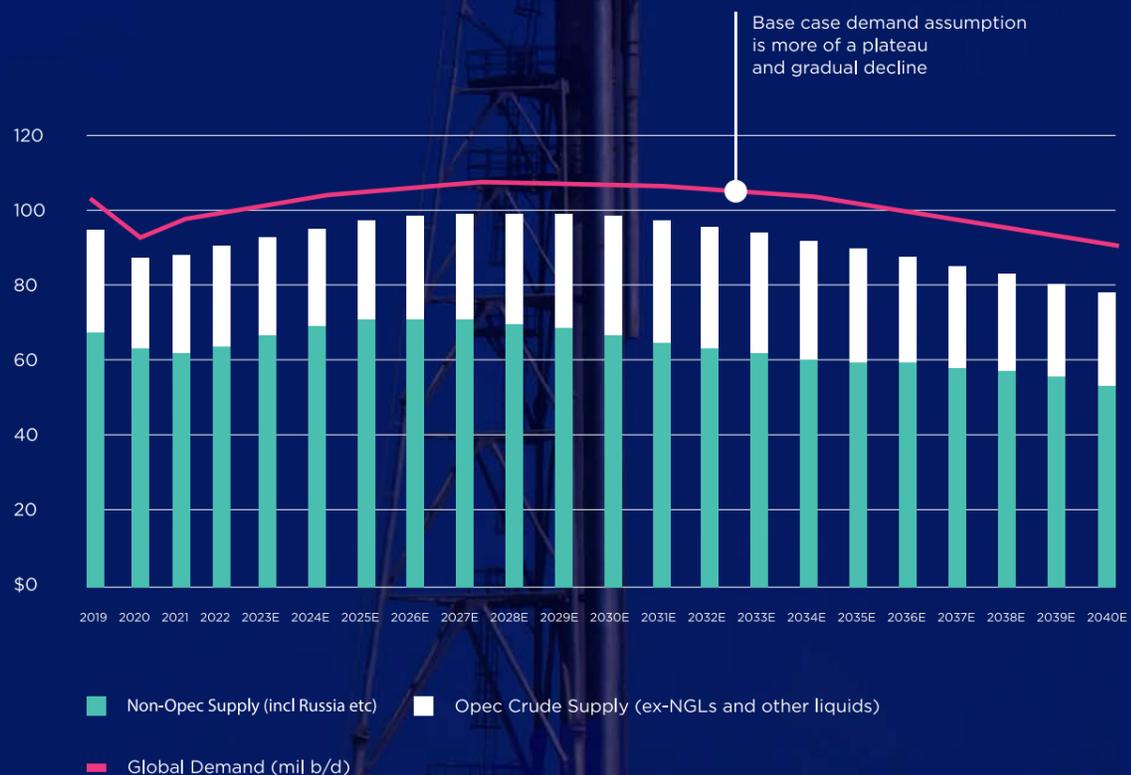
LONG-TERM SUPPLY AND DEMAND: A SHIFTING LANDSCAPE

The world will continue to see an annual peak of around 105 million b/d, with adequate supply to meet the trajectory.

The long-term outlook presents a shifting landscape, with peak demand anticipated towards the end of the current decade, followed by a gradual decline into the 2030s and beyond. While electrification is a key driver of demand reduction, the petrochemical sector is expected to extend the plateau after peak demand is reached.

Some of the key variables moving forward are the trajectory of Chinese demand, the pace of the United States' demand with slower electrification than other major markets and the resilience of supply from Russia and other more minor OPEC+ members.

OUTLOOK: GLOBAL OIL SUPPLY AND DEMAND



Source: Energy Intelligence

OPEC+ SUPPLY AND DEMAND DYNAMICS

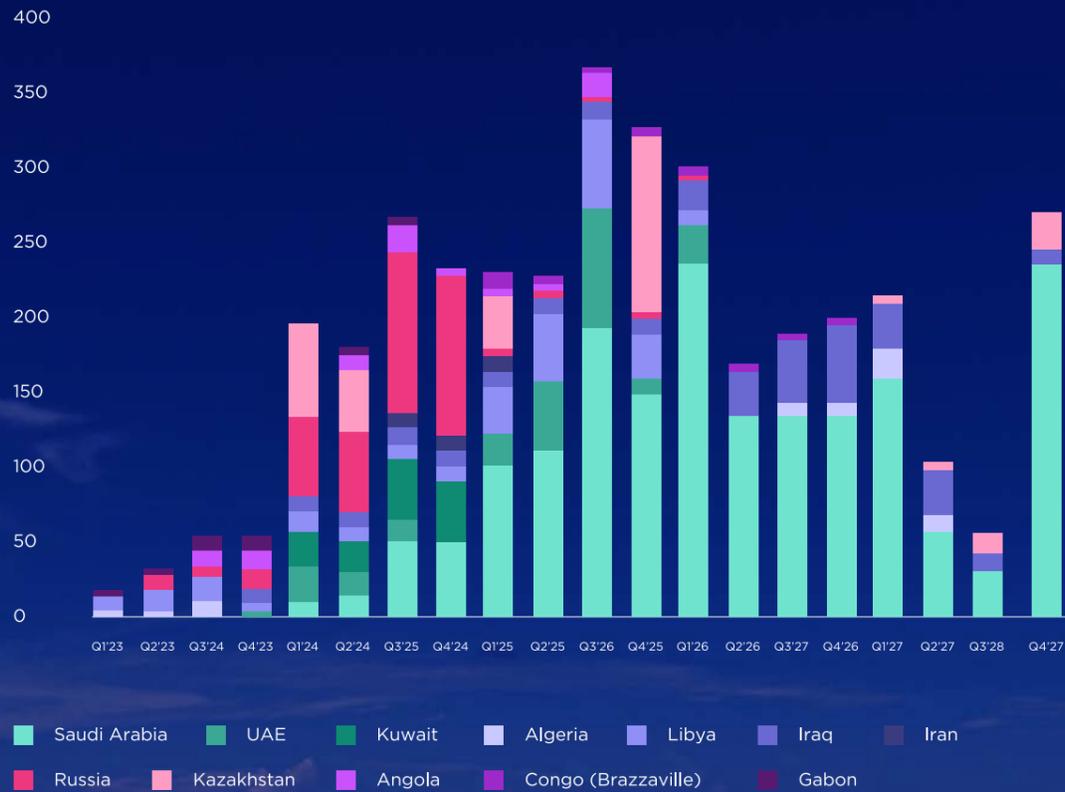
■ MIDDLE EAST GULF EXPANSIONS WILL DRIVE THE BULK OF OPEC+ UPSTREAM GROWTH

OPEC+ continues on its path to add 3.6 million b/d in new capacity by 2027, although this may not fully offset potential declines and quota disputes in the future.

The bulk of this new supply will originate from the Gulf, driven by production expansions in Saudi Arabia and the UAE, each expanding crude capacity by 1 million b/d. Some portions of upcoming capacity additions may help offset declines elsewhere as major producers like Nigeria, Iraq and others struggle to attract new upstream investments.

The most sought-after barrels in this evolving landscape are characterised by lower costs, reduced carbon emissions and swift monetisation. The Middle East Gulf, US Gulf of Mexico, and Brazil are deemed highly advantageous in this context.

OPEC-PLUS: UPSTREAM CAPACITY ADDITIONS THROUGH 2027 ('000 B/D)



Source: Energy Intelligence

CONCLUSION

Although uncertainty surrounding the global macroeconomic outlook will be a key driver of oil demand into 2024, OPEC+ has demonstrated that it is highly likely to remain proactive in its market balancing strategy again during the coming year. The extension of Saudi Arabia's unilateral, one million b/d cut to the end of 2023, though always subject to change, reinforces this outlook. The concentration of new supply additions in more powerful OPEC+ members also supports this outlook as upcoming supply will potentially be subject to constraints from the alliance, depending on its strategic direction.

MIDDLE EAST ENERGY LANDSCAPE

The Middle East stands at the apex of the global energy stage, strategically positioned to harness the long-term development of its vast oil and gas reserves while committing major investments into renewable forms of energy. Within this dynamic landscape, major industry players are meticulously shaping their upstream portfolios to prioritise projects that promise the lowest costs and risks and the swiftest path to revenue generation.

Global investors are increasingly seeking out players that prioritise opportunities in areas with distinct advantages. These encompass key factors such as favourable costs, short development timelines, reduced carbon emissions, access to lucrative markets, integration opportunities and lower susceptibility to aboveground and geopolitical risks. Evidence suggests that capital allocations and project investments are gravitating towards regions possessing these attributes, with the Middle East taking centre stage, but also including the US Gulf of Mexico, Permian Basin, offshore Brazil, and the Guyanas Basin.

ADVANTAGED RESOURCES AND UPSTREAM PORTFOLIO POSITIONING

The Middle East stands out due to its low-cost and low-carbon intensity oil production. National oil companies (NOCs) play a pivotal role in project advancement across the region. In contrast to other regions that boast similar cost and carbon credentials, such as the US Gulf of Mexico or the North Sea, the Middle East offers greater policy consistency. This stems from robust government support for upstream expansion, which is set to persist as long as oil and gas production remains central to national strategies in countries like Qatar, Saudi Arabia and the UAE.

Upstream growth is progressing steadily across the region, with expansion efforts consistently meeting or exceeding targets. Meanwhile, NOC-backed infrastructure has in recent years attracted world-class investors and boosted the advantages for shorter development cycles and improved access to markets.



REGIONAL DOWNSTREAM GROWTH

Gulf-based NOCs and their partners continue to drive downstream growth in the region. Their efforts are bolstered by robust government support for diversification of the oil sector, explicit capex guidance from NOCs and strong demand for liquids – driven in part by European desires to reduce reliance on Russian refined products. Meanwhile key petrochemical projects continue to advance, with NOCs expanding their international footprint.

STRONG ALL-AROUND OUTLOOK FOR MIDDLE EAST LNG

The Middle East demonstrates a robust outlook in the global liquefied natural gas (LNG) market. Regional players are securing offtake agreements for new LNG capacity and replacing expiring contracts. ADNOC LNG, for instance, has engaged in new deals with Indian Oil and Japex, with varying contract durations indicating flexibility towards shorter-term agreements. Its expanding international upstream strategy suggests a sustained interest in penetrating European gas markets, potentially positioning it advantageously given the European preference for shorter-term agreements.

QatarEnergy and Oman LNG continue to engage in broader deal activity, underscoring that, despite speculation about a shift towards European LNG markets, South Asia remains a focal point for long-term demand growth, leveraging the geographic proximity of the Gulf.

DUBAI AND DMCC

Comprehensive economic partnerships with emerging and advanced economies propelled the UAE's non-oil trade to a record \$338 billion in the first half of 2023, with industrial and precious metals making up a significant portion of this volume and only pointing to a greater role for Dubai as a major hub for commodities.

■ **AS GLOBAL ENERGY TRADE EVOLVES IN MULTIPLE WAYS, THE MIDDLE EAST'S TRADE HUBS ARE EXPECTED TO REMAIN PROMINENT, WITH DUBAI IN PARTICULAR WELL-POSITIONED TO GROW AS A CRITICAL DESTINATION FOR ENERGY COMMODITY FLOWS FROM THE REGION AND BEYOND**

This has bolstered the role of key players such as DMCC, whose status as the largest free trade zone in the UAE, and strategically important geographical location opening and connecting East and West trade routes, has attracted several thousand energy companies to its business district. Companies registered in DMCC include a broad range of energy companies and products both traditional and renewable including crude oil, natural gas, solar panels, wind turbines, geothermal systems, biofuels, hydrogen, and energy storage solutions. It counts on its roster NOCs like Saudi Aramco, as well as multinational trading giants Glencore, Mercuria,

Petronas, and Trafigura – underscoring the centrality of its position as one of the most important energy trade hubs in the world.

Moving forward, Dubai's gravitational pull is expected to get stronger as the UAE expands and matures its ties with the world's major economies and the geopolitical landscape for energy evolves. Centralised trade hubs with supporting ecosystems such as those provided by DMCC will remain highly attractive to global energy companies, its established commercial networks providing net importers with energy resources and enabling net exporters to expand their global reach in energy markets.



ENERGY TRANSITION: SCALING UP AMBITIONS AT THE GLOBAL LEVEL

At the global level, the scale and ambition of energy transition policies are growing, often in response to international political dynamics and new climate laws at the domestic and regional levels.

Key policies have come into force such as the United States' 2022 Inflation Reduction Act (IRA), a major piece of legislation that has broad implications for trade, security and climate. Crucially, the IRA represents a boon to the US renewables market, providing major tax incentives and subsidies to US-made products, with Washington predicting a 40 per cent reduction in US emissions by 2030.

In Europe, the colossal Green Deal is the flagship policy of the European Union, a legally-binding framework that commits the EU's 27 members (minus the UK) to emissions reductions of at least 55 per cent by 2050. A raft of new industrial policies has followed, namely REPowerEU which aims to increase uptake of clean energy across the bloc and reduce reliance on Russian oil and gas. The EU has expanded its Emissions Trading System for domestic industry, capping the level of carbon emissions and credits European companies are allowed to emit and trade.



From Japan to India, similar packages and measures are being replicated across the world, which are often tied to clean energy production, industrial incentives, and emissions reductions targets.

In the Middle East, the situation is equally dynamic with new and ambitious frameworks coming into play that will bear on the regional, and global, energy landscape. As will be further explored in the following sections, these developments carry significant implications for trade and global competitiveness – whilst the overall outlook for the energy transition remains uncertain overall and with multiple pathways still possible.

GLOBAL TRANSITION POLICY- DEVELOPMENTS, 2023

The **EU** has followed up on 2022's RePowerEU (and responded to the US IRA) with measures including its Green Industrial Plan. Other advances include EU ETS expansion, and deals on ending ICE sales by 2035 and on the Renewable Energy Directive.

Germany unveiled its delayed draft climate action plan, seeking to accelerate action across all sectors, with measures like power sector reforms, carbon CfDs for industry, and synfuels in transport.

Japan has launched its Green Transformation Package, partly in response to the US IRA, with multiple targets and measures covering renewables and EVs, and plans to subsidise clean hydrogen.

The **US** IRA kick-started domestic clean energy investment and spurred international competitors to respond. The US has proposed tough vehicle emissions standards and unveiled a full hydrogen strategy, but gaps remain in regulatory details, and the 2024 election campaign looms.

Brazil's President Lula is seeking to tighten climate targets, and aims to end Amazon deforestation by 2030. The government recently raised biodiesel mandates.

GLOBAL /UN:

Led by the **UAE** - which recently upgraded its own climate goals - COP28 will stress urgency, but faces a tricky balance especially on climate finance and the role of fossil fuels.

India, seeking "self-reliance" and responding to growing competition, is expanding its production-linked incentives (subsidising key industries like solar PV, batteries) to cover grid-scale storage, and unveiled an updated National Hydrogen Mission in early 2023.

China is prioritising post-Covid recovery and energy security, while recent months saw Beijing raise renewables targets and extend EV subsidies out to 2027.

Australia is responding to global competition with policies like Hydrogen Headstart, to underpin hydrogen prices, and aims to expand support for CCS after recent reversals.

ENERGY TRANSITION PATHWAYS

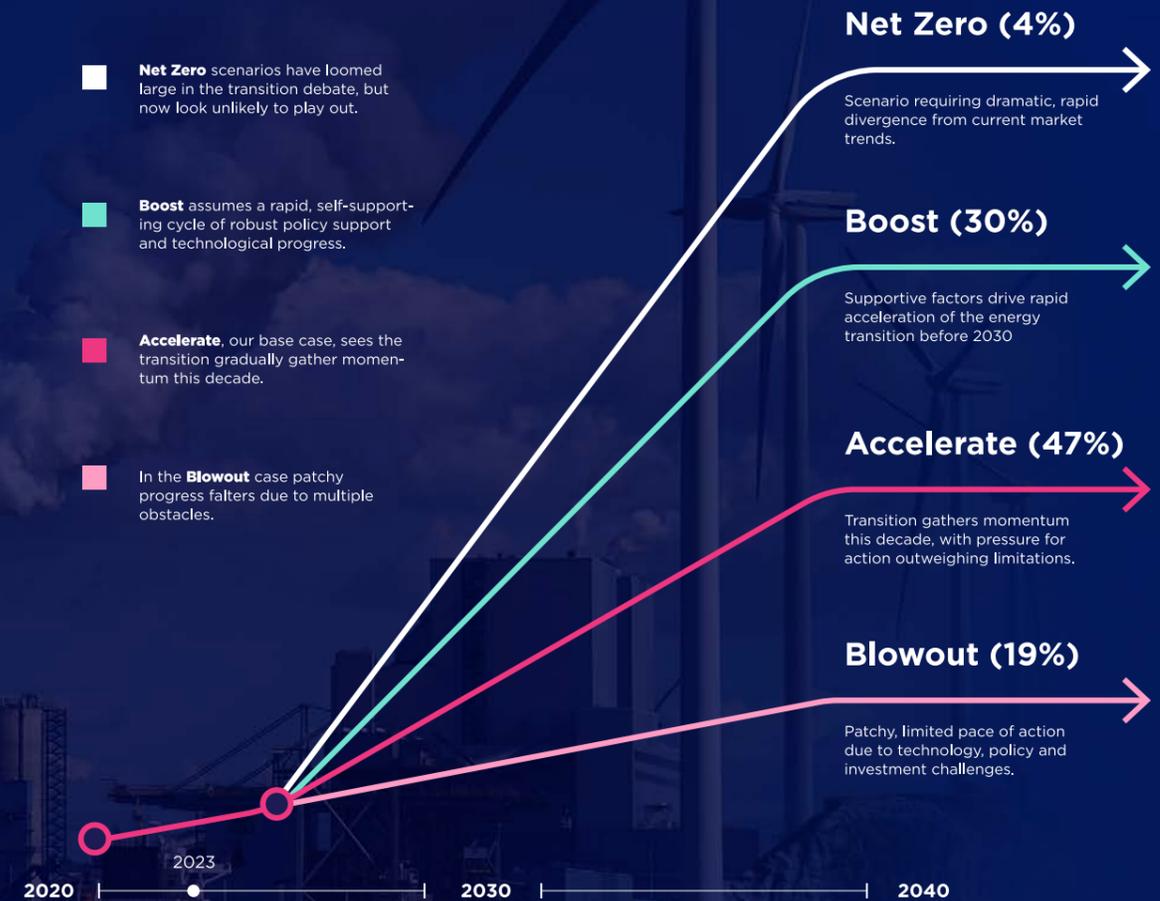
In our exploration of the energy transition trajectory, expert analysts Energy Intelligence chart four main scenario pathways below, each offering a unique perspective on the evolving landscape.

At the forefront is the core Accelerate scenario (47% probability), reflecting the growing momentum behind transition efforts driven by technology adoption and global policy support.

The Boost scenario (30% probability) presents a faster transition path, bolstered by potential policy support. While the possibility of a slower transition still lingers, the Blowout scenario (19% probability) could gain prominence should obstacles hinder technology deployment.

The chances of a Net Zero scenario unfolding remain slender (4% probability).

ENERGY TRANSITION SCENARIOS TO 2040



Source: Energy Intelligence

Note: Percentages (%) indicate probability of each scenario.

ENERGY TRANSITION SCENARIOS TO 2040

Accelerate (47%)

Transition gathers momentum this decade, with pressure for action outweighing limitations.

Accelerate, the base case scenarios, sees the transition gradually gather momentum this decade.

Boost (30%)

Supportive factors drive rapid acceleration of the energy transition before 2030.

Boost assumes a rapid, self-supporting cycle of robust policy support and technological progress.

Blowout (19%)

Patchy, limited pace of action due to technology, policy and investment challenges.

In the Blowout case patchy progress falters due to multiple obstacles.

Net Zero (4%)

Scenario requiring dramatic, rapid divergence from current market trends.

Net Zero scenarios have loomed large in the transition debate, but now look unlikely to play out.

Note: Percentages (%) indicate probability of each scenario.

Source: Energy Intelligence

ENERGY TRANSITION SCENARIOS AND LONG-TERM IMPLICATIONS

Delving deeper into each scenario, we uncover key dynamics and implications that shape the energy transition landscape.

Scenario	Critical Dynamics to 2030	Probability	Key Long-Term Implications
Accelerate (47%)	<ul style="list-style-type: none"> Despite some headwinds, impetus for faster action gradually builds as key clean energy technologies are rolled out at growing pace. Policymakers, investors and others offer mixed but growing support for faster action. 	<p>47%</p> <p>◀ Slower Faster ▶</p>	<ul style="list-style-type: none"> Temperature rises stay within 2.5°C Oil demand peak: around 2030 Gas demand peak: around 2040/later
Boost (30%)	<ul style="list-style-type: none"> Infection point seen by 2025 led by robust policy support amid rising climate urgency. Assumes self-reinforcing cycle of stronger policy incentives and corporate responses, faster technological progress and falling costs. 	<p>30%</p> <p>◀ Slower Faster ▶</p>	<ul style="list-style-type: none"> Temperature rises stay within 2.0°C Oil demand peak: late 2020s Gas demand peak: around 2030
Blowout (19%)	<ul style="list-style-type: none"> No acceleration in activity pre-2030 as policy, technology and cost obstacles see transition efforts delayed and derailed. Rising climate risks and direct impacts may fuel pressure for action in the 2030s. 	<p>19%</p> <p>◀ Slower Faster ▶</p>	<ul style="list-style-type: none"> Temperature rises of 2.5°C or above Oil demand peak: mid-2030s or later Gas demand peak: mid-2040s or later
Net Zero (4%)	<ul style="list-style-type: none"> Dramatic, disruptive acceleration in near term, driving abrupt change well before 2030. Multiple factors align to easily outweigh near-term headwinds and enable forceful near-term policy action and rapid investment. 	<p>4%</p> <p>◀ Slower Faster ▶</p>	<ul style="list-style-type: none"> Temperature rises stay within 1.5°C Oil demand peak: mid-2020s Gas demand peak: before 2030

Note: Percentages (%) indicate probability of each scenario.

Source: Energy Intelligence

The trajectory of the energy transition, particularly its impact on oil demand, is of paramount importance.

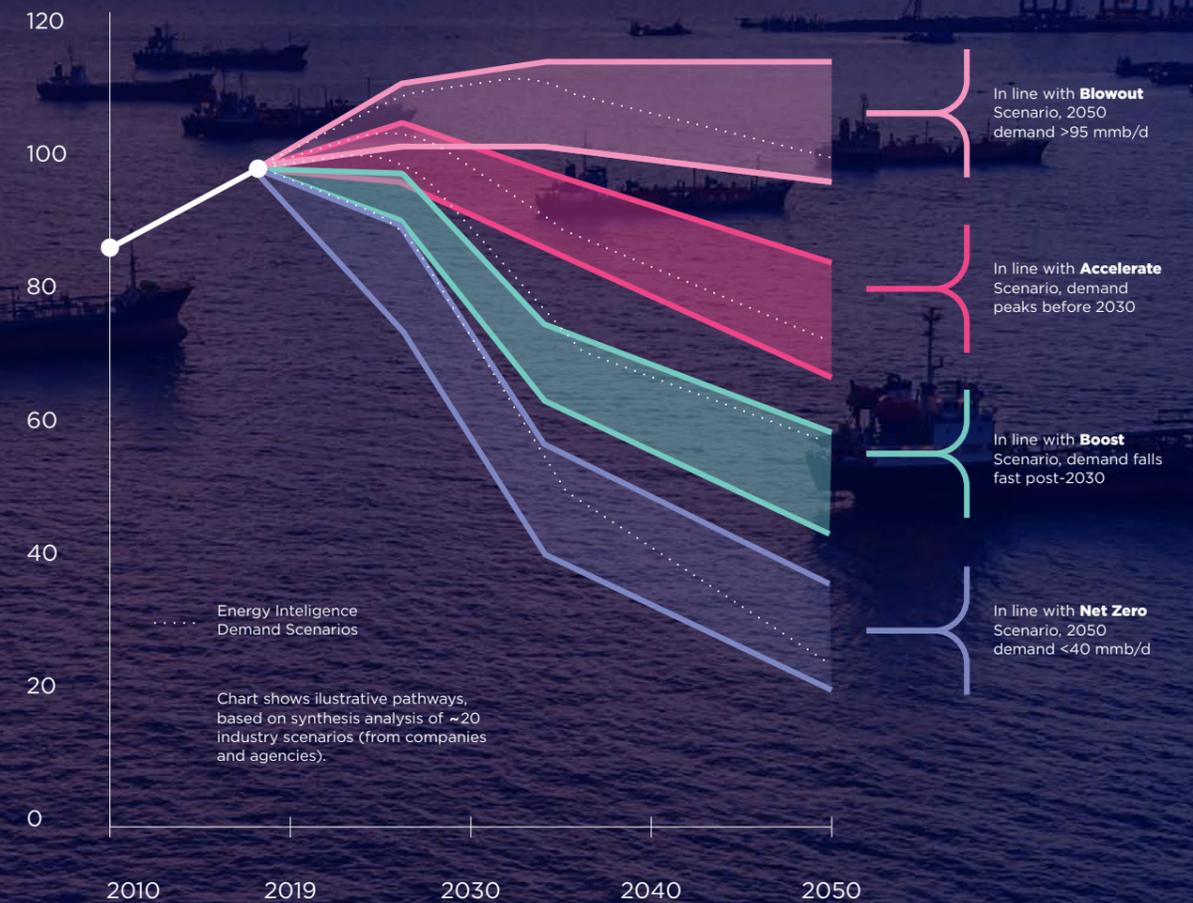
The synthesis of external scenarios and in-house long-term models offers a varied picture of oil demand across each transition scenario.

In the most likely Accelerate scenario, peak oil demand is anticipated in the late 2020s, propelled by the mounting momentum for clean energy adoption, despite some headwinds. The Boost scenario envisions an even earlier peak in demand. However, a crucial inflection point beckons soon after 2025, demanding substantial low-carbon investments for accelerated realisation.

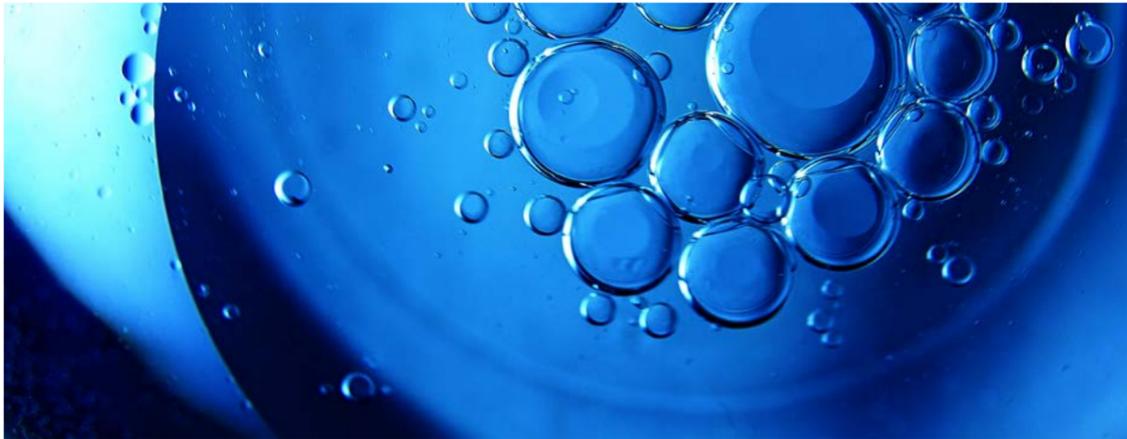
At the other end of the spectrum, the Blowout scenario suggests a slower pace of change, potentially peaking in oil demand in the mid-2030s or beyond due to technology and policy obstacles.

Meanwhile, the Net Zero scenario hinges on an abrupt and intense shift, which currently appears highly unlikely.

ILLUSTRATIVE OIL DEMAND, BASED ON ENERGY TRANSITION SCENARIOS (MILLION B/D)



Source: Energy Intelligence. Scenarios from IEA, EIA, IPCC, OPEC, WEC, BP, Exxon, Total, DNV, Equinor



DRIVING THE ENERGY TRANSITION: INVESTMENTS IN CLEAN ENERGY AND LOW-CARBON TECHNOLOGY

■ FOR OIL AND GAS FIRMS, RENEWABLES' SHARE WILL SHRINK AS INTEREST IN HYDROGEN AND CARBON CAPTURE AND STORAGE SURGES

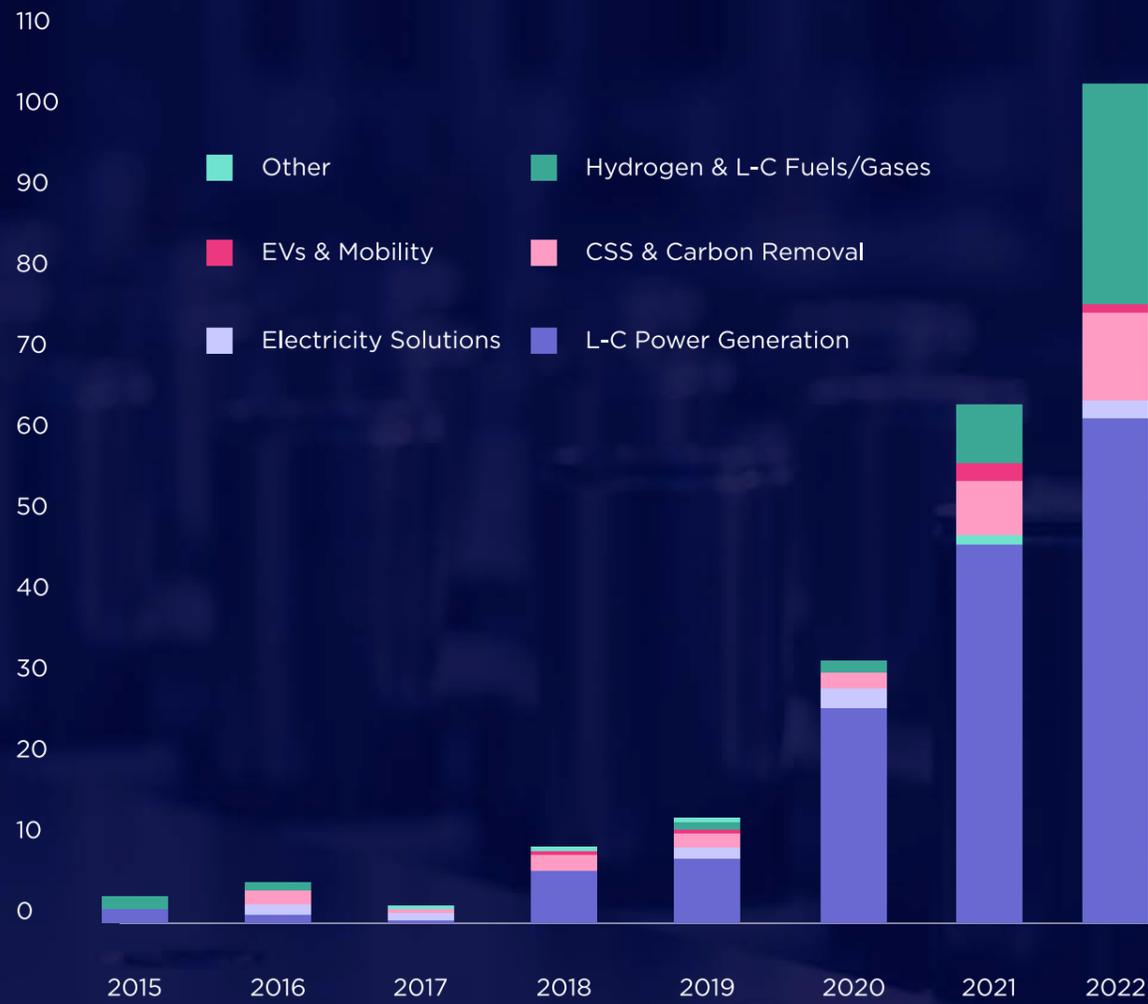
In 2022, the world witnessed a significant surge in low-carbon investments, as oil and gas giants collectively committed to allocate over \$100 billion toward sustainable initiatives. Since 2015, 34 companies in the oil and gas industry have announced more than 1,200 investments aimed at reducing their carbon footprint.

As the year progressed, other maturing technology sectors also saw an uptick in activity. Notably, investments in hydrogen and low-carbon fuels and gases soared to a substantial \$27 billion, reflecting the growing interest in these cutting-edge solutions. The field of carbon capture and storage (CCS) and carbon removal also attracted investments totaling \$11 billion, underlining the increasing importance of carbon management strategies in the global energy landscape.

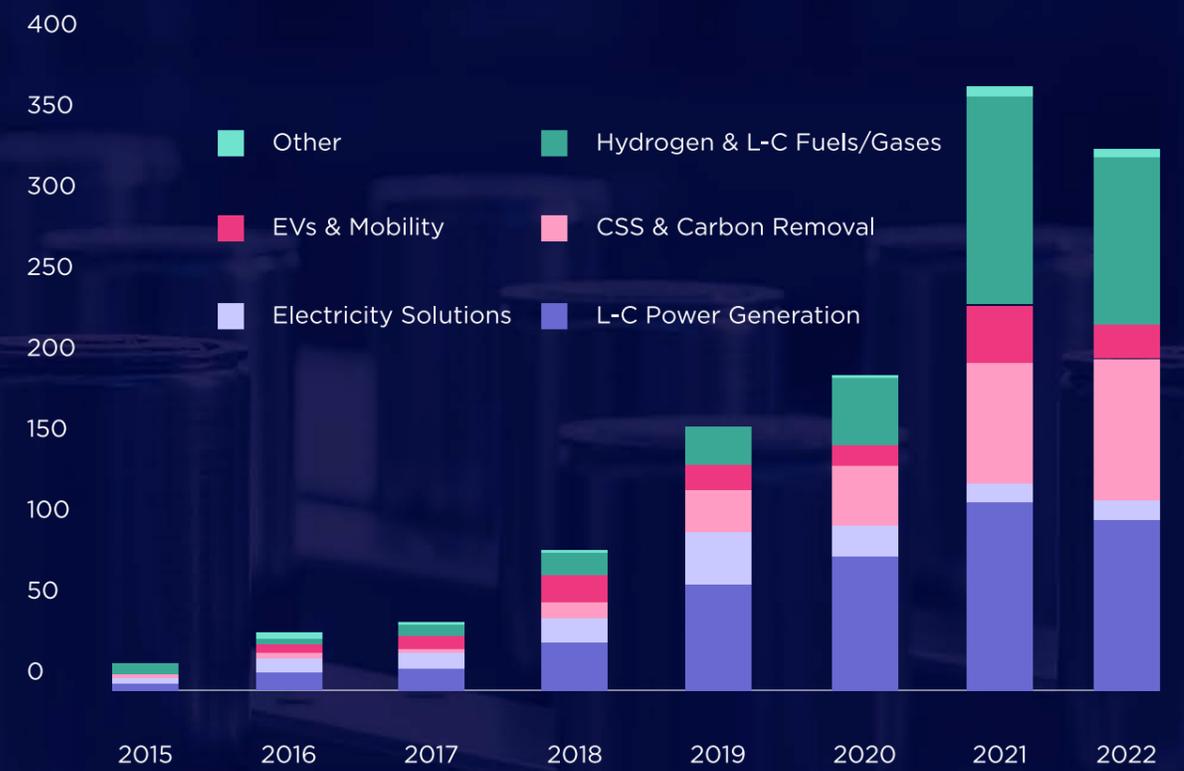
While renewable power generation remains a pivotal driver of the low-carbon revolution, its dominance has somewhat receded. This shift is indicative of the rising significance of other low-carbon sectors, signalling a diversified approach to sustainability across the industry.

Leading the charge in the realm of low-carbon spending are European majors, including Shell, BP and TotalEnergies who have set the pace with an investment total of \$74 billion in 2022.

LOW-CARBON INVESTMENT VALUE BY CATEGORY (\$ BILLION)



LOW-CARBON INVESTMENT COUNT BY CATEGORY (#)



■ HIGH-IMPACT AND MATURING TECHNOLOGIES LIKE RENEWABLES AND ELECTRIC VEHICLES ARE SET TO DRIVE THE ENERGY TRANSITION

The rapid advance and implementation of low-carbon technology has emerged as the main driver for the global energy transition. This transformation is not uniform, however, in particular as it relates to the maturity of technologies and the degree of certainty surrounding their adoption.

Another factor is competition. Some regions retain advantages, notably the Middle East, where the transition enjoys a significant boost due to a combination of abundant natural gas reserves and renewable energy resources, positioning it favourably on the path to sustainability.

Robust policy support underpins the widespread deployment of these innovative technologies within the Middle East, solidifying a clear regional advantage in the global clean energy landscape. The Middle East’s role is further explored in more detail in this report.

Numerous other factors are contributing to the successful dissemination of clean energy technologies. Among these are steadily declining costs associated with their implementation and increasing, if inconsistent, national policy support. These factors converge to create a favourable environment for the adoption of sustainable energy solutions on a global scale.

There still remain distinct challenges related to security of energy supply and the escalating costs of critical materials. Furthermore, the sluggish development of markets for clean hydrogen, a pivotal component of the low-carbon ecosystem, remains a concern that will require careful national consideration and strategic planning to ensure continued progress.

CLEAN ENERGY TECHNOLOGIES: UNCERTAINTY AND IMPACT



Source: Energy Intelligence

ENERGY TRANSITION: HYDROGEN IN FOCUS

Hydrogen production costs could fall sharply, but questions persist on infrastructure and demand.

The hydrogen sector has garnered significant attention from various industries, but despite the enthusiasm, the production of clean hydrogen and its subsequent applications remains constrained. A number of challenges persist, including costs, infrastructure limitations, and slow demand.

Numerous projects have been proposed with the aim of producing both “green” and “blue” hydrogen. However, progress further along the value chain appears less distinct and more uncertain.

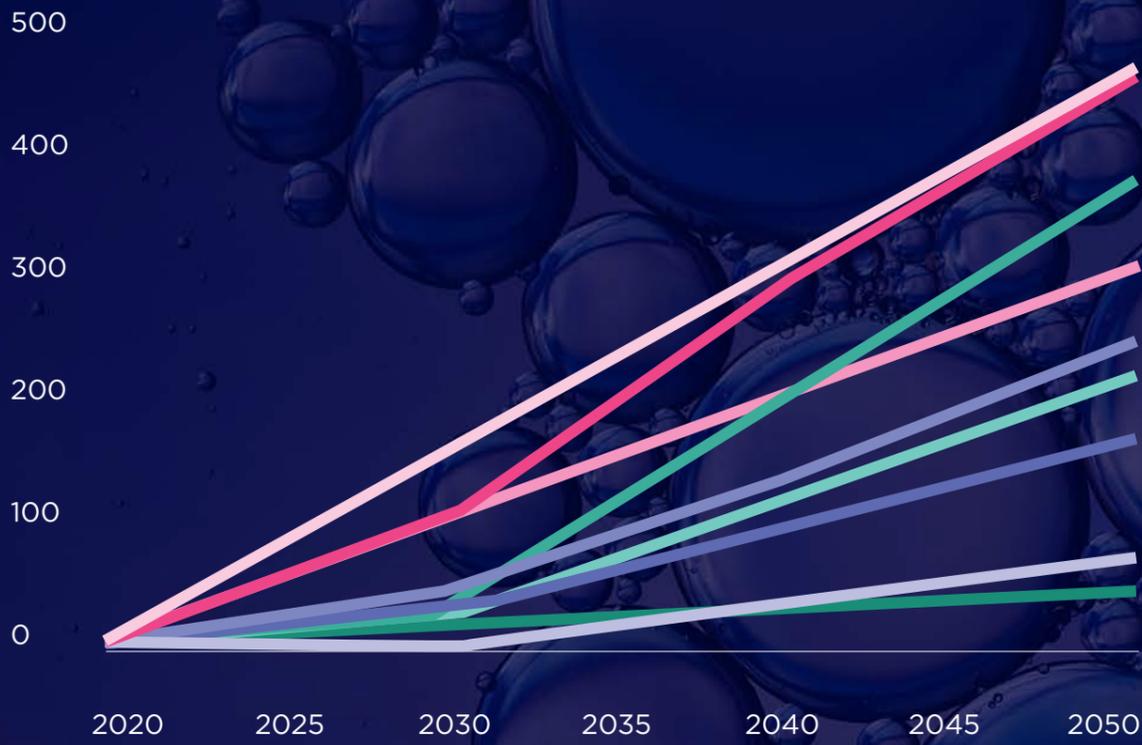
Projections for the use of clean hydrogen in 2050 paint a varied picture, with estimates ranging from under 45 million tonnes per year to a vastly more ambitious 450 million tonnes per year. These diverse forecasts underscore the unpredictability surrounding the pace of hydrogen’s development and integration into the global energy landscape.

Energy Intelligence take a levelised cost of hydrogen (LCOH) approach, which shows potential production costs experiencing a significant decline by 2030. This is particularly evident in the case of green hydrogen, driven by the decreasing costs of renewable power generation and more affordable electrolyser technologies. In contrast, the costs associated with blue hydrogen production remain closely linked to fluctuations in natural gas prices, offering limited room for capex gains.

The development of the hydrogen sector looks set to unfold at a measured pace. Throughout this decade, progress is expected to be primarily concentrated on projects that offer greater certainty in terms of local demand, thus reflecting the cautious and pragmatic approach to hydrogen’s role in the energy transition.



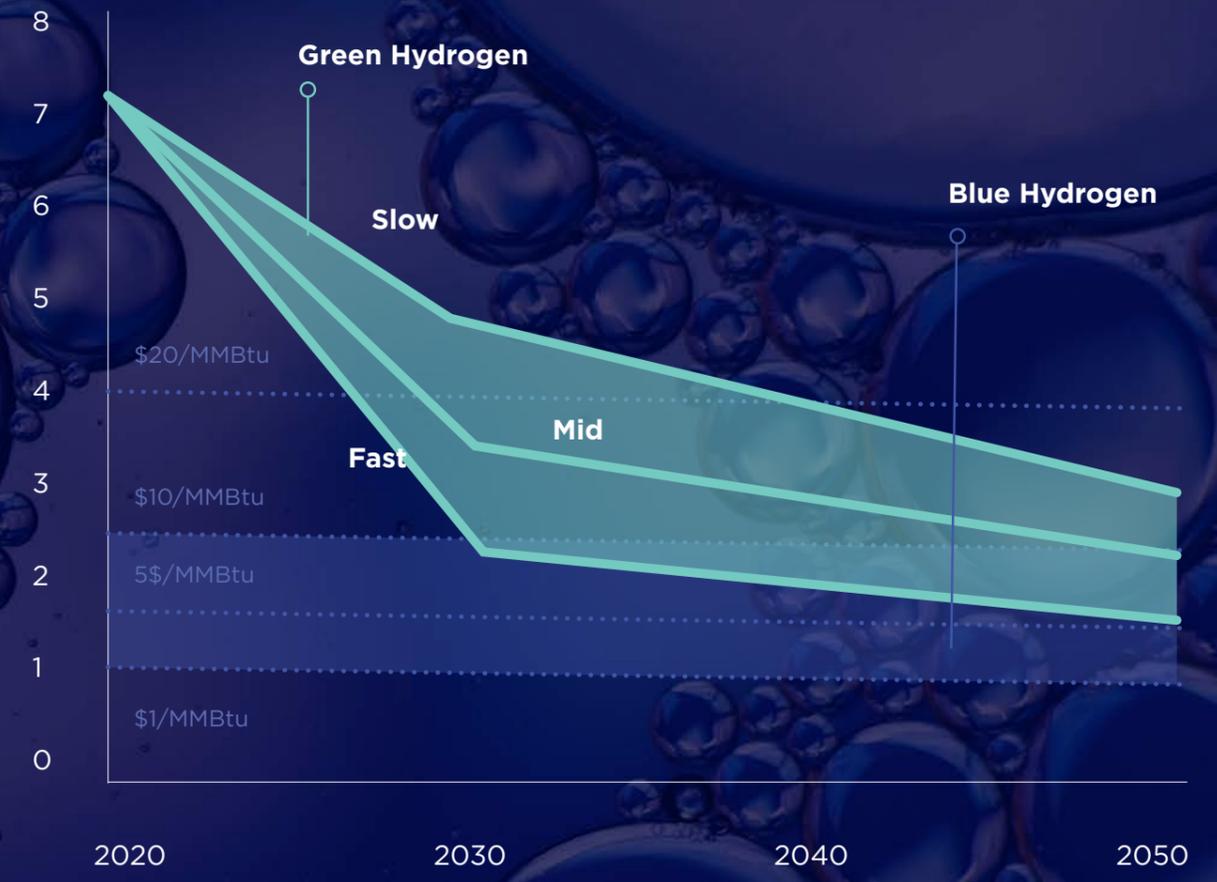
CLEAN HYDROGEN DEMAND GROWTH*, SELECTED SCENARIOS (MILLION TONNES)



- █ BP - Accelerated
- █ BP - Net Zero
- █ IEA - STEPS
- █ IEA - APS
- █ DNV
- █ Equinor - Walls
- █ Equinor - Bridges
- █ Total - Momentum
- █ Total - Rupture

Source: BP, DNV GL, IEA, Shell, Equinor, Total, Energy Intelligence; *Note: Projections include hydrogen as an energy carrier but exclude current use as an industry feedstock

GLOBAL HYDROGEN PRODUCTION COSTS LCOH* ANALYSIS (\$/KG)



Source: Energy Intelligence. Note: *LCOH = Levelised Cost of Hydrogen.

Global hydrogen trade: Middle East poised for competitive edge, but costs are key.

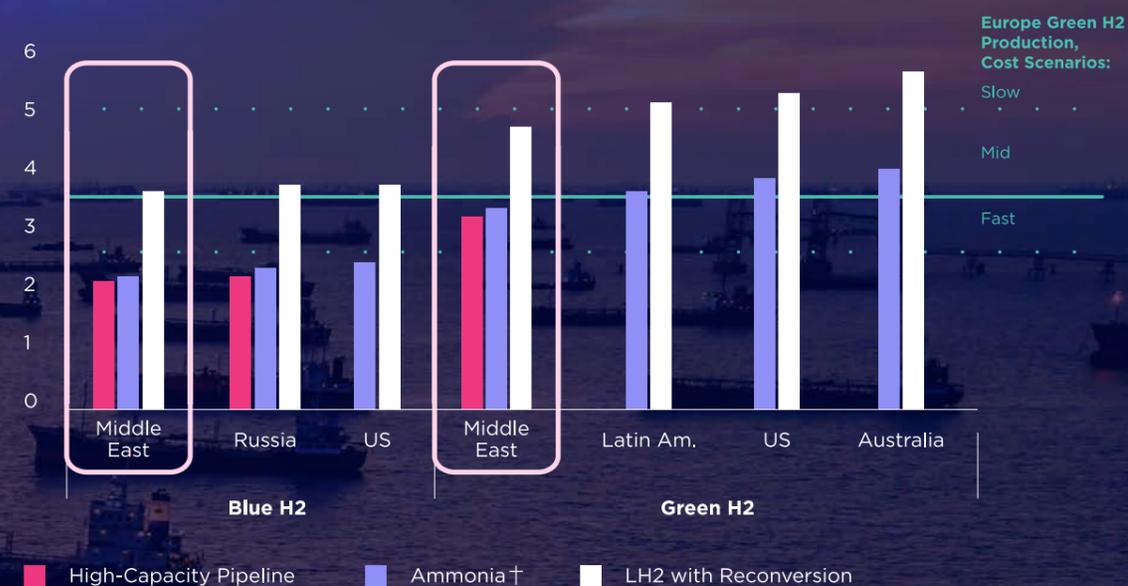
The prospect of a global hydrogen trade is enticing and one that could transform the energy landscape on a global scale.

There is significant economic allure to the potential of blue and green hydrogen, along with ammonia, particularly in low-cost regions such as the Middle East. A competitive edge could emerge for Gulf producers, pricing out higher cost regions and fuelling their economic incentive for international hydrogen trade based out of major trade hubs such as Dubai, laying the foundation for a truly global hydrogen exchange.

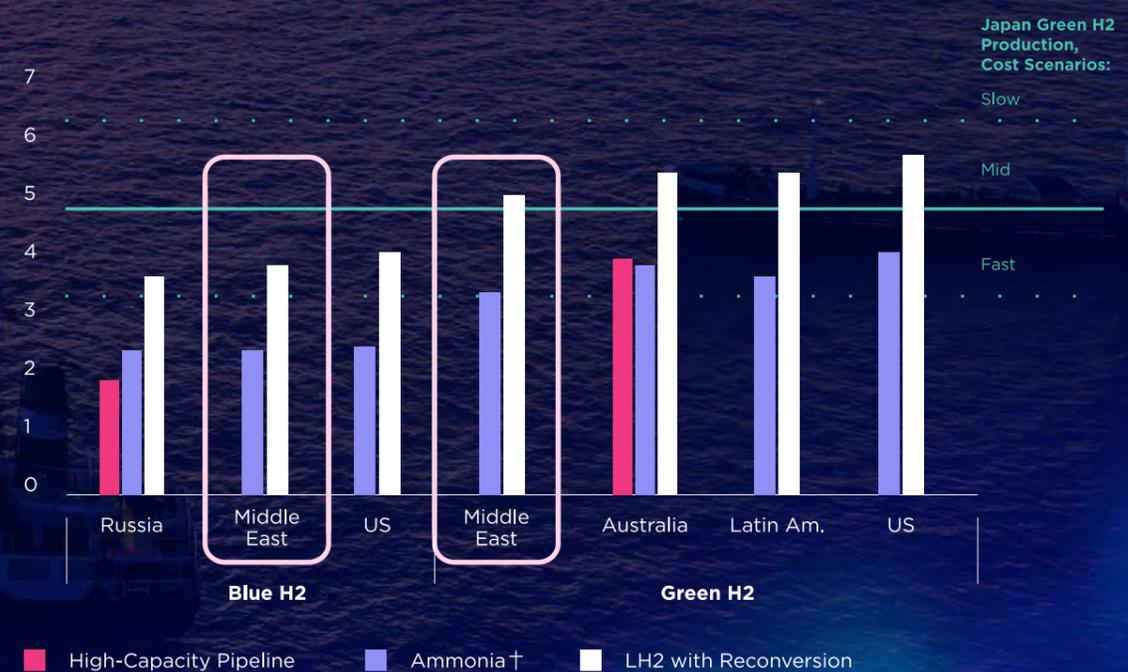
Key import markets for hydrogen would include Europe and East Asian nations like Japan. These regions are already heavily reliant on energy imports and face limitations in their domestic hydrogen production capacity. Meanwhile producers with substantial reserves of low-cost natural gas, such as the Middle East and the United States, hold the potential to emerge as competitive blue hydrogen exporters.

The stage is also set for a diverse array of regions to step into the role of green hydrogen exporters, with countries in the Middle East, Africa, Latin America, and even Australia expressing keen interest. However it should be noted that this may take time to fully materialise. The cost considerations for trade are substantial and encompass not only production but also the intricate web of transportation and (re)conversion processes. The accompanying charts offer a glimpse into possible future scenarios, and examples of the potential for hydrogen exports.

EUROPE HYDROGEN IMPORT COSTS*, BY EXPORTER AND CARRIER 2030 ESTIMATES (\$/KG)



JAPAN HYDROGEN IMPORT COSTS*, BY EXPORTER AND CARRIER 2030 ESTIMATES (\$/KG)



Source: Energy Intelligence. Notes: * Estimated 2030 costs for production, (re)conversion and transportation, shown for a limited selection of possible export countries/regions and transport/carrier methods only. † Ammonia shown without reconversion costs.

KEY TECHNOLOGY DEVELOPMENTS: HYDROGEN GLOBAL TRADE

Europe seeks to ramp up clean hydrogen use and could become a major importer.

Russia looks shut out of European markets

Asia-Pacific economies are eyeing hydrogen imports, led by **Japan** and **South Korea**. China may meet its own needs. Australia hopes to win market share.

North America may look east and west to export markets.

Middle East and North Africa producers are very well placed to serve future markets in Europe and Asia.

Latin America also hopes to emerge as an exporter.



ENERGY TRANSITION: MIDDLE EAST AND UAE

The Middle East's energy transition trajectory is becoming clear with recent developments in renewable power and hydrogen projects.

In the UAE, strong economic growth will foster even more demand for power, which will be met partly with significant growth in solar photovoltaic capacity. Estimates vary between 25-50% growth in peak electricity demand in Abu Dhabi and Dubai by 2030, likely accounting for the heavy emphasis being placed on industrial decarbonisation efforts in these two emirates.

Masdar's selection as the preferred bidder for the 1.8 GW Phase 6 development of Mohammed bin Rashid Al Maktoum Solar Park in Dubai emirate shows that it continues to serve as the UAE's renewable power developer and investor of choice. Its expected completion in 2026 will boost the solar park's total installed capacity to 4.23 GW.

In Abu Dhabi, EWEC continues to advance the decarbonisation of the power sector with both renewable and nuclear power generation. The Barakah nuclear power plant started its third 1.4 GW reactor in February 2023, and its fourth and final reactor has completed operational readiness. Renewable growth in Abu Dhabi is set to continue with the 2 GW Al-Dhafra plant due online in 2024, as well as expected tendering for an additional 3 GW of solar PV to be developed by 2029.

In Saudi Arabia, new investments in natural gas and renewable power generation are now expected to reach \$293 billion by 2030. Projects currently in the pipeline are expected to provide a 6 GW boost by 2025, with Saudi Aramco likely to announce additional investments that build on its target of 12 GW of net renewables capacity by 2030.

Both Saudi Arabia and the UAE are leading the region in their early-stage development of carbon markets. Policy support and clarity will be a key factor in building out these markets, and this appears to be coalescing in the UAE. Abu Dhabi Global Market (ADGM) launched its scheme in 2022 in partnership with the Air Carbon Exchange (ACX) of Singapore. A financial regulatory framework was launched in July 2023, with a comprehensive regulatory framework under development. Saudi Arabia has made similar moves through a partnership between the local Tadawul stock exchange and the Public Investment Fund (PIF) in order to found the Regional Voluntary Carbon Market Company (RVCMC). Its inaugural auction sold 2.2 million tonnes of credits to 15 Saudi companies.

Although there has been considerable enthusiasm for hydrogen projects during the last couple of years, bold ambitions are coalescing into realistic policy frameworks, and the UAE's national hydrogen strategy, released earlier in 2023, sets targets of 1.4 million tonnes of clean hydrogen per year by 2031. Some 500,000 tonnes of this total have been designated for capacity to be developed outside of the UAE, while ADNOC is expected to contribute another 400,000 tonnes towards the annual target, indicating that at a minimum, these volumes are likely to be represented by blue hydrogen. Other than Saudi Arabia's flagship Neom Green Hydrogen Company project, Oman has made considerable advances establishing the regulatory framework for its green hydrogen sector, which the International Energy Agency expects could make it the largest green hydrogen producer in the region and the sixth-largest worldwide by 2030.

Middle East NOCs driving large-scale renewables, CCS and hydrogen projects in the region

The Middle East's national oil companies (NOCs) have assumed a prominent position within their peer group when it comes to low-carbon investments.

A significant portion of these is concentrated within CCS and carbon removal, while investments in hydrogen and other low-carbon power segments have remained more constrained. While many NOCs in the region have set ambitious targets for hydrogen production and are involved in flagship blue ammonia projects, current low rates of demand will continue to place emphasis in the

near term on expanding CCS infrastructure and making incremental investments in new renewable power capacity.

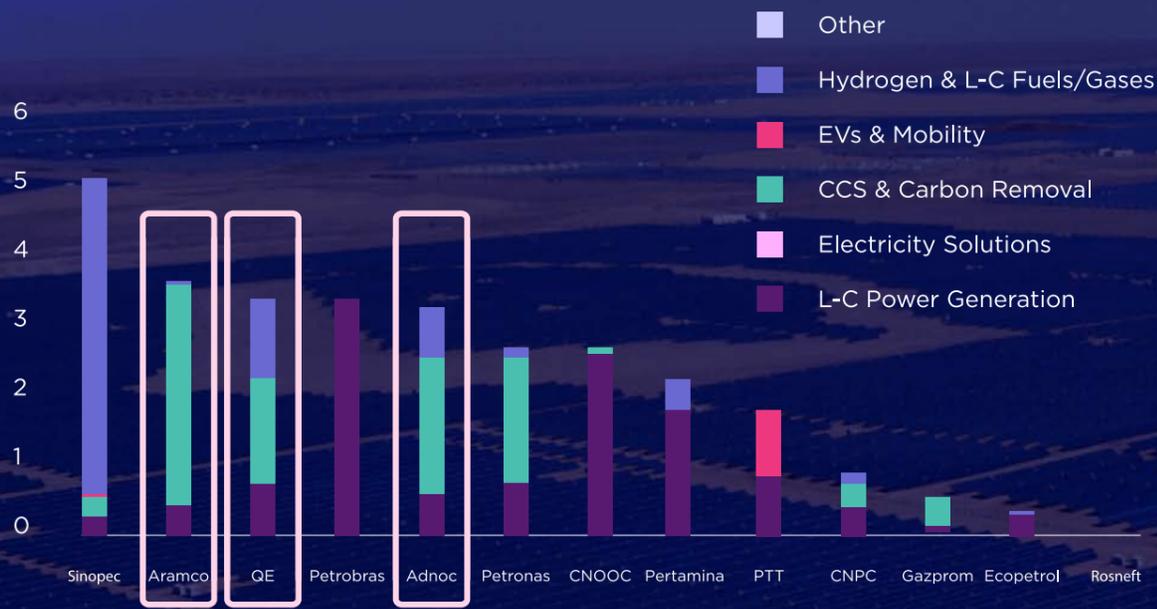
Clean hydrogen initiatives in the Middle East will nevertheless continue to build momentum. Detailed plans are beginning to emerge, shedding light on offtake arrangements and export strategies.

Leading green hydrogen and ammonia projects in the region often involve a diverse array of partners, encompassing national utility companies, industrial and fertiliser firms, global industrial gas corporations, and trading entities. Presently, NOCs such as ADNOC and Saudi Aramco appear more inclined to prioritise blue ammonia exports over the production of green hydrogen or ammonia through renewables. However, this dynamic could evolve should these NOCs expand their role in renewable power generation.

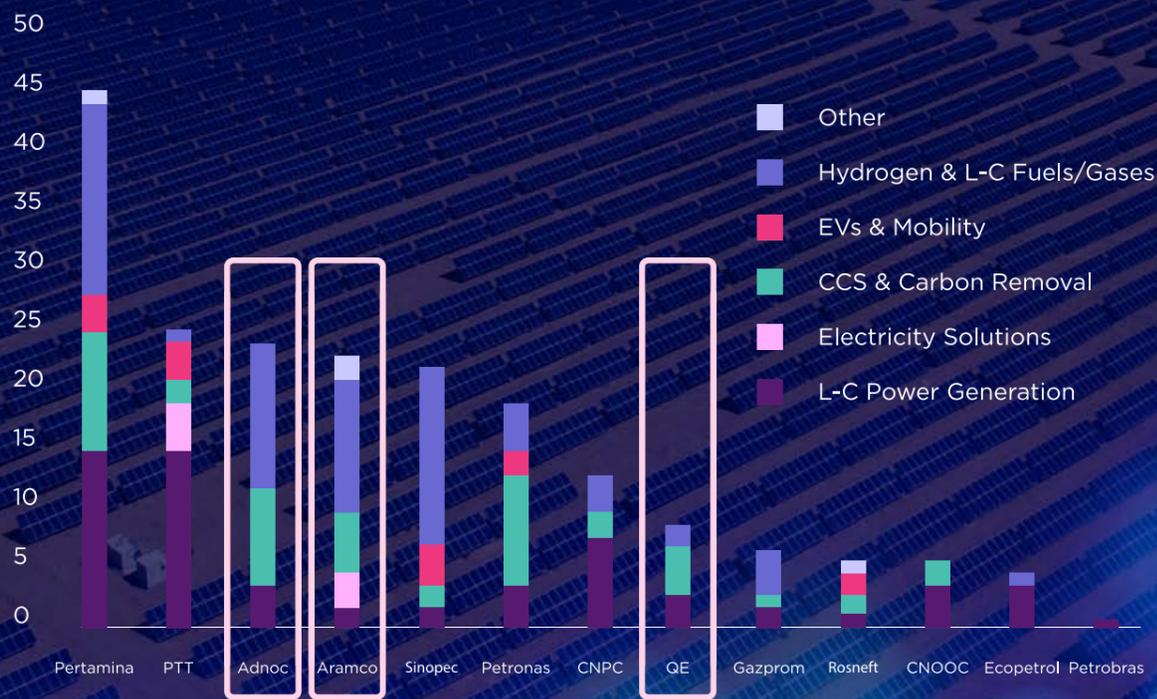
The prospects for domestic use of clean hydrogen in the region are gradually taking shape. Collaborative endeavours like the partnership between Germany's Hydrogen Rise and a local Omani steel producer, exploring green hydrogen for "green steel" production, highlight this evolving landscape.

For Western international oil companies (IOCs), the emergence of large-scale clean hydrogen projects in the MENA region represents both a potential threat and an opportunity. As rivals in this future energy market begin to take shape, some IOCs, like BP, Eni, and TotalEnergies, are actively seeking partnerships and engagements within the region to secure their position in this transformative sector.

LOW-CARBON INVESTMENT VALUE BY COMPANY & CATEGORY, 2015-22 (\$ BILLION)



LOW-CARBON INVESTMENT BY COMPANY & CATEGORY, 2015-22 (#)



Source: Eneray Intelligence; Note: L-C = Low-Carbon; Pemex is included in our coverage but has not announced any low-carbon investments in 2015-22

Middle East in prime position to advance clean hydrogen production

Gas-rich regions like the Middle East are strategically positioning themselves to leverage their natural advantages by venturing into the hydrogen market, targeting markets in Europe and Asia.

Recent geopolitical developments, particularly the Ukraine conflict, have also unleashed a profound impact on gas prices globally. This has elevated the opportunity cost associated with producing blue hydrogen, whose production is tethered to gas pricing, amplifying the significance of pricing dynamics in the equation.

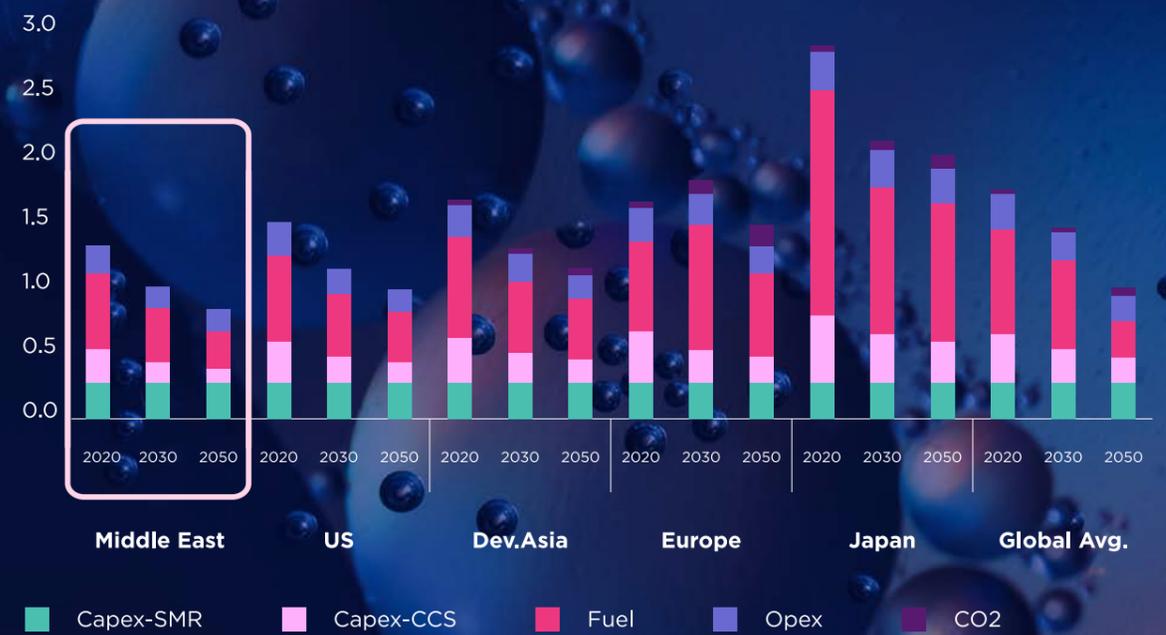
The Middle East, a key player in the blue hydrogen landscape, stands to benefit from favourable gas prices, bolstering its competitiveness on the global stage. Forecasts for 2030, as outlined in this report, paint an enticing picture, estimating the levelised cost of blue hydrogen to hover at approximately \$1 per kg within the Middle East.

In contrast, the journey for green hydrogen is more uncertain, marked by relatively high production costs. A silver lining emerges with the promise of falling electricity rates, more cost-effective electrolyser technologies, and supportive policy measures. These combined forces are expected to gradually narrow the cost differential between green hydrogen and its counterparts.

The cost drivers for green hydrogen predominantly revolve around two factors: the expense of electricity as a fuel source and the capex associated with electrolyser deployment. In this context, the Middle East's green hydrogen production costs are poised to occupy the lower end of the global spectrum by 2030, primarily owing to the region's access to cost-efficient renewable power sources. This augurs well for the Middle East's prospects in the evolving hydrogen landscape.



BLUE HYDROGEN PRODUCTION COSTS, BY REGION LCOH (\$/KG)



GREEN HYDROGEN PRODUCTION COSTS BY REGION (2030) LCOH (\$/KG)



Source: Energy Intelligence

UAE IN FOCUS

■ INDUSTRIAL DECARBONISATION AND BUILDING OUT THE HYDROGEN SECTOR ARE CENTRAL TO THE UAE'S LONG TERM ENERGY STRATEGY

The UAE's preferred approach to the transition has come under focus in 2023. Ahead of the COP28 summit in Dubai, the UAE rolled out its updated energy strategy, building on the overall transformation of its energy sector with added detail and specifics to key policies and technology.

The UAE National Energy Strategy aims to triple the contribution of the renewable energy over the next seven years, and invest between USD 40-54 billion during the same period. It outlines new emissions reduction goals, a significant portion of which will come from revised power mix targets, which sees an enduring role for natural gas with substantial growth in renewables by 2050.

The new strategy also contains updated targets for clean energy, emissions reduction, hydrogen production, energy efficiency measures, and a greater rollout of EVs and charging infrastructure.

UAE CLEAN HYDROGEN STRATEGY: A CORNERSTONE OF TRANSITION

As part of its updated energy strategy, the UAE will look to balance economic growth in the industrial sector – its largest power consumer – with efforts to boost its decarbonisation aims and green industry economic opportunities. This will include new production of renewable forms of energy, namely nuclear and hydrogen, with supply channeled to key industrial and commercial segments to further boost their decarbonisation efforts.

In 2023, the UAE unveiled its National Hydrogen Strategy 2050 which it sees as a cornerstone to its longer-term decarbonisation, transition and economic diversification goals, whilst enhancing the UAE's position as a global producer and exporter of low-emission hydrogen within the next decade.

■ **THE UAE'S NEW HYDROGEN STRATEGY CONTAINS A NUMBER OF TARGETS, NAMELY A 25% REDUCTION IN EMISSIONS IN KEY SECTORS, PRODUCTION OF 1.4 MILLION TONNES OF HYDROGEN PER YEAR, THE LAUNCH OF AN EXTENSIVE HYDROGEN R&D CENTRE AND THE DEVELOPMENT OF TWO HYDROGEN OASES (PRODUCTION HUBS)**

It also foresees the development of two hydrogen “oases” (production hubs), with a further three to be completed by 2050. Such hubs foster industrial clustering, making it easier for global companies to establish commercial networks through which wider trade and investment can be channeled. This is a format familiar to regional players such as Dubai’s DMCC, which have in recent years successfully pioneered a number of commodities-specific ecosystems, including in energy, precious metals, precious stones and high-value service industries, with hydrogen now an area of significant potential.

COP28 in focus:

COP28 gathers world leaders, governments, industry and thousands of stakeholders for the world’s biggest climate summit. In its position as host for 2023, the UAE has committed to guide discussions, providing political leadership, momentum and renewed calls to action the global climate agenda.

In the build-up to the summit, COP28 President Dr Sultan Al Jaber released a four-pillar action plan to structure the negotiations. One of these was fostering a “responsible” energy transition, which called for a tripling of renewable energy production, a doubling of hydrogen production by 2030, and pushing oil and gas companies to diversify into clean energies. Dr Al Jaber also emphasised the need to take an “integrated approach” that considers supply and demand – a nod to the ongoing economic uncertainty engendered by supply and trade constraints on the global energy trade landscape.

Whilst there is scope for progress at COP28, there are also a number of key challenges – outlined in more detail below – and the UAE presidency will need to dexterously leverage its powers of negotiation and diplomacy to the fullest in order to drive its desired outcomes.

COP28: KEY DRIVERS AND AREAS TO WATCH

Drivers of Faster Action

IPCC AR6 Synthesis Report

restated urgency of action, with time running out to keep the 1.5°C goal on track

Areas of Possible Progress & Potential Disagreement

Technology Investment is set to be a major focus at COP28, with hopes for a clear pledge for faster roll out of renewables in the power sector

Oil and Gas Decarbonisation focused on further reductions of operational emissions including methane, is also likely to see a push for action

Emerging Transition Technologies like CCS and hydrogen are also set for plenty of interest - but may not enjoy the same degree of consensus support

Possible Progress

Drivers of Faster Action

Global Stocktake

process, due to conclude at COP28, is expected to highlight need for accelerated action

Areas of Possible Progress & Potential Disagreement

Carbon Offset Trading will again be a major theme of discussion at COP28

Climate Finance is again high on the agenda - including for loss and damage - but with scope for disagreement, amid pressure for pledges from advanced economies, and possible new funds from non-Western players

Fossil Fuels are likely to be at the heart of more challenging negotiations at COP28, as some parties push for more rapid, explicit phase-out, while others highlight need for a "pragmatic" approach, as well as a "just transition"

Potential Disagreement

KEY RECOMMENDATIONS

In a fluid energy landscape, what is clear is the central role the Middle East will continue to play across all segments. Upstream oil and gas growth across the region and in the UAE in particular will be required to meet demand across the world. At the same time, investment in clean energy driven by Gulf states contributes to supplying new forms of demand and decarbonisation, as well as driving down costs of technologies critical to the energy transition.

REIMAGINE THE TRADITIONAL SUPPLY CHAIN

Firms should develop acute awareness of how shifting geopolitical and geoeconomic landscapes impacts traditional energy supply chains as well as efforts to prepare for the energy transition, in order to both identify challenges – for instance, reshoring of industrial operations or requirements to meet economic targets. To mitigate risks, firms should undertake supply chain audits and critical assessments to better manage their own supply chains. This includes reshoring efforts for industrial operations.

PREPARE FOR POLITICAL AND REGULATORY VOLATILITY

The energy sector should identify risks such as the potential for regulatory volatility due to political upheaval, changing national strategies and policies towards energy consumption, and the ways in which the energy value chain may also be impacted. The diverse and volatile landscape of energy policies around the world means firms should brace for sudden shifts in regulations to the energy sector which could swing widely between greater or more limited market access in relatively short spaces of time.

ADOPT BROAD MARKET PERSPECTIVES

Uncertainty should be minimised by firms by avoiding the adoption of a single “house view” and considering a range of perspectives on potential market outcomes that better prepare and insulate against unexpected developments, especially in periods of elevated volatility.

MAINTAIN A PREDICTABLE INVESTMENT CLIMATE

Maintaining a predictable and transparent investment climate from all stakeholders in the energy sector is crucial for attracting capital, fostering innovation, and ensuring sustainable energy development. This includes clear and stable national energy policies and regulations, streamlined processes that facilitate ease of investment, and greater access to relevant data such as energy demand forecasts in key markets.

ENSURE SECURITY OF ENERGY SUPPLY

Ensuring continued access to conventional energy supplies during the transition is essential to maintain energy security and a smooth transition to cleaner energy sources. Whilst not without risks, governments should maintain a diverse energy portfolio to provide resilience against supply disruptions and fluctuations in renewable energy generation.

FOSTER LOCAL AND REGIONAL PARTNERSHIPS

Local partnerships including public-private partnerships should be actively encouraged as they play a significant role in fostering innovation. In the Middle East, strategic partnerships with local players, especially NOCs, are key to establishing market credibility and facilitating the transfer of advanced energy technologies. Emphasis on local content regulations is only likely to grow stronger, making firms which choose greater localisation better positioned.

PROMOTE INNOVATION THROUGH INDUSTRIAL CLUSTERING

Renewable energy sources and low-carbon technologies must become more accessible and economically viable in order to fully realise the energy transition. Large-scale investments must be made in R&D and the development of knowledge and production hubs, for instance through the UAE’s “hydrogen oases”, which will facilitate industrial clustering and a multiplier effect on production, innovation, efficiency and trade.



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