

Honeywell

ADIPEC Roundtable Insights

Q4 2022

MANAGING THE ENERGY TRANSITION
Tradeoffs, Technologies, and the Path to Carbon Neutrality



Executive Summary

The exclusive insights revealed in this Whitepaper reflect the opinions and outlooks discussed by senior energy and technology delegates during Honeywell's roundtable on the sideline of the world-renowned ADIPEC Exhibition & Conference in November 2022.

The exclusive insights shared in this Whitepaper reflect the opinions and outlooks discussed by senior stakeholders in the energy and technology industries at a private roundtable during ADIPEC in Abu Dhabi on 1 November. The event was hosted under the Chatham House Rule. Any further use of this material must cite Honeywell and this Whitepaper in full.

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In-depth discussions throughout the roundtable benefited greatly from the cross-regional and international experience of delegates from national oil companies (NOCs), international oil companies (IOCs), state-owned and private energy companies, as well as technology providers and experts from academia. All the delegates are critically influential in propelling the energy transition, the biggest and fastest global overhaul in modern history, in the Middle East and beyond.

Key topics during the roundtable delved into what technologies should be prioritized to accelerate the decarbonization of industry in the Middle East in the next year and what emerging technologies would most benefit from more attention by 2025? Delegates also explored what technology strategies can underpin an inclusive approach to the Middle East's energy transition. The depth of

dialogue surrounding these compelling points, and many others, reflects the complexities underway in the global energy-technology-environment nexus – the most pertinent of which we have captured in this Whitepaper.

Among the many pressing takeaways that emerged, the importance of collaboration and clarity were at the forefront as overarching necessities: work together and as transparently as possible. In this vein, delegates emphasized how holism must be the future for it feeds into strengthening every aspect of the energy transition – from financial fluidity, circularity, human capital, and more. We welcome you to examine these points detailed in this Whitepaper, for sharing knowledge and intelligence is a cornerstone of ensuring our collective focus on the three Ps – people, planet, profit – sets the energy industry on a greener and even more prosperous trajectory in the 21st Century.

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It took more than a century to develop today's energy system. To advance the energy transition, what we have achieved in the last 100 years must now be done four times faster to make Net Zero a reality by 2050. Accordingly, the energy sector and its supporting pillars – notably technology, academia, and finance – must work harder, faster, and more innovatively than ever. This enormous effort is non-negotiable to safeguarding energy security, advancing the climate agenda, and strengthening the global economy. Leveraging technologies to deliver speed, visibility, and reliability underpins this dynamic outlook, especially for the global guardians of energy; national oil companies (NOCs) and international oil companies (IOCs).

How can you address what is arguably the greatest challenge modern humans have ever faced? This is the extraordinarily weighted question that NOCs, IOCs, and the rest of the energy industry – responsible for approximately 75% of greenhouse gas (GHG) emissions¹ – are tackling. Pressure to report more tangible progress is also mounting with just one year till COP28 in Dubai, the world's largest annual climate gathering, and the announcement of several Middle Eastern nations' Net Zero goals by 2050 and 2060.

Delegates agreed that multifaceted and speedy solutions are urgently needed. There are two aspects to this. First, NOCs and IOCs have already achieved meaningful progress in recent years, all of which provides a strong foundation to build upon. The region is already home to some of the world's most competitively sized and priced renewable energy projects, as well as ambitious growth plans for fossil fuels. It also has many examples of creatively blending these two 'camps', such as the Al Reyadah carbon capture and storage (CCS) project in Abu

Breed of new partners

Rising numbers of competitors and cross-industry alliances will emerge in 2023, as well as more partnerships between companies that historically had a relationship in a supply chain. The "chase and compete" mentality will increasingly be replaced by "complement and complete", as stakeholders all appreciate the magnitude of Net Zero and how it calls for all hands-on deck. A delegate described how their company has spent five decades building a very deep understanding of how CO₂ emissions behave in reservoirs, which could be blended with other delegates' expertise in digital and technology development, or organic research projects, and so on. Another delegate shared how their company sold 32 projects related to sustainable aviation fuels (SAF) in two years as part of a partnership, having only sold a single project in the preceding eight years. The message is clear: ignore the power of partnerships at your commercial peril. However, far more incentives are needed to encourage more collaborations from across the worlds of energy, technology, academia, and finance, to name a few. Delegates are optimistic that more alliances will reveal the true value of human ingenuity and collaboration, adding that Net Zero is possible if we make it possible.



We must examine the reality of every continent and every country – not what we think it *should* be – and then apply the best technological solutions. A nuanced approach unified by standards and regulations is the best route.

Dhabi. This supports state-owned ADNOC's enhanced oil recovery (EOR) at nearby fields. The other aspect is that while industry knows it must keep accelerating, there are some who are still unsure what to prioritize amid a fast-evolving myriad of urgent matters relating to energy security, environmental protection, and commercial strength. Within both these points lies the critical need to focus more on collaboration; the challenge is too demanding and the schedule too tight to succeed operating in silos (see page 3: New breed of partners).

That most of the reductions in CO₂ emissions through to 2030 are expected to come from technologies already on the market today provides some relief,² but this does not mean that efforts to ramp up the creation and application of clean technologies can slow. In 2050, almost half the CO₂ emission reductions could come from technologies that are currently at the demonstration or prototype phase,³ so the rate of innovation must only increase.

4

countries in the Middle East have committed to Net Zero: the UAE and Oman by 2050 and Saudi Arabia and Bahrain by 2060.

\$4trn

per year of clean energy investment worldwide is required by 2030 to reach Net Zero by 2050.

100x

more harmful than CO₂ emissions, delegates called for more research into how to replace and reduce hydrofluoroolefins (HFOs).

2

significant downturns in upstream oil and gas investments worldwide have been recorded since 2015: -26% in 2015-2016 and -30% in 2019-2020. This trajectory must be reserved to protect energy security and indeed, help fund the climate agenda.

\$1.1bn

of business value has been generated by ADNOC's Thamama Center of Excellence since its inception in 2017. Thamama is part of the energy giant's investments in advanced technology and digitalization to boost efficiency.

25%

reduction in GHG emission intensity is what ADNOC has pledged as part of its 2030 Sustainability Strategy.

4

year capital spending plan of \$127bn between 2022-2026 was announced by ADNOC, amid a rise in the UAE's oil and natural gas reserves.

2050

is when state-owned Saudi Aramco, the world's biggest oil exporter, plans to achieve Net Zero Scope 1 and 2 emissions.

Sources: ADNOC, Saudi Aramco, IEA. Any data point not marked is information shared by delegates.

Bolstering financial fluidity

Despite the clear pressures, large and meaningful exploratory projects that support both energy security and decarbonization still sometimes struggle to gain financial support. A search for \$40bn for a SAF project has been highly challenging, one delegate said, adding that financings that are "more than a little and less than a lot" are a weak spot. This needs to be addressed immediately for projects within this range tend to be important building blocks for other research. NOCs and IOCs must work harder at whetting investors' appetite, but in turn, the financial community must be more open-minded about branching out from tried and tested processes. Improving environmental legislation can help, as there are still many loopholes and gaps. This ranges from a lack of emission performance standards, to standardized engineering solutions, to opacity on pricing carbon. Investors do not generally appreciate ambiguity, especially with large-ticket financings in relatively new or innovative endeavors.

Generally, digital research and implementation are more affordable when exploring operations in silico, though deep dives into technology need far more investment. Funding projects for sustainability in material systems has been easier, such as applications in energy, sustainable construction, water technologies, reducing the weight of materials, and so on. For the latter, for example, approximately 30% of emissions associated with cement can be cut via optimized processes. This is highly relevant for NOCs and IOCs in the Middle East, as many have big infrastructure projects planned or underway as part of the region's three-decade boom in energy demand and building. There is significant potential for improvement in this space, considering 33% of global waste is attributable to construction.¹⁵

The call for this magnitude of collective action across the energy sector is justified. For one, limiting global warming to 1.5°C, as per the Paris Agreement, translates into around 6GtCO₂ of carbon dioxide removal (CDR) per year by 2050 – more than the weight of all the petroleum produced today.⁴ And achieving Net Zero by mid-century requires renewables to account for nearly 90% of global electricity generation (solar PV and wind accounting for nearly 70%), from approximately 30% today.⁵ All this must be accomplished without jeopardizing energy security – a risky imbalance playing out to a degree in Europe amid the Russia-Ukraine war – and sustaining profitability. The impact of intensifying urbanization and swelling energy demand from a 23% rise in the global population, from 7.9bn today to 9.7bn by 2050, must also be factored in.

'AND': A NEW NORM

The future of energy is one grand balancing act, as both fossil fuels and renewables will be two instrumental spokes in the wheel of energy security and environmental protection well into the latter half of the 21st Century. Therefore, pinning down synergies between these avenues of energy supply is key. This is well illustrated by the desire of the UAE, the third largest producer in OPEC, to simultaneously become a global leader in renewable energy. The demands on the energy system are too great to "switch off oil and switch on solar in a few years", a delegate said, so the word 'and' is increasingly part of the industry's narrative.

Delegates said this dual approach must also be embedded within NOCs and IOCs' design ambition. Engineers must automatically consider safety, efficiency, and environment "all in one", rather than environment being an add-on when convenient. This holistic method, which reduces time-consuming backtracking, is already showing dividends across the Middle East's energy sector. One delegate shared how their energy company saved 17.5mn tons of CO₂ from its operations over the last decade by integrating relatively simple and affordable technologies.

Another crucial aspect of 'and' is how energy stakeholders and their partners are having to address multiple fronts more than ever before. NOCs and IOCs are now tasked with safely and profitably sustaining production levels, educating themselves on the climate agenda, investing heavily in research and development (R&D) in clean technology, integrating tools of the 4th Industrial Revolution, spurring cultural change, hiring and training new types of talent, and trying to dramatically cut their CO₂ emissions, to name just some of the major steps simultaneously underway. This is a tall order and the more technologies are leveraged, the more energy stakeholders will benefit from greater speed, transparency, and robustness.

This weaves into a third aspect of 'and' in that companies' previous approach to technology development was extremely focused; choose one, maybe two, and work on those for years at a time, delegates said. Now, NOCs and IOCs' increasingly broader approach means they identify technologies that will generate the greatest value the soonest – i.e., energy security and environmental protection in a commercially viable way – and pursue them in parallel, a delegate said. They added that more than 30% of their company's CapEx is currently dedicated to new technologies, a point particularly welcomed by the table considering some research budgets are increasingly limited in size and scope (see page 5: Bolstering financial fluidity).

POWER OF VISIBILITY

The energy industry cannot improve what it does not know, which is why accurate and regular measurement and reporting via the use of technologies and digital tools is pivotal. Yet, therein lies its own challenge: to what baseline? Today, many calculations relating to environmental footprints are conducted ad hoc and / or by teams that specialize in other areas, which can lead to inaccuracies. A delegate said their company discovered their carbon footprint was actually 15% less than anticipated once it started measuring and reporting using technologies, rather than the use of historical manual calculations. Not only does this updated finding improve the company's overall environmental footprint and reputational value, it also helps create a benchmark for what others in industry can achieve. Plus, the stakes are far higher now, especially for NOCs and IOCs operating in countries with Net Zero goals. Previously, such a miscalculation would be unfortunate, but today's heightened climate agenda means mistakes can directly affect a company's ability to capture competitive financings, hire top human capital, or at worst, be criticized for greenwashing. This shows how the application of relatively simple and accessible technologies enables busy energy companies to bypass additional stress.

Such technologies also help NOCs and IOCs produce more detailed and targeted sustainability reports, which increasingly link to reputational value and act as essential stepping stones to companies submitting annual Environment, Social, and Governance (ESG) reports. ADNOC, Dubai's state-owned ENOC, and Saudi Aramco have released sustainability reports, for example, while ADNOC Distribution has an ESG report. All these reports rely heavily on information and data gathering, which is why integrating technologies and digitalization into companies' status quo is so valuable. This is especially true for large companies like



In Focus: UAE

1st

UAE announced its pledge to reach Net Zero by 2050 – the first in the Middle East and North Africa (MENA) to do so.

≈12

months until COP28 in Dubai opens its doors next November, marking the first time two consecutive events have been held in the MENA since the annual gathering began in 1995.

3

The UAE is one of just three nations worldwide that increased the strength of its Nationally Determined Contributions (NDCs), as per the Paris Agreement, in 2022.

2015

saw the UAE become the first nation in the Gulf Cooperation Council (GCC) to cut gasoline subsidies.

\$163bn

is what the UAE has committed to support its Net Zero by mid-century target so far.

NOCs and IOCs with a multi-nation reach, particularly in developing countries where data transparency can be more opaque. For example, having clean and thorough data sets will be instrumental to enable energy companies to calculate and reduce their Scope 1, 2, and 3 emissions, all of which are part of ESG scorings. This is especially the case for the more complex Scope 3 emissions. These are emissions resulting from activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value

chain – a core aspect of achieving Net Zero. Improving industry standardization is another area of visibility that NOCs and IOCs have the opportunity to strengthen. For example, there is currently a lack of national, regional, or international policy, regulations, or laws to provide an industry rulebook on ESG. There are varying metric systems that assign companies a score, yet rankings and ambition differ hugely. This makes comparable results and monitoring aspirations very difficult and it risks a first mover disadvantage to companies that have proactively contributed to and



Solving the enigma of storage

The complexity of development means large-scale batteries for energy storage are increasingly technically feasible, but still not commercially so, delegates said. Therein lies an opportunity that these energy majors can tackle as soon as possible. Success will likely take several years, so these energy giants can take other steps to enhance grid management. A delegate referenced the value of using AI-based systems to provide reliable and real-time guidance on supply-demand flows within a national, or perhaps even regional, grid of renewable energy. Such systems will be especially needed as the volume of renewable energy inevitably increases to support Net Zero targets.

paid for an ESG report. Becoming a leading voice in this fast-growing space would enable NOCs and IOCs to enhance the transparency, reporting, and competitiveness of their own operations and be far more influential in the global climate agenda.

Investing resources in ESG is just one of many routes to support Middle Eastern NOCs' desire to sustain their leadership, having played a central role in the evolution and domination of fossil fuels for more than half a century. ESG is a "horse worth betting on," a delegate said. Asset managers globally are expected to increase their ESG-related assets under management (AuM) to \$33.9trn by 2026, from \$18.4trn in 2021. With a projected compound annual growth rate (CAGR) of 12.9%, ESG assets are on track to constitute 21.5% of total global AuM in less than five years.⁶

TALK IN CIRCLES

NOCs and IOCs can also expand on the potential of weaving circular principles into operational norms as our 'use and abandon' approach incurs great damage; humans need 1.5 planets per year to feed our appetites to consume. In the energy industry alone, more than 500mn barrels of water are used every year to meet the world's desire for oil, for example.⁷ Boosting NOCs and IOCs' circular efforts in this space alone would have a hugely beneficial impact across the Middle East, where water scarcity is one of the greatest threats. Both NOCs and IOCs can collaboratively examine ways to use technology in this circular future, including the use and re-use of plastics, delegates said. The benefits are clear: a circular economy could generate \$4.5trn of additional economic output worldwide by 2030.⁸ Delegates also flagged that NOCs' remit as social leaders and champions means they can more proactively help spur circular cultural change amongst the societies they serve, thus reducing waste and CO₂ emissions.

DOING MORE WITH LESS

Energy efficiency is the single largest measure to avoid energy demand in the journey to Net Zero.⁹ Delegates believe strengthening regulations in this space can have the greatest, short-term impact in improving day-to-day operations and refining long-term operations. This applies to both new-builds in renewables and fossil fuel markets, as well as legacy infrastructure in fossil fuels, some of which is up to 40 years old.

Many efforts to streamline energy efficiency are already underway across the Middle East. One delegate detailed their plans to enhance energy efficiency in the 2,500 buildings their team oversees in the UAE, reducing annual energy demand by a minimum of 40% and water demand by 50%. Other examples include a \$3.8bn close on a strategic project by ADNOC and Abu Dhabi National Energy Company, better known as Taqa, to power and decarbonize ADNOC's offshore production operations – reducing the carbon emissions footprint by more than 30%. The project includes replacing existing offshore gas turbine generators with more sustainable power sources from Abu Dhabi's onshore power network, with commercial operations expected to start in 2025. Again, this highlights the emerging holistic approach to energy management: support growth while protecting the environment.

Such energy-saving efforts are fundamental to Net Zero pathways, one of which expects the global economy to be 30% larger in eight years, yet using 7% less energy.¹⁰ A major worldwide push to increase energy efficiency could result in the primary energy intensity of global GDP improving by an average of 4% through 2030 – about three times the average rate achieved over the last two decades.¹¹ As delegates said, picking up the pace and creativity of current endeavors is paramount to making forecasts a reality.

TAPPING POTENTIAL

CCS remains a central part of NOCs and IOCs' plans in the Middle East, although delegates said the complexity of scaling up projects means momentum has been slower than anticipated. Still, progress is undeniably being made. The Al Reyadah project is the world's first commercial CCS facility for the iron and steel industry and three facilities in Gulf Cooperation Council (GCC) countries now account for approximately 10% of the CO₂ captured worldwide every year.¹² Delegates pointed to some projects that could lead to scalable yet affordable options in the medium-term. Whether this will be quick enough to maximize the Middle East's plans for hydrogen – the UAE wants to be a powerhouse for blue hydrogen¹³ – remains to be seen. Delegates called for more support to maximize CCS' potential, adding that opportunities are rife.

THE MOST PRECIOUS RESOURCE

Human capital is the beating heart of the energy industry; enablers of innovation, collaboration, and on-the-ground

momentum. This value is highlighted by the stream of ideas shared during major knowledge-sharing events, like ADIPEC. These minds craft the mission and vision for the society of the future; one that can balance the triple priority of people, planet, and profit. Yet, some universities are closing down their petroleum engineering departments and talent is still exiting the industry. Better communicating the allure of working in energy markets, notably fossil fuels, is important to start reversing this damaging trend, especially considering the Middle East has one of the highest rates of youth unemployment worldwide.¹⁴

“It is an extremely exciting time to be an engineer and to be in the energy industry, which needs to be better showcased,” a delegate stressed. Using digital tools could help enhance education for existing and potential talent, such as using digital twins or simulators. Plus, the large gap between the women excelling in science, technology, engineering, and mathematics (STEM) academically and those joining the workforce must be plugged, especially as working norms following the COVID-19 pandemic have made flexible options like remote and hybrid contracts far more common.

SAF gains height

Delegates expect interest in developing SAF to grow quickly in the Middle East, with energy companies taking advantage of the region's position as a global hub of aviation. Most recently, UAE flag carrier Etihad delivered delegates to COP27 on a net zero flight powered entirely by SAF¹ and announced its first journey with 40% SAF supplied by Japan, reducing the CO₂ emissions of the trip by 75.2 tons.² Plus, ADNOC, BP, and Masdar have agreed to explore the production of SAF in the UAE³ and Saudi Arabia's Alfanar Group will invest \$1.1bn in a SAF project in the UK.⁴ Global progress means Middle Eastern energy companies must pick up the pace. So far, 57 airports worldwide distribute SAF, 34.9bn liters are under offtake agreements, and more than 440,000 flights have used it.⁵ The market has swelled in recent years from \$7bn of offtake agreements to \$25bn during the COVID-19 pandemic.⁶

Sources: 1 Zawya; 2 Etihad; 3 Gulf Business; 4 Renewables Now; 5 International Civil Aviation Organization (ICAO); 6 Air Transport Action Group (ATAG).

How Honeywell can support the Energy Transition

Honeywell is dedicated to driving the transformation to a sustainable future and is well on its way to delivering on its commitment to make all Honeywell facilities and operations carbon neutral by 2035. Honeywell's plan to do so includes improving energy efficiency, switching to renewable energy sources, and leveraging Honeywell low-global-warming technologies.

Honeywell is also committed to helping customers meet their sustainability goals and the company's technologies are already out in the world making an impact. The company has a wide range of solutions to help advance its customers' decarbonization efforts, including technologies that support:

- The Circular Economy
- Environmental Transformation
- Energy Evolution
- Healthy, Safety and Security, and
- Resilience and Accountability

Honeywell's key technologies, such as plastics recycling, emissions monitoring, biofuels and sustainable aviation fuels, carbon capture, hydrogen, energy storage, energy efficiency, healthy buildings solutions and advanced measurement systems, among others, can help decarbonize the most carbon intense sectors of the global economy.

More Information

- [Sustainability at Honeywell](#)
- [Corporate Citizenship Report 2021](#)

Roundtable delegates

- Ali Al-Jarwan, Chief Executive Officer, Dragon Oil
- Charlotte Wolffby, Chief Sustainability Officer, Petronas
- Dr. Patrick Allman-Ward, Chief Executive Officer, Dana Gas
- Dr. Steve Griffiths, Board Member of the Dubai Future Council on Energy Senior Vice President for Research and Development, Khalifa University
- H.E. Engr. Yousif Al Ali, Assistant Undersecretary for the Electricity, Water and Future Energy, Ministry of Energy & Infrastructure
- George Bou Mitri, Vice President & General Manager, MENA, Honeywell
- Giuseppe Ricci, Chief Operating Officer Energy Evolution, Eni
- Kamel Ben Naceur, President, Society of Petroleum Engineers
- Lucian Boldea, President & Chief Executive Officer of Performance Materials & Technologies, Honeywell
- Mohannad Abuissa, Gulf Chief Technology Officer, Cisco
- Mohammed Mohaisen, President & Chief Executive Officer MENA, Honeywell
- Richard Spires, Global Director of Technology Development, Wood
- Sean Evers, Managing Partner, Gulf Intelligence
- Sophie Hildebrand, Chief Technology Officer, ADNOC
- Steve Kelly, President, 1PointFive International
- Vimal Kapur, President and Chief Operating Officer, Honeywell

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