



THIRTY TO NET ZERO

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Editor's Opinion

Dear Reader,

The Middle East's hydrogen industry is a multifaceted and consistently changing landscape. There will always be challenges to conquer, opportunities to seize, and skills to hone. It has seen tremendous growth in the region over the past decade, and that has prompted a renewed interest in expanding the region's reach into the field.

To further understand these shifts, we brought together a select group of experts in Hydrogen from various disciplines last month. Hebah Abbas, Technical Advisor and Sustainability Committee Chairwoman at KWA (Kuwait Water Association), Frank Wouters, Senior Vice President New Energy at Reliance Industries, Wietse ter Veld, Green Hydrogen Expert at Atkins Middle East, Mohammed AlGhazal, Co-Founder & CEO, Noor Energies Group.

We looked also at key relevant topics around the regional Hydrogen Industry such as Hydrogen diplomacy in Middle East, and the challenges surrounding the transition to Net Zero. We deep dived into questions such as whether Green Hydrogen is the answer to earth's quest for Net Zero.

These in-depth discussions with key figures together with articles that summarise the regions industry, despite its overall brevity have made the issue rather powerful.

If there are other topics you would like to see us cover send me an email at editor@secretariatsworld.com.

Nitin Konde

Nitin Konde
Editor
Thirty To Net Zero Magazine
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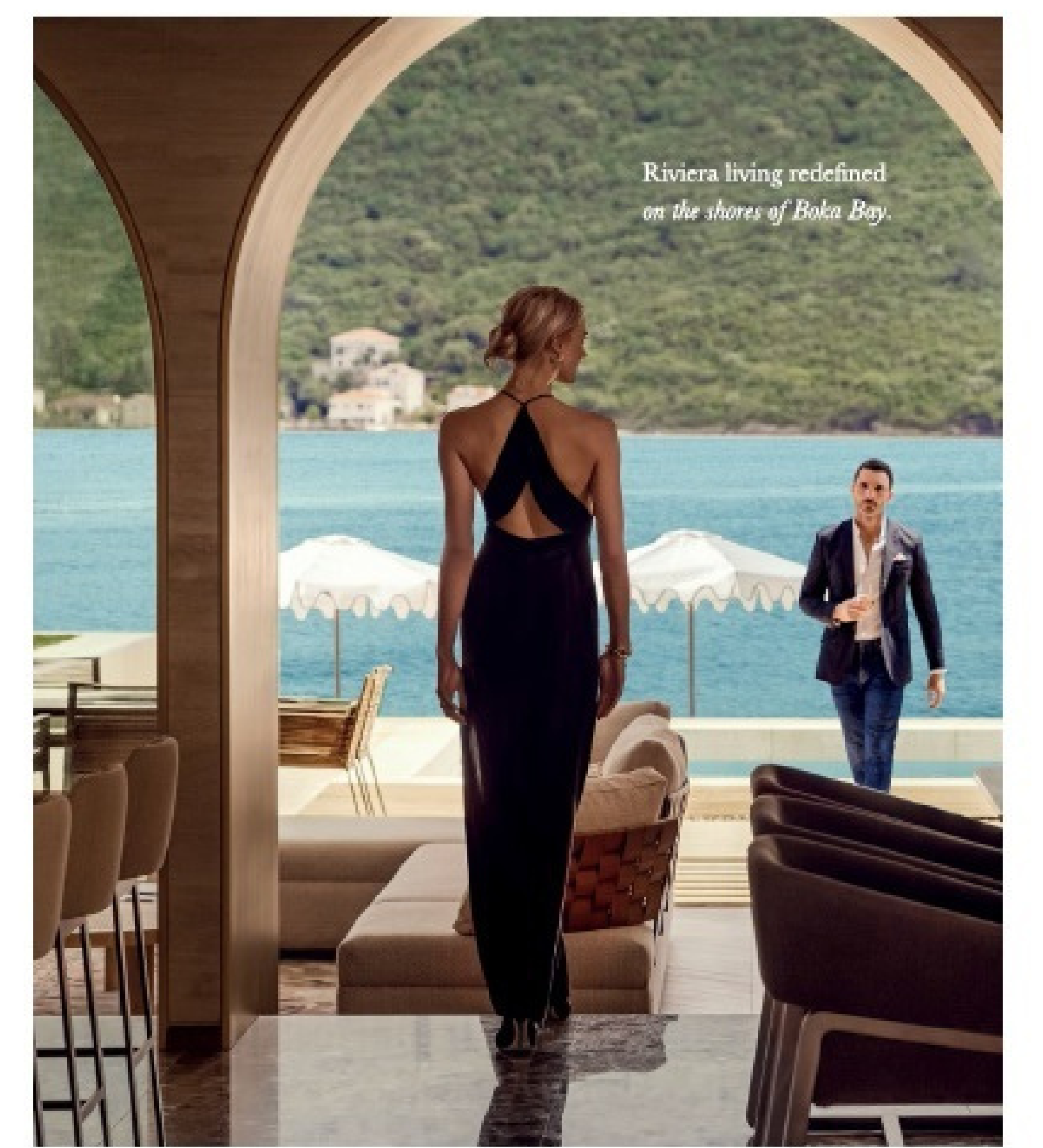


People who see challenges differently, see the world differently.

A world where healthcare workers are better equipped to treat patients. Where energy is more sustainable and can power more lives. And where faraway places feel closer with flight that's more fuel-efficient. Because seeing a smarter, healthier, cleaner world isn't something that's far in the future. **It's the world we're building now.**



Building a world that works

A woman in a black, backless, floor-length dress stands on a terrace, looking out at a man in a dark suit and blue jeans who is walking towards her. The terrace is furnished with a light-colored sofa and several white patio umbrellas. In the background, there is a large body of blue water (Boka Bay) and a lush green hillside with some buildings. The scene is framed by a large, arched opening in a building's facade.

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HYDROGEN DIPLOMACY IN THE MIDDLE EAST

GCC nations are planning initiatives to jumpstart the hydrogen economy in the region. The United Arab Emirates (UAE), Saudi Arabia, and Oman have particularly lofty goals to sell the carbon-friendly fuel to the European Union and the Asia-Pacific region. Numerous letters of intent have been signed, and the groundwork for some major initiatives has been laid. Hydrogen is a way for Gulf states to diversify their economies, but it also has other uses. Because of its compatibility with the petroleum industry's existing institutional and budgetary framework, the hydrogen economy presents a unique opportunity for the GCC economies to preserve their current economic and political hierarchies. Hydrogen from the Gulf is a powerful instrument for mitigating climate change, but Germany and Europe must weigh the benefits of this option against the costs.

One-third of the world's oil reserves and one-fifth of the world's natural gas reserves are located in the six countries that are part of GCC.



Hydrogen // Modern Diplomacy

Now, Gulf countries have revealed their grandiose ideas for a hydrogen economy. Green hydrogen (generated from renewable electricity) can be efficiently produced in regions with both high solar yields and ample land. Blue hydrogen, made from natural gas with carbon capture, benefits from similar geological conditions and natural gas sources. The economies of the GCC are well-suited to be among the first to adopt hydrogen because of their access to abundant money, decisive leadership, and existing infrastructure. Hydrogen, however, provides the Gulf states with more than just diversity; it ensures their continued economic and political dominance in a post-carbon world.

The Kingdom of Saudi Arabia has already begun to create solutions to combat the climate crisis by releasing the Saudi Green Initiative and the Middle East Green Initiative. During Saudi Arabia's G20 presidency in 2020, it introduced the circular carbon economy to reduce, reuse, recycle, and remove carbon, and create ways towards economic growth. This means being energy efficient, becoming carbon neutral, and capturing carbon.

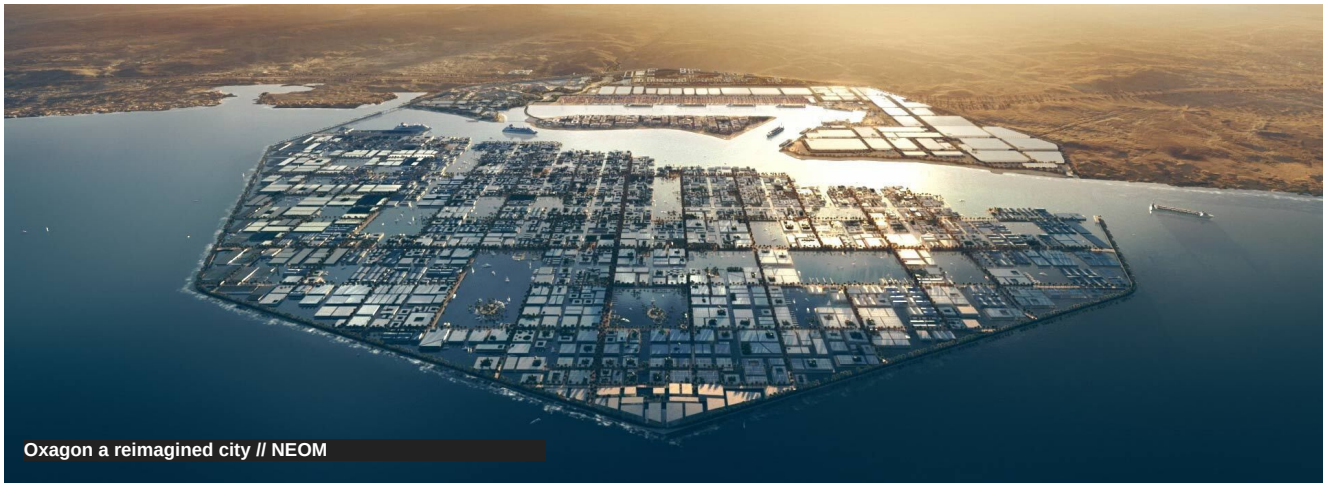
Hydrogen is the lightest element, is colourless, odourless, and will not generate pollutants by itself. It can be stored and transported easily with pipelines, ships, and trucks. Thus, becoming a great source of energy and an efficient replacement for fuel. However, it requires a chemical process for its development. There are three ways to develop hydrogen, they are named by colours such as grey, blue, and green.

Grey hydrogen: This is the most common form of hydrogen production and is created from natural gas or methane. Grey hydrogen uses steam at a high temperature and pressure to produce synthesis gas, consisting of hydrogen and carbon monoxide. The gas is then reacted with water to produce pure hydrogen and carbon dioxide. Since they produce a significant amount of CO₂, they are termed "grey hydrogen."

Blue hydrogen: This is the second-most common hydrogen generation process. The process is similar to that of grey hydrogen but traps 90 percent of greenhouse gases through carbon capture technology. This method of capturing carbon is called carbon capture and storage (CCS). In certain cases, the carbon must be stored underground, but this raises costs.

Green hydrogen: It is obtained from renewable energy, which makes it sustainable creating zero pollution. It is a process of electrolysis powered by renewable energies such as wind or solar. Electrolysis is a chemical reaction that splits water into hydrogen and oxygen while emitting zero carbon dioxide in the process. This requires energy since it comes from surplus renewable energy sources, as mentioned above (solar or wind).

Green hydrogen promises to offer high efficiency at a low cost, but it requires a long startup time. It is an expensive process, but its cost may reduce if it becomes more common. Also, hydrogen is abundant but must be produced to get it in its pure form.



Preparing for the Hydrogen Economy

Hydrogen is not yet commercially and widely available; and technological advancements are required to deploy it on a large scale. However, in 2021, Saudi Arabia's Minister of Energy, Abdulaziz bin Salman al-Saud, announced a plan to become the world's largest hydrogen producer.

Aramco is also taking steps to reach operational net-zero emissions by 2050. The company recently published its sustainability report which pledges to reduce its upstream carbon intensity by at least 15 percent by 2035 and use technology to produce low-carbon hydrogen.

Similarly, it has planned to explore and collaborate with Indonesia's PT Pertamina (Persero). These companies signed an MoU that commits them to devise a solution to the global energy crisis and to achieving net-zero greenhouse gas emissions by 2050 at the B20 Summit in Bali.

They will develop new ammonia and hydrogen pathways for an affordable, equitable, and sustainable transition for everyone. The MoU aims to understand the possibilities of developing the ammonia and hydrogen value chains. It will explore business options and be studied for the next two years; according to the results, it may develop further.

NEOM aims to achieve a US\$5 billion world-scale green hydrogen-based ammonia production facility that will operate by 2025. It has also installed a Hydrogen and Innovation Development Centre developed by ENOWA, the energy, water, and hydrogen supplementary of NEOM.

According to the World Energy Summit, the demand for green hydrogen is set to increase in the coming years because it is a flexible and stable source of energy. As per recently published reports, it is set to double from 100 mega tonnes to 223 mega tonnes in 2050. The costs are around US\$600 billion in investment.

Siemens Energy, the Dubai Electricity and Water Authority (DEWA), and Expo 2020 Dubai decided to establish the first solar-powered green hydrogen plant at the Mohammed bin Rashid Al Maktoum Solar Park in Dubai. They stated that 46 green hydrogen projects worth US\$92 billion are possible in the MENA region. Further, it will roughly plan 50+ projects that have US\$150 billion in investments. The UAE also declared at the COP26, 2021 summit to establish itself as the leader in hydrogen and will be developing a "Hydrogen Roadmap."

The King Abdullah Petroleum Studies and Research Centre (KAPSARC) is an advisory committee that will offer organisational solutions in the Saudi energy sector by focusing on energy economics as well as sustainability. It hosted a virtual roundtable partnering with the Columbia Centre on Global Energy Policy to accelerate hydrogen, meet demands, and increase international trade.

Moreover, many green and blue projects are in the beginning stages, and the market for them is also small. This would require regulation and support across all regions and sectors.

Hydrogen: A Path to a Sustainable Future

To reap the benefits of hydrogen and build a hydrogen-ready infrastructure, key concerns are vital.

To deploy green hydrogen at a large scale, leaders need to make it available at a low cost and increase its efficiency across production, storage, and transportation stages. Industries also need to adopt green hydrogen and create demand for it across all sectors. This demand will give rise to investment.

Another concern is its environmental impact. Since it is a small molecule, it can pass through materials and create leakage issues. It can also cause damage to health if it has a high combustion reaction, releasing nitrogen oxide, causing asthma, and respiratory infections. To address them, strict health and safety standards need to be in place. Leaders' and experts' decisions will help understand how hydrogen is stored safely and efficiently.

Governments require regulations to ensure their environmental impact, market readiness, and safety. Thus, investing in research methods that are safe and economically beneficial for all with appropriate policies and collaborating with partners across the value chain will determine whether hydrogen is here to stay.



The Mohammed bin Rashid Al Maktoum Solar Park in Dubai // DEWA

**“MIDDLE EAST’S CONNECTIVITY
TO MARKETS BENEFICIAL FOR
HYDROGEN PRODUCTION”:
FRANK WOUTERS**

Hydrogen has become a key element in the future of fuel, especially green hydrogen. It is abundant, clean, and produced from renewable electricity, so there are no carbon emissions. Mohamed Jameel Al Ramahi, Chief Executive Officer, Masdar, said during the Green Hydrogen Summit 2023, “As green hydrogen continues to show growing promise as a critical enabler of our net-zero future, we must unlock its full potential by accelerating research and development and investment in this vital sector. Masdar is excited to launch the ADSW Green Hydrogen Summit to support the development of the UAE’s green hydrogen economy and help realize the global energy transition. This inaugural Summit will also pave the way toward COP28 in the UAE, where we can expect green hydrogen to be a key component of a future low-carbon energy market.”

The latest figures by the International Energy Agency (IEA) in 2019 suggest that global energy demand will increase by 25 percent to 30 percent



Frank Wouters



by 2040. In an interview with T2NZ Magazine, Frank Wouters, Senior Vice President New Energy at Reliance Industries revealed that there are many things to consider. He thinks hydrogen in the Middle East has a great future based on several premises. "First is the resource. Green hydrogen is created from green energy, and the region has an abundance of sunshine and some places also wind. The second is the availability of land at a low cost because it's not a very densely populated area. And third, many countries, such as Saudi Arabia, Oman, UAE, and Kuwait are oil and gas producers."

Wouters added, "So these oil and gas producing countries have strong physical and intellectual infrastructure available to make industrial gases with the skills that we need in the future to be cost-effective. We can build on this experience," said Wouters.

And lastly, many countries, especially oil and gas producers such as Saudi Arabia and the UAE, have the resource to invest, train people, build the infrastructure, and do everything that is required to make it cost-effective."

On Having the Existing Infrastructure

Hydrogen is not widely available; however, the Middle East plans to develop and deploy the right technology for it in the next few years. In 2021, Saudi Arabia's Minister of Energy, Abdulaziz bin Salman al-Saud, announced the country has set its goal to become the world's largest hydrogen producer. The region, especially Saudi Arabia, the UAE, and Oman are likely the best candidates for transporting clean hydrogen because they have the existing infrastructure to transport and store oil. They also have the right expertise to deliver it, so adaptability to hydrogen is easy.

Echoing a similar voice, Frank Wouters stated, "Besides favourable conditions, such as having the existing infrastructure to transport and store oil and gas, another factor is that the Middle East is close to Europe and has existing trade relationships with other future importing markets such as Korea and Japan. It is geographically located between these countries where you can build a relationship with them."

"After generating green hydrogen, other products such as green ammonia and methanol can also be produced from it.

Two years ago, I attended a workshop with the Saudi Energy Minister, who suggested that it was technically feasible and cost-effective to do this. It is possible to transport hydrogen as a liquid or connect Saudi Arabia to Europe with hydrogen pipelines," stated Wouters

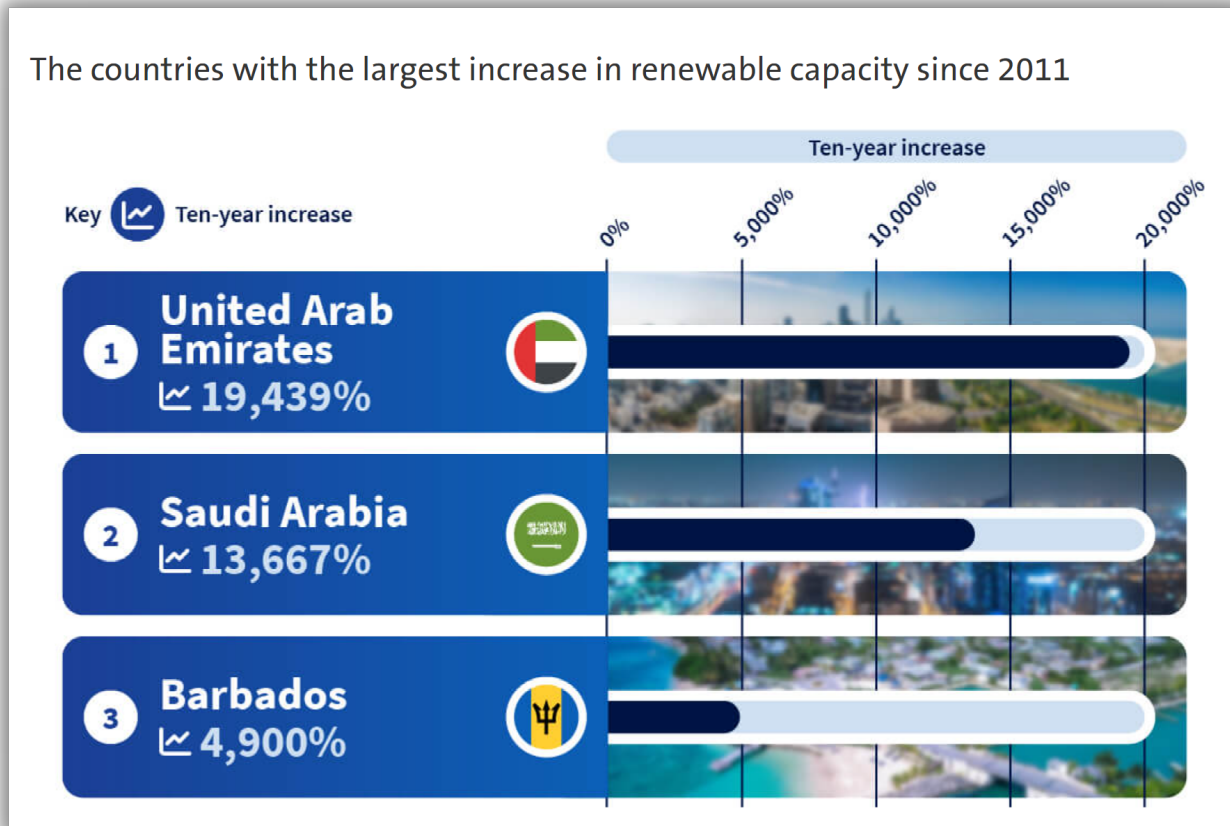
"However, it's politically complex because we must go through several countries with our pipeline infrastructure. It's difficult, but it would certainly be a very elegant and low-cost way to connect these markets," added Wouters

Saudi Arabia has promised to keep the price of hydrogen low compared to other players. Typically, the current production costs vary from US\$2 to US\$7 per kg. However, the country targets production cost of hydrogen lower than US\$2/kg in the future.

To this, Wouters explained, "The main reason is the resource, which allows to produce hydrogen at a low cost. Especially Neom, the north-western part of the Kingdom of Saudi Arabia, has excellent solar irradiation and wind that picks up in the afternoon. Combine the two smartly, and you have a high capacity factor for electrolysis, leading to low costs of hydrogen. So Saudi Arabia is in a very good place."

Challenges in Building the Future of the Hydrogen Economy

Hydrogen is an energy carrier, that is currently produced mostly from oil, coal or natural gas. It can also be generated from water and electricity produced from solar, wind, or biomass.



The Green Furel Index // CompareTheMarket

Frank Wouters clarified the issue with currently producing hydrogen, "In our overall final energy mix, electricity constitutes 20%, whereby 80% of the current energy usage is from molecules. We have now cracked the nut and know how to make renewable electricity cheap, so solar and wind power have been growing exponentially for 20 years or so."

Wouters continued, "However, electricity is difficult to store. And it's also not cheap to transport over longer distances. Whereas transporting hydrogen is nearly 10 to 15 times cheaper over longer distances. And you can store it loss-free over the seasons. For example, Europe currently has a quarter of its annual gas consumption in underground storage, which is significant. This is the level of storage we will need in the future. Fully pivoting towards a green energy system based on solar, wind, and biomass still needs storage. This is because more solar energy is available in the summer months, and we need more energy in the winter for heating and longer lighting times," said Frank Wouters.

"We have to use electricity as much as we can and build electric vehicles and use heat pumps wherever we can. But, according to most analyses, when we go beyond 50% usage, electricity becomes more expensive. This is not feasible, I believe then, this is where hydrogen will play a role," responded Wouters

Green hydrogen may be the fuel of the future, but there are major challenges. Since it is a new technology, the advanced equipment to enhance production is currently not available.

Elaborating on the issue, Wouters replied, "If I look at where solar comes from today, 97% of all solar wafers are made in China. So, we need to diversify our production base but also ramp up capacity for everything that we need, such as critical minerals and metals, that are used in electric motors, batteries, solar cells, etc."

"Another is infrastructure, we don't have the grids now to make the entire system work on renewable electricity. Coal-fired power plants, gas-fired power plants, and nuclear power plants are located at places different from where the future solar and wind power plants will be. So, the expansion of the grid needs to be much more resilient, robust, and flexible," said Wouters.

Wouters continued, "We need storage capacity as well. Part of the challenge is building them and making those investments. Even though it is going to be cost-effective, it still requires massive mobilisation and allocation of capital, which we haven't even started working on yet. So, it's doable, and it will be cost-effective, and we need to start building factories for it.

Building The Right Infrastructure

The government is also taking the necessary steps to invest in building the right infrastructure and technology. They are involved in regulation, providing subsidies, and providing land and infrastructure. Neom, being built by the Saudi government, is also being supported by the private sector.

"Governments are necessary as the private sector can't do this alone. They both need each other. It is a joint effort," said Wouters.



Decarbonization is on the high regional agenda of the Middle East and green energy is a key tool. The region promises to become a world leader in it and achieve net zero emissions by 2050. But to attain this goal, green energy needs to be more accessible, cost-effective, and include green hydrogen in the next few decades.

"At this point, conventional hydrogen is mostly used in fertilisers and refining. These are big sectors in the Middle East, especially in oil- and gas-producing countries. But in the future, if hydrogen becomes one of the major energy carriers of the green economy, the use cases for hydrogen will expand beyond petrochemicals, refining, and fertilisers. We would be able to use hydrogen to make green steel, for mobility, energy storage, etc," elaborated Wouters.

"We're just starting to understand the bandwidth of hydrogen," stated Wouters.

Apart from being actively involved in driving hydrogen technology, Frank Wouters loves being involved in sports, reading books, and watching movies.

All photos provided by Mr. Frank Wouters



MIDDLE EAST REGION LIKELY TO LEAD RENEWABLE ENERGY SECTOR: MOHAMMED ALGHAZAL

Large gains in renewable energy generation capacity are beginning to improve the Middle East's status as having the world's lowest share of clean power in its electrical mix. The percentage increase in renewables capacity in the Middle East of 12.8% in 2022 over the previous year was the highest of any region worldwide, as reported by IRENA. United Arab Emirates, Jordan, Iran, Iraq and Syria, some of the region's top renewables producers, all increased their green capacity in 2022.

More renewable capacity was linked in Qatar, Oman, and Lebanon in 2022 than had been added in those countries in the preceding decade, according to data from the International Renewable Energy Agency (IRENA). An important energy transition momentum will be established in one of the world's largest producers and exporters of fossil fuels as a result of both ongoing expansions among established leaders and significant new renewables projects in surrounding countries.



Mohammed AlGhazal

Expressing his views, Mohammed AlGhazal, Co-Founder & CEO, Noor Energies Group stated, "Sustainable development is the target, with longevity and prosperity as its byproducts. Green technologies are the wave of the future, and their popularity will only increase. Products that are better for the environment and the climate will become increasingly common. This holds true everywhere you look because the modern world demands nothing less than spotless and intelligent infrastructure."

The energy picture for the world is greatly impacted by developments in the Middle East. Furthermore, the area is endowed with renewable energy resources.

His Royal Highness the Crown Prince of Saudi Arabia, Mohammed bin Salman Al Saud, announced as an extension of the Kingdom of Saudi Arabia's presidency of the G20, Saudi green initiative and Middle East green initiative aim to unite Middle Eastern leaders around a common vision to enable far-reaching goals for the green economy. The green effort backed by Middle Eastern nations has supporters outside the region. This initiative's attraction and attractiveness can be directly attributed to its noble goal. In order to capture far-reaching opportunities and enhance the positive influence on the environment, countries throughout the world must work together under this regional collaboration.

Saudi Arabia is positioning itself as a pioneer in the renewable energy sector with the launch of its ambitious, visionary green agenda.

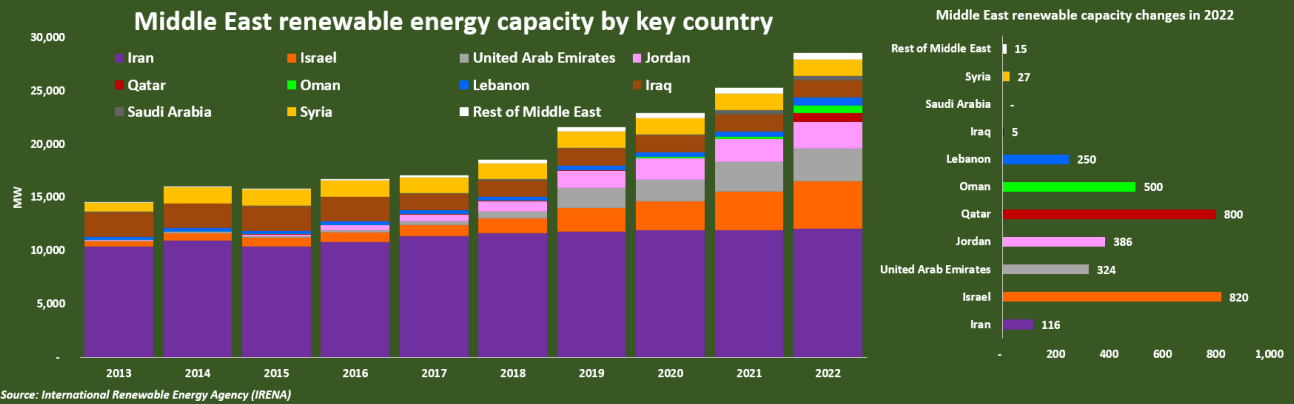
Challenges of Energy Projects

Energy projects are highly sophisticated to accomplish due to their complexity, the number of labour and domain-expertise departments involved, and the amount of raw materials and capital costs required to complete them. Futuristic researchers, technologists and regulatory experts in renewable energy are constantly innovating and perfecting new techniques.

"There are many obstacles. Wind energy, for example, has many moving parts. As a result, regular upkeep is essential. Since solar and wind rely on the weather and other conditions, the supply that is delivered is not constantly reliable and suffers from intermittence. Also, renewables are material-intensive and this necessitates more mining for metals, rare minerals, and other raw materials to manufacture industrial components, which presents significant difficulties. Despite this, we've had a lot of success and are making progress towards massive renewable deployments," opined AlGhazal.

"The goals of the Kingdom of Saudi Arabia's vision 2030 are lofty. And the vision is the driver to facilitate pathways towards sustainable growth. The plan also includes the incorporation of renewable energy resources. This is why the kingdom is implementing long-term plans to build enormous renewable energy facilities of international standard. Hydrogen is also gaining momentum as a solution to low-carbon emissions and the expanding energy sector.

Middle East renewable energy supply capacity increased by 12.8% in 2022 from the year before



The kingdom's approach to renewable energy is therefore hybrid, opening up environmental, energy, and economic possibilities," he added further.

Wind turbines, blades, and magnets are all examples of complex industrial components relevant to the renewable energy sector when addressing wind energy projects. In addition, solar panels are included when discussing solar energy. A large number of manufactured components, such as the motor and batteries are needed for electric vehicles. This would necessitate more activities and processing to be done at mines. Moreover, there must be a sufficient quantity of the raw materials involved at a reasonable price to make a larger scale more feasible.

Innovation in material science will be a major factor in accelerating this move. More energy must be stored in batteries, and batteries must charge more quickly.

When the battery technology evolves, the result will be a leap increase in the number of electric, environment-friendly vehicles on the road, and the widespread use of renewable energy sources made possible by the compact, light-weight, more efficient batteries. Some answers can be found in these examples.

New jobs are created in part because of the influx of young people attracted by these renewable energy initiatives. The bright side is this. While this process requires a lot of raw materials, it also generates economic benefits in the form of new jobs and skills, as well as technological advancements in the form of improved designs and the promise of a better tomorrow thanks to the talents that pioneer and lead forward the renewable energy markets.

Clean Hydrogen New Kid in The Block

Through international cooperation, carbon-free hydrogen continues to emerge as a clean fuel.

Hydrogen has a greater energy density than any other mass carrier—it can replace three times as much petrol. The fuel's energy density is unparalleled. It's incredible to think that hydrogen will one day shine a light into the darkness. Thus, the smallest molecule in the universe, H₂, is fueling the largest industrial operations on Earth, as well as powering agriculture, refrigeration, mobility, energy storage etc. "As the hydrogen niche unlocks, more H₂ vehicles and fuel-cell products will occupy a significantly increasing share, reshaping the energy markets," according to AlGhazal.

As far as transport, while compressed hydrogen is viable for short distances, liquified hydrogen has higher potential for longer transport distances, e.g. conversion to ammonia.

"It's fascinating how would the tiniest molecule in the universe make the biggest positive effect in the future. We conducted deep-dive studies and research at Noor Energies, looking into various ranges of hydrogen technology advancements, market trajectories, regulatory framework conditions and environmental impacts. The findings are promising along the full hydrogen value chain. And hydrogen would be the clean energy sector's leading light," commented AlGhazal.

Highlighting some of the ongoing projects of his firm, AlGhazal spoke about deploying low-carbon industrial internet of things (IIoT) and low-carbon communication networks on solar panels. The application of IIoT technology enabled predictive maintenance and enhanced energy efficiency. These are all aspects of the IIoT technology that promotes greater levels of visibility, transparency, and traceability through unprecedented levels of monitoring, control, and cognition.

Because of this, we can make more environmentally responsible decisions. And it enables renewable energy to become more affordable, stable and secured.

Depending on his location, Mohammed AlGhazal enjoys exercising and sports. He would be playing and attending a soccer game if he was in Saudi Arabia. If he is out of town, he could go for a skate, swim, run, or even just ski. As spring turns to summer, he splits his time between the gym and the beach, where he plays beach volleyball and other games. He lists volunteering and helping others as a favourite pastime; it gives good feeling and instills hope for a better future for all. "If it can inspire and empower someone else to rise and shine, then it is all worth it."

All photos provided by Mohammed AlGhazal





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THE ROLE OF HYDROGEN IN ACHIEVING NET ZERO IN MIDDLE EAST

Hydrogen has long been touted as a potential game-changer in the fight against climate change, with its high calorific value and clean burning properties. However, its potential to decarbonize the Middle East economy hinges on how it is produced. Currently, the majority of hydrogen is produced from fossil fuels in a process known as “grey hydrogen,” which generates significant carbon emissions. To make a meaningful contribution to decarbonisation, hydrogen must be produced from renewable sources or through carbon capture and storage (CCUS).

One potential solution is “blue hydrogen,” where hydrogen is produced from fossil fuels but the resulting carbon emissions are captured and stored. However, CCUS technology is not yet deployed at the scale needed to make a significant impact on emissions reductions, and the economics of its mass use have not been established. As a result, blue hydrogen cannot be relied on as a high-volume contributor to decarbonisation in the short- to medium term.



Noor Abu Dhabi Solar Power Project // NS Energy

The other option is “green hydrogen,” where hydrogen is produced through electrolysis using renewable energy sources such as wind and solar power. While the rapid expansion of renewable energy provides important possibilities for the mass production of green hydrogen in the future, there is currently an unmet need for renewable-sourced electricity to directly contribute to power supplies as demand for electricity rises in both domestic and industrial settings.

Moreover, the use of green electricity to produce hydrogen involves the inefficiency of all industrial processes, resulting in energy loss. Despite the challenges, the future of power generation will inevitably involve digital technologies deeply integrated into plant operations.

These technologies will enable performance optimisation, predictive maintenance scheduling for equipment, selective automated decision-making in matters of operation and maintenance, and risk reduction, all of which will help maximize the profitability of gas-turbine combined cycle power plants.

Opportunity For The Middle East As A Key Player For Hydrogen

The Middle East has long relied on its vast reserves of oil and gas to power its growth as a global economic powerhouse. However, with the world moving towards more sustainable forms of energy, the region is now looking to become a pioneer in the hydrogen industry.

Building on their extensive experience and expertise in the oil and gas sectors, countries like Saudi Arabia, Qatar, Kuwait, and the UAE are

now positioning themselves as leaders in the transition to more sustainable forms of energy.

While some of this shift is driven by concerns about the long-term demand for oil, there is also a growing recognition that renewables can be made more cost-effective, thereby smoothing the energy transition.

Diversification of exports is also seen as essential, with existing supply chains serving as a platform for the development of competitive advantages in new industries.

There is clear evidence of buy-in to hydrogen's potential across the region, with Saudi Arabia leading the way in becoming a leading global supplier of hydrogen. The region expects to produce 650 tonnes of green hydrogen daily by 2026.

The Middle East has abundant natural resources that fuel renewable energy and a strategic location that enables green hydrogen exports to European and Asian markets. The region, especially Saudi Arabia, the UAE, and Oman are likely the best candidates for transporting clean hydrogen because of their existing infrastructure to transport and store oil. They also have the right expertise to deliver it, so adaptability to hydrogen is easy.

Smart grid technologies will be needed to enable multi-directional flows and provide greater control over electricity and information in a widely distributed network.

In 2021, Saudi Arabia's Minister of Energy, Abdulaziz bin Salman al-Saud, announced the country's aim to become the world's largest hydrogen producer.



If hydrogen is to replace fossil fuels within the Middle East's energy system, significant investment will be required in the networks and infrastructure needed to distribute it around the country. Ultimately, to maximize the future possibilities of using hydrogen to decarbonize the economy, clear commitments will be needed by governments in the short- and medium term to the development and deployment of CCUS and renewable energy.

This investment in technological innovation will enable clean energy sources like hydrogen to become more affordable, driving down costs and enabling mass adoption.

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This investment in technological innovation will enable clean energy sources like hydrogen to become more affordable, driving down costs and enabling mass adoption.

It has the potential to play a significant role in decarbonising the Middle East economy, but this potential can only be realised if it is

produced from renewable sources or through CCUS. Blue hydrogen cannot be relied on as a high-volume contributor to decarbonisation in the short- to medium term, and significant advances in the economic deployment of CCUS and/or the development of a renewable-to-hydrogen capacity are required.

With the right investment in technological innovation, however, hydrogen could become a key player in the fight against climate change, helping to create a future that works for people and the planet.

DEWA Wins Hydrogen Project of the Year 2023

Dubai Electricity and Water Authority (DEWA) have been recognized for its contribution towards promoting renewable and clean energy by winning the Hydrogen Project of the Year 2023 Award. The award was given for DEWA's green hydrogen project at the Mohammed bin Rashid Al Maktoum Solar Park, which is the first project of its kind in the Middle East and North Africa region to produce green hydrogen using solar energy.

The Hydrogen Future Awards 2023, organized during the 'Connecting Green Hydrogen MENA' (CGHM2023) conference in Dubai,

also saw HE Saeed Mohammed Al Tayer, MD&CEO of DEWA, receiving the World Energy Transition Leader 2023 award. This award recognizes influential leaders from international energy corporations who have made significant contributions to the global growth of the clean energy industry.

The green hydrogen project is a significant step towards achieving the Dubai Clean Energy Strategy 2050 and the Dubai Net Zero Carbon Emissions Strategy 2050, which aim to provide 100 percent of Dubai's total power production capacity from clean energy sources by 2050.

It also supports the Dubai Green Mobility Strategy 2030 to encourage the use of sustainable transportation and the UAE's Hydrogen Vehicles System, which aims to develop the hydrogen economy in the UAE and open up local markets to hydrogen vehicles.

Waleed Bin Salman, Executive Vice President of Business Development and Excellence at DEWA, said that the station was designed and built to accommodate future applications and test platforms for various uses of hydrogen, including energy production, transportation, and industrial uses.

The green hydrogen project also supports the UAE's hosting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 28) during the Year of Sustainability.

It is aligned with Dubai's firm commitment to sustainability and its unwavering support for energy and combating climate change.

DEWA's achievements in the transition towards renewable and clean energy were highlighted at the CGHM2023 conference, providing an opportunity to showcase its pioneering green hydrogen project. DEWA's efforts towards promoting the transition to carbon neutrality and supporting a green economy represent one of the pillars of a sustainable future, contributing towards achieving a globally leading sustainable innovative corporation committed to achieving net zero by 2050.

According to Wood Mackenzie forecast hydrogen demand will more than double by 2050. The hydrogen amounts to a \$600 billion investment opportunity. MEED report stated that Saudi Arabia and the UAE had projects worth \$10.5 billion and \$10.28 billion respectively. Egypt has invested worth \$63.8 billion in hydrogen projects. Oman has invested in projects worth \$48.9 billion. Moreover, Saudi Arabia has claimed to keep the cost of hydrogen lower than \$2 per kg.

The Middle East region is primed to become a leader in green hydrogen production and exportation due to a combination of rising global demand, cost reductions via innovation, and pre-existing conditions suitable for the production and transportation of green hydrogen.

However, success hinges on scaling sustainable production facilities, supported by tailored logistical setups.

The key to securing a market lead is to shift towards fully scalable, sustainable production facilities that can efficiently transport green hydrogen from plant to ship.

The region has a promising future in this area. It has dozens of green hydrogen projects in the pipeline that could fuel the development of this pioneering renewable energy source and ambition towards achieving net-zero emissions.

It is also a reflection of the region's willingness to adapt and embrace new technologies and industries. As the world moves towards a more sustainable future, the Middle East is poised to play a leading role in the development of hydrogen, providing a key source of energy for decades to come.



KUWAIT ROADMAP TO WATER SECURITY: STRATEGIES AND SUCCESS STORIES

Kuwait, like many countries in the Middle East, faces significant challenges in the area of water sustainability due to its arid climate, high temperatures, and low rainfall. However, Kuwait has been at the forefront of innovating and implementing various measures to address these issues.

Desalination is the initial step, then. We are one of the world leaders in desalination, the process of removing salt and other impurities from seawater to make it suitable for human consumption and irrigation. Elaborating further on such developments, Hebah Abbas, Technical Advisor and Sustainability Committee Chairwoman at KWA (Kuwait Water Association) stated, “The country operates several large-scale desalination plants. While this process is energy-intensive, Kuwait is looking into more efficient and environmentally friendly methods, such as reverse osmosis and the use of renewable energy to power these plants.



Hebah Abbas moderating the opening panel at the 2nd PPP MENA Forum - Dubai

The MENA region holds 48 percent of desalinated water produced each day worldwide and governments are accelerating their efforts to increase their investment in the industry through PPP initiatives”.

The reuse of treated wastewater is the focus of the second section. Treated wastewater is used for a variety of purposes such as irrigation, freeing up more potable water for human consumption. Integrating renewable energy into wastewater treatment to make the process more sustainable and cost-effective.

Campaigns to encourage water conservation among the general public have also been established by the government. This includes public education programs to raise awareness about the importance of water conservation and regulations to promote water-efficient appliances and fixtures.

As a non-governmental organisation, Kuwait Water Association is essential in the country's efforts to ensure reliable access to clean water. Since their founding in 2012, KWA has focused on training government sectors in water efficiency and implementing projects to raise awareness about water conservation.

Many meetings and discussions are held there amongst various government agencies. They like this friendly rivalry in which they vie to see who can save the most money and amass the most accurate records. And the follow-up doesn't end once the training is over.

KWA has conducted field studies in water efficiency with various government ministries,

including the Ministry of Education, Ministry of Awqaf and Islamic Affairs, and Ministry of Electricity & Water & Renewable Energy. These studies were based on IOT, smart metering and real time measurements. The data was then analysed to provide valuable insights into the water use practices of these sectors and help identify areas for improvement.

In addition, modern irrigation techniques are point number four. Drip irrigation and hydroponics are two examples of innovative irrigation methods being used to reduce water waste in the agricultural sector. Naturally, using these methods decreases the amount of water required for the crops.

“We have also poured resources into research and innovation to discover cutting-edge techniques for water preservation. Among these are the refinement of desalination processes, the improvement of seawater treatment procedures, and the exploration of non-traditional water supplies. The aforementioned initiatives are merely the tip of the iceberg of Kuwait's sustainable water initiatives. It's a multi-pronged, multifaceted strategy that incorporates the dissemination of technological advancements, policy changes, and public education in order to address this pressing problem,” stated Abbas.

Challenges In Managing Wastewater

In order to guarantee and provide a sustainable water supply, wastewater treatment is crucial. Several difficulties exist. The first is the obvious rise in demand. Kuwait's urban population is growing quickly, which means more and more wastewater is being produced. This places a burden on the nation's wastewater treatment facilities.

The second issue is the infrastructure's advanced age as many parts of the wastewater treatment system have to cope with the city's rapidly growing wastewater volume. Consequently, it can cause problems like leaks, which can contaminate the environment. Therefore, the ageing population is a global challenge for many nations' energy usage.

Given Kuwait's goal of reducing its carbon footprint, it comes as no surprise that wastewater treatment is an energy-intensive procedure. Water treatment's high energy consumption is a major obstacle. Problems with public opinion and education are also prevalent. It is not easy to execute wastewater reuse programmes because of the possible public stigma surrounding the use of treated wastewater, especially for irrigation.

Commenting further on the issue, Abbas stated, "We don't want to talk about problems without suggesting ways to fix them, therefore we've already thought of ways to deal with these issues. Possible answers to these issues may involve things like. Infrastructure upgrades and expansions, We plan to allocate resources towards this. And there are a lot of initiatives in the works right now. using cutting-edge technologies for treating water and energy recovery from the purification procedure, thus using them can boost treatment efficiency and allow for more effective energy reuse. These are a few potential answers. Obviously, the first step should be a public awareness and education campaign. Public opinion on treated water can benefit from increased knowledge and understanding."





Call For Support From The Government!

Achieving a net zero agenda in the utility industry is an extremely difficult and multi-faceted endeavour. It calls for a suite of policies that prioritise not just lowering greenhouse gas emissions but also advancing environmentally friendly methods and tools. Therefore, renewable energy Mandates and targets are essential to reaching net zero in the GCC region. Utility firms should be incentivized to invest in renewable energy sources by the government through tax cuts and subsidies.

Governments should impose stringent energy efficiency criteria on all new construction, including homes and businesses. Heating and cooling are two of the biggest energy drains, therefore it makes sense to mandate the use of energy-efficient appliances.

Grid modernization for the structure - Smart grid technology can aid in the management of an increase in the use of renewable energy,

which will necessitate the updating and modernization of utility grids.

Implementing a carbon pricing mechanism, such as a carbon tax or a cap-and-trade system, can offer utilities a financial incentive to cut their GHG emissions. Renewable energy and energy efficiency improvement programmes can benefit from the funds generated by these initiatives.

The water-energy nexus - It's crucial to understand the interconnected nature of water and power consumption. Therefore, governments should encourage water-saving devices and methods in the residential and commercial utility sectors, as well as in the water supply and treatment industries. There must be a harmony between our use of water and our use of electricity.

Public-private partnerships (PPPS) allow governments to promote private-sector investments in renewable energy. By working together, we can pool resources like money, knowledge, and creativity, and speed up the move towards a utility sector that uses zero energy.

Governments should run initiatives to educate the public and increase their level of awareness. At the Kuwait Water Association, we're doing our best to spread the word about the initiative. We are also the National Operator for eco-schools in Kuwait, led by the Foundation for Environmental Education (FEE). In addition, we are collaborating with a large number of accredited institutions in Kuwait to green their operations and encourage their students to adopt sustainable lifestyles.

In terms of policy, the implementation and enforcement of a green construction code is crucial since it has the potential to cut energy demand. The usage of renewable power sources and water-saving fixtures may be mandated under these regulations.

"The utility sector can now get closer to its net-zero energy targets because of these policies, continuous technology improvements, and heightened public awareness of climate change. It's true that making the switch will require a lot of work and money, but the long-term advantages to the planet and the economy are undeniable," opined Abbas.

Way Forward For Kuwait

The current water situation in Kuwait is difficult but can be improved by the use of a number of different measures.

The first is Revising Subsidy Policies. Subsidies can be helpful in making water affordable for all citizens, but they can also encourage overconsumption. Therefore, Kuwait may want to reconsider its subsidy policy in order to

promote a more responsible consumption of water. The importance of this cannot be overstated. When each home is given a set amount of free water each month, it only seems sensible that any usage above that amount is paid for. However, there needs to be a fee for excessive usage of anything.

Water conservation can only be achieved by widespread public education and awareness campaigns. Regulations should or may be put in place to mandate the use of water-saving appliances and fixtures in new construction, and incentives might be provided to encourage current homeowners to update to more efficient models.

The loss of water through breaches in the water distribution system can be substantial, making leak detection and repair crucial. Since water leaks are costly and can shorten the lifespan of a building, preventative maintenance and renovations can help us cut down on these expenditures. The accumulation of moisture could have serious consequences for the health of the building's occupants, especially those with allergies or asthma. Consequently, the detection of leaks is very crucial.

Water reuse is still another technique. Treated wastewater can be recycled for stationary applications like irrigation. The use of water in agriculture is substantial. Implementing more efficient irrigation techniques, such as drip irrigation, can greatly reduce water usage.

Suggesting further on the subject, Abbas said, "Although desalination uses a lot of energy, it is possible to enhance our region's water supply through ongoing investments in more effective and sustainable desalination methods.

It is also crucial to pay attention to water metering and billing. Therefore, implementing water metering for all clients can guarantee that infrastructure is constructed in accordance with actual demand. Consequently, it's more appropriate for individual use than for building-wide use. By adopting these measures, Kuwait will be able to foster more water-wise behaviour among its population while still meeting the needs of all its residents.

There must be rigorous planning and policymaking to strike this equilibrium.”

Hebah is the type of person who prefers to put her spare time to good use. At least five times a week, she'll hit the pavement. She loves to jog in the early morning hours, preferably in the park or along the beach. This offers her the mental fortitude to face the day with optimism, decreases her stress, heightens her focus and creativity, and kick-starts her day. She also takes pleasure in reading and spending time with her loved ones.

All photos provided by Hebah Abbas



Hebah Abbas At Abu Dhabi Sustainability Week 2023 at COP 28 Booth

UAE IS RIGHTLY POISED TO BECOME A MAJOR PLAYER IN THE GLOBAL HYDROGEN SECTOR: WIETSE TER VELD

The rising demand for energy in the Middle East and North Africa (MENA) is satisfied almost entirely by fossil fuels. According to DNV's Energy Transition Outlook, primary energy consumption is expected to rise by 42% over the next 30 years, from 49 EJ in 2015 to 69 EJ in 2050. Scientists are optimistic that by 2050, just 71% of global energy would be derived from fossil fuels, with the remaining 18% and 6% coming from solar and wind. The majority of the expected 3.6-fold increase in global electricity output from 2015 to 2050 will come from renewable sources like solar and wind. More people switching to electric vehicles will be the primary force in lowering oil consumption. Even when its share of the energy mix falls, petrol will still be considered a "transition" fuel.

It is expected that the MENA region will play a pivotal role in the production of low-carbon hydrogen. Blue hydrogen, created via methane reforming with CCS, is expected to contribute significantly to this



Wietse ter Veld

expansion, with volumes increasing from about 1 mt in 2030 to 10 mt by 2050. However, beginning in the 2040s, it is expected that more green hydrogen and yellow hydrogen will be added to the grid.

Elaborating further on the subject, Wietse ter Veld, Green Hydrogen Expert at Atkins Middle East stated, "From what I can see, the United Arab Emirates (UAE) is planning to seize 25% of the worldwide hydrogen market in the near future. Natural gas derived from fossil fuels is used to manufacture about 300,000 metric tonnes of hydrogen annually. So, going forward, picture a massive increase in global hydrogen demand, perhaps as high as 600 million metric tonnes of hydrogen. With a capture rate of 25%, that would amount to 150 million metric tonnes for the UAE. That's a massive increase compared to current production levels.

And all the carbon dioxide released during the hydrogen production process must be sequestered in order to make it "green" or "blue" hydrogen. As a result, the growth rate will skyrocket. And that, at least as far as anyone can tell right now, is the UAE's ultimate goal. Already, we can see that people are taking action, and plans are being put into motion."

Everyone is aware that significant initiatives are now being pushed out in the region. All of these projects are in some stage of development or engineering and capital raising at the present time.

Of course, it's only reasonable that some, if not most, of the equipment needed for such projects would be built in the regions once



Wietse ter Veld at Atkins

development reaches the stage where it's time to execute and realise them. Together, these two trends necessitate investment in R&D to advance the state of the art in hydrogen compression, solar and wind power plants, and the supply chain as a whole. It makes sense to have some of the development's research and manufacturing done in close proximity to the area's initiatives. And I can see that happening very soon.

Cost-Effective Generation Of Green Hydrogen

"There is a major push to get significantly more affordably priced hydrogen than is now available, and these advancements are occurring in the United States, Chile, and Europe. Our current hydrogen production costs are \$2-\$5 and could go as high as \$7-\$8 per kilo. When hydrogen is produced via electrolysis using renewable resources, electricity accounts for 60-70% of the LCOH, making it the single largest contributor to the cost of producing hydrogen," opined ter Veld.

"That's why we're working to find ways to reduce the overall cost of electricity. And neither the United Arab Emirates nor Saudi Arabia would be a bad choice. Solar power's per-megawatt-hour price tag can be reduced to between \$10 and \$20. That puts the area on track to achieve the \$1 per kilogramme goal. Equipment costs, along with those of the entire value chain, need to be cut in half. Within the next decade or two, I believe it will be possible in this area," he added further.

Challenges Of The Sector

All parts of the hydrogen value chain have difficulties, but green hydrogen is particularly vulnerable. Although much technology has been around for decades, it is still undergoing changes.

value chain is not static, but rather the sum of its parts. The financial justification is also changing.

It's not like you built an electrical generator and have paying customers. Now, when you first begin producing green hydrogen, you have no idea who or what will buy your product. To employ green hydrogen as a feedstock and replace existing grey hydrogen for that feedstock is something that everyone wants, as is the replacement of fossil fuels and its application as an energy element. We're aware of the fact that we need it. However, the future course of events is unknown.

Furthermore, the European Union (EU) is currently experiencing a significant push to decarbonize for climate change purposes as well as economic reasons relating to the war in Ukraine.

When it comes to settling on a precise definition of "green," the European Union is in the lead. Many parts of Asia and the United States are still trying to figure out what constitutes "green" as the concept develops.

"Making the business case and engineering a project with specifics like "how you're going to do that" and "where exactly the power is going to come from" gets difficult when the wind isn't blowing and the sun isn't shining.



These are the obstacles we face, and my company is attempting to overcome them. The end is in sight,” stated ter Veld.

“Several initiatives have been placed under our care. I need to exercise some caution regarding the location and identity of my clients. This year, however, we have regional projects in the United Arab Emirates, for several businesses in Oman, and Egypt. We are considering a move into the Indian market for the same reason that we see India as a rising power in the hydrogen and renewable energy industries,” he added further.

Release Of CO2 A Major Concern

Carbon dioxide is released in large quantities during the chemical process currently used to produce more hydrogen from gas or coal. It is a major concern when the entire game is working on reducing the carbon footprint.

Answering the query, ter Veld stated, “There isn't a definite solution to that. Reducing our energy

consumption is a good first step because it is both clear and, by coincidence, more efficient. Lots of oil, gas, and coal are still waiting to be extracted from the ground. We cannot expect to make the change to a completely green economy in the next few years. Therefore, we will use such fossil fuel resources during this transition phase. The difficulty lies in ensuring that their use is carbon neutral and that their emissions are captured. It does, however, raise the price. It's also really challenging to gather up all the carbon. We should have no trouble snagging 50% if not 60%. However, if you aim to collect every last bit of carbon dioxide emissions, you'll have your hands full.”

“More plantings or seaweed farms could also help. Plants that are allowed to grow will absorb carbon from the air, compensating for the greenhouse gas emissions that have been produced. Therefore, I believe that all of these potential avenues are emerging simultaneously. And I think in the next two decades, will arise and blend together to become a preeminent

route where we produce sustainable energy, green energy supported by, perhaps some nuclear power and power produced from fossil fuels," he added further.

As a proud parent with two young ladies, ter Veld enjoys, helping his kids with their schoolwork and chauffeuring them to their various extracurricular activities.

They have a blast visiting water parks, so he usually takes a day off to take them there. They are also The ter Velds are enthusiastic campers, and go on numerous trips.

He also likes to exercise to counteract the time he spends sitting at his desk. He enjoys the usual array of athletic pursuits, from cycling to swimming to running.

Note: All photos were provided by Wietse ter Veld

Disclaimer: Views, thoughts, and opinions expressed by Mr. Wietse ter Veld in the article belong solely to Mr. Wietse ter Veld, and do not reflect the view of his employer, organization, committee or other group or individual.



With climate change bars on cycling shirt, first coined // Ed Howkins

THE SMART TRANSPORTATION REVOLUTION IS RESHAPING MIDDLE EASTERN CITIES

According to the UAE Ministry of Economy, the worldwide smart cities market is expected to nearly double from its 2021 level of US\$457 billion to reach \$873.7 billion by 2026, a compound annual growth rate (CAGR) of 13.8%.

The global mobility service industry is predicted to rise to US\$40.1 billion by 2030 from a paltry US\$3.3 billion in 2021, while the value of the smart building market is expected to virtually quadruple to US\$229.1 billion by 2026 from US\$82.6 billion in 2020. Solar panel installers, battery producers, artificial intelligence (AI) platforms that optimise energy usage, and water reuse enterprises all stand to benefit from the smart building market's increasing demand for green technology.

In addition to the present standalone solutions, businesses that are able to integrate smart mobility platforms into ecosystems would gain from the transformation push.



EV Charging Stations _MEP Middle East



Services including electric vehicle (EV) charging infrastructure, infotainment and linked vehicle services, and parking management systems all fall under the umbrella term "mobility as a service" (MaaS).

All smart mobility services need HD mapping data, low-latency navigation, and real-time traffic updates to ensure their users' safety and productivity. Better mobility experiences can be achieved when businesses join ecosystems to gain access to data generated and exchanged by partners.

UAE Smart Mobility Evolves With Sustainability

Smart mobility has taken over the landscape with clever concepts that are altering the social infrastructure of the region six years after the Dubai Roads and Transportation Authority lay the groundwork for driverless vehicles by 2030.

Smart mobility, including autonomous shuttles, e-bikes, and e-buggies, is poised to take control of the roadways in sustainable cities as a result of the shift.

Sharjah Sustainable City is a model of efficiency and sustainability in urban planning for private residences. This green idea is powering a net-zero energy community where eco-friendly villas with low energy bills are available to anyone.

Solar-powered smart homes, bio-domes for vertical farming, electric vehicle chargers, driverless shuttles, and a biogas plant are just some of the cutting-edge environmentally friendly technologies that will be available in the sustainable city developed by Sharjah Investment and Development Authority in collaboration with Diamond Developers.

"We have to do our part because the United Arab Emirates is the first country in the Gulf Cooperation Council to commit to net-zero by 2050," as stated by Karim El-Jisr, chief sustainability officer, SSC.

El-Jisr noted that the bottom of the pyramid represented soft mobility, which included those who walked or rode bicycles to work. With this in mind, the SSC master plan constructed highways with no zebra crossings.

All 1,250 villas in SSC are conveniently located away from any zebra crossings or traffic lights. "Those villas could be linked by foot for residents and guests," El-Jisr explained.

The third tier of the pyramid saw the introduction of shared electric buggies and butler services.

Residents can reserve a buggy through the concierge service using their mobile devices. He also noted that the concierge service's capacity might be expanded in the event of rising demand.

Electric vehicles were displayed at the very top of the pyramid, and SSC will promote making the conversion from petrol to electric vehicles.

"We will install charging stations at various locations across the complex. According to El-Jisr, there will be 80 charging stations in the neighbourhood, making it the project with the highest density of charging points in the GCC," he added further.

To assess whether or not to implement them, the sustainable city is also looking into the Dubai autonomous shuttle trials.



The Arrival Of Anonymous Transport

There's more to the tale. The sustainable transportation business ION in the United Arab Emirates (UAE) launched the country's first driverless shuttle service in December 2017 along Ajman's Corniche.

Between the Fairmont and the Coral Beach Hotels on the Ajman Corniche, the driverless shuttle makes use of a public route. Bee'ah <https://www.beeahgroup.com/services/beeah-education/>, a sustainability pioneer in the Middle East, partnered with Crescent Enterprises of Sharjah to form ION.

Bee'ah's Director of Sustainable Mobility, Nasir Al-Shamsi, said that in addition to deep learning technology, the autonomous shuttle is also fitted with 3D vision, automatic routing, navigation, IoT sensors for optimal safety, and motion sensors to open and close doors.

The autonomous shuttle is able to sense its surroundings and sound an alarm anytime it approaches a pedestrian crossing thanks to information received from traffic lights and signals.

The shuttle can accommodate up to 15 people at once and is handicap accessible to boot.

About half of Dubai's population does not own a car and relies heavily on public transport, according to Al-Shamsi, who also argued that autonomous vehicles are safer than human-driven ones because a human driver could make a mistake that leads to an accident.

Human mistake accounts for about 90% of all accidents in the United Arab Emirates. That percentage, when converted to money, is worth billions of UAE dirhams. He emphasised the impact that this loss would have on the economy.

Al-Shamsi claims that the corporation is also considering introducing drone delivery solutions outside the line of sight, which might eventually lead to the delivery of items between buildings.

In conjunction with the Sharjah Civil Aviation Department, the company is now conducting tests of the system in preparation for the upcoming maiden trial.

Bee'ah is investigating the feasibility of introducing micro-mobility mechanisms like electric bikes and scooters.

Biking With No Impact On The Environment

With the installation of 175 stations beginning in the next month, Dubai's Careem Bike will surpass all others as the largest docked, pedal-assisted bike-share system in the world.

The business began its 15-year cooperation with the Road and Transportation Authority of Dubai by introducing 800 e-bikes and 80 stations throughout the city.

"We just exceeded 2 million trips and about 10 million kilometres in the distance travelled, displacing about 450 cars in the city in terms of CO2 emissions," Sami Amin, senior director of operations, Careem Bike, told media. The company also plans to expand to 3,500 bikes and 350 stations.

The roadways in Dubai, like those in most Middle Eastern cities, are not constructed with bikes in mind. However, RTA is committed to making this region the world's most bicycle-friendly metropolis.

The company is investigating driverless vehicles, delivery robots, and other electrified vehicles with a clear focus on sustainable mobility. "Sustainability is the key to our success," Amin remarked.

Sustainable urban planning, vehicle reduction, and the introduction of micro-mobility will make local areas more inviting by lowering transportation costs, increasing accessibility, and lessening environmental impact. Communities are the key to smart mobility.

Saudi NEOM Knocking A Sustainable Punch

Plans to create the world's most user-centric, ecologically friendly, and technologically advanced land mobility ecosystem are now underway in Saudi Arabia as part of the NEOM smart megacity project.

NEOM's goal is to prioritise active, autonomous, electric, shared, and smart mobility alternatives, in addition to introducing a new paradigm for urban sustainability driven by 100 percent renewable energy.

Along with urban air mobility and a high-speed underground transport system, on-demand urban passenger mobility will be provided by shared autonomous and electric shuttles. NEOM's goal is to be the first carbon-free zone in the world by eliminating the need for vehicles and conventional roadways.

The project also intends to create a smart water distribution network, which, according to NEOM, will reduce water loss to below 3 percent, as opposed to the 30 to 60 percent often seen in cities with ageing infrastructure and consequently undetected leaks.

In other parts of the kingdom, intelligent mobility is also progressing. Both a multibillion dollar public transit project featuring driverless trains and an AI-based adaptive signalling technology are currently under construction in the Saudi city of Riyadh.



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MIDDLE EAST RISING PROJECT HYDROGEN

The market for clean hydrogen is growing, and so is the demand for its by-products such as green ammonia, low-carbon steel, and synthetic fuel for aviation. Several projects have been announced since the end of 2021, with the number of announced projects increasing. Oil and gas companies, renewable energy developers, chemical producers, and manufacturers are all trying to secure an advantage.

Moreover, energy is not just about producing clean energy, it is also about storing, transporting, and delivering the clean energy worldwide. The Middle East aims to lead the global hydrogen market. Its market has great potential because it possesses the right scalable infrastructure and transportation capabilities throughout the globe.

Hydrogen is generated through a chemical process, such as gas or coal, emitting huge amounts of carbon.





Green hydrogen, however, constitutes two percent of global hydrogen production. It uses electrolyzers powered by renewable electricity. This process splits water into oxygen and hydrogen with zero carbon emissions.

It can be burned as a fuel and produces only water as a by-product, and it can be used to store excess energy produced by renewable electricity plants or converted into other substances.

According to Wood Mackenzie, a global energy research and consultancy organisation, location determines the power generation needed to capture and store hydrogen. Based on their analysis, a more stable supply of clean energy results in lower project costs, as energy and hydrogen storage requirements can be optimised.

The greater the level of variability in the power supply, the greater the cost of buffer storage. Mackenzie stated that the use of

Renewable Energy Credits (REC), using the grid as an energy storage buffer, is a short-term solution but might become a problem if the proportion of renewables creates grid stability issues.

Middle East As A Key Player In Hydrogen Development

The Middle East can become a key player in the green hydrogen industry.

Saudi Arabia is building a US \$5 billion green hydrogen plant that will produce 650 metric tonnes of hydrogen daily via solar and wind, converting it into ammonia. It will be the world's largest green hydrogen plant, and production will start in 2026.

There is a rising demand for low-carbon hydrogen, including blue hydrogen, which captures and stores carbon produced when making gas. It has been predicted by Wood Mackenzie that it will rise to 223 Mt by 2050 from less than 100 Mt in 2022, generating a \$600 billion investment opportunity.

The UAE's Energy Minister, Suhail al-Mazrouei stated that the country intends to capture 25 percent of the global hydrogen market.

Abu Dhabi National Energy Company (TAQA), in partnership with Emirates Steel, will produce green hydrogen that will be used to manufacture green steel in the future. TAQA and Abu Dhabi Ports Co. are at an "advanced stage" in developing an industrial-scale green ammonia plant. It will convert green hydrogen using solar energy. It also plans to make green hydrogen at its solar park.

Oman signed an agreement with BP to develop green hydrogen projects by 2030. It will evaluate wind and solar data covering 8,000 square kilometres of land to develop the projects at optimal locations.

Middle East's Plans To Develop Green Hydrogen

The Middle East is planning to beat its competitors, Europe and Asia. The regions where the hydrogen market dominates the most. The UAE has announced many projects to support this. France's Engie and Abu Dhabi will invest US\$5 billion in the renewable energy business, which aims to have an electrolyser capacity of 2 gigawatts by 2030.

Dubai has also launched its first 'industrial scale' green hydrogen plant. Saudi Arabia announced a US\$7 billion agreement to produce green hydrogen in Oman's Salalah Free Zone with ACWA Power and Oman Oil and Air Products. Oman will also be focusing on becoming a hydrogen-powered economy by 2040 with 30 GW of green and blue hydrogen.

Saudi Arabia plans to keep the cost of green hydrogen production to US\$1 per kg, making it the cheapest in the world. Hydrogen will typically cost US\$7 in the market, but Saudi Arabia's aim to keep the cost low has been due to major investments in research and development in this industry.

Other companies, such as Siemens, have identified 46 viable green hydrogen projects worth US\$92 billion. The UAE, Oman, and Saudi Arabia are seen as potential investors in the hydrogen industry. Additionally, the UAE aims to increase renewable energy contribution to 75 percent by 2050.

NEOM: The Greatest Hydrogen-Powered Project

The Middle East is especially blessed with space and solar irradiation levels. It has the world's most ambitious hydrogen projects, which will diversify the economy, create job opportunities, and make it a world leader in new sectors and the energy transition.

Although hydrogen isn't available on the market, some of its projects are in the early stages: the NEOM Helios and the Egyptian Ain Sokhna complex.



These are under development. The NEOM Green Hydrogen Company intends to become one of the world's largest at-scale green hydrogen production companies. It is based in Oxagon, features a port, and is part of a logistics network with an integrated supply chain.

NGHC is a joint venture between NEOM, ACWA Power, and Air Products that aims to build a world-scale, green hydrogen-based ammonia production facility using 100 percent renewable energy by 2026.

In 2026, the company's plant will start producing green hydrogen from 100 percent renewable energy sources. The production capacity will be up to 1.2 million metric tonnes of green ammonia annually. The company aims to produce nearly 600 metric tonnes of green hydrogen per day.

This plant will save up to 5 million metric tonnes of CO2 per year. This move by Saudi Arabia is to support and reduce its carbon emissions.

In May 2022, NEOM Green Hydrogen Company's Board announced the appointment of David Edmondson as Chief Executive Officer, which will boost the company's On Neom's website, Nadhmi Al-Nasr, CEO of NEOM and Chairman of NGHC, commented that Edmondson will have full accountability for establishing all aspects of the joint venture, including building the future organisation. "The appointment of David Edmondson as NGHC's CEO is a natural follow-up to our recent agreement to build the world's largest green hydrogen plant, which will produce 1.2 million metric tonnes of green hydrogen-based ammonia per year," Al-Nasr said.

The green ammonia will be sold to Air Products under a long-term supply agreement and will be exported to international markets. It will be converted back into green hydrogen to fuel the hydrogen mobility market. According to the company, its other investment at Oxagon, NEOM's advanced manufacturing hub, will also develop clean, autonomous electric vehicles in NEOM to ensure a sustainable and safe environment.

"We aim to revolutionise the global energy market and create a circular economy as we redefine the parameters of sustainable living and abundant resource production,

all in harmony with nature," CEO of Neom, Al-Nasr stated.

According to MEED's 2023 report, more than 45 new hydrogen projects have been announced, with a value of US\$100 billion last year alone and a total hydrogen production capacity of more than 10 million metric tonnes a year.

In conclusion, the market and need for hydrogen are expected to expand substantially. However, for it to succeed, it needs to have access to the right location for the plants to be installed, renewable energy resources, partnerships, and investments.



NEOM Oxagon // NEOM

THE OIL-RICH MIDDLE EAST'S HYDROGEN POWER TRANSITION CHALLENGES

The globe is in the midst of a hydrogen frenzy. Japan established a plan in 2014 to transform into a "hydrogen society." Australia plans to become a leading producer and exporter of hydrogen by 2030, as stated in the country's 2019 National Hydrogen Strategy. Hydrogen is described as an "investment priority to boost economic growth and resilience, create local jobs, and consolidate the EU's global leadership" in the European Commission's "Next Generation EU" economic recovery plan for 2020. Even oil and gas exporters in the Middle East are getting in on the hydrogen action. In August 2020, Saudi Arabia's Crown Prince Mohammed bin Salman unveiled plans for a future high-tech city called Neom, which would include a US \$5 billion hydrogen plant, the world's largest clean hydrogen plant to date. Dubai aims to open the Middle East's first solar-powered green hydrogen plant. Next door, the Abu Dhabi Police Department plans to retrofit parts of its fleet with fuel cell vehicles in the near future.



Murray Douglas, Wood Mackenzie's Head of Hydrogen Research // Wood Mackenzie

The Sultanate of Oman has similar ambitious hydrogen plans.

Hydrogen Taking Off In MENA

Hydrogen is the most basic element because its atoms only contain a single proton. It is commonly found in mixtures with other elements and organic substances like water and hydrocarbons, despite its abundance. One molecule of natural gas, for example, consists of one carbon and four hydrogen atoms. Separating the hydrogen from the carbon atom yields pure hydrogen (H₂).

Hydrogen is everywhere, however, its colour might vary based on where it was produced and how. Both brown hydrogen (derived from coal) and grey hydrogen (derived from natural gas) are based on fossil fuels. Owing to these elements, the GCC region placed itself perfectly to be a dominant player in the hydrogen production game.

Frank Wouters, Senior Vice President Of New Energy at Reliance Industries revealed that there are many things to consider. He thinks hydrogen in the Middle East has a great future based on several premises. "First is the resource. Green hydrogen is created from green energy, and the region has an abundance of sunshine and some places also wind. The second is the availability of land at a low cost because it's not a very densely populated area. And third, many countries, such as Saudi Arabia, Oman, UAE, and Kuwait are oil and gas producers."

Approximately 75% of yearly hydrogen output (or 6% of global natural gas use) comes from natural gas, as reported by the International Renewable Energy Agency (IRENA).

for about 2 percent of global coal use but 23 percent of global output. Oil, power, and biomass supply the remainder.

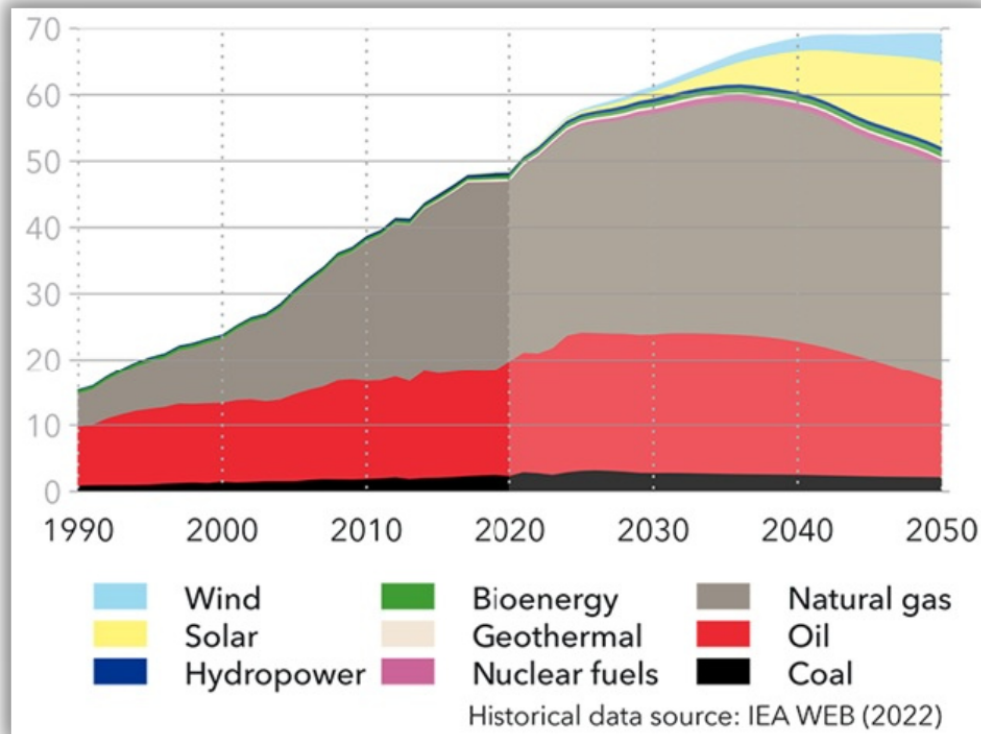
It is anticipated that the Middle East and North Africa will play a significant role in the generation of low-carbon hydrogen. The majority of this growth will come from blue hydrogen produced from methane reforming with CCS, and volumes are projected to increase from roughly 1 mt in 2030 to 10 mt by 2050. However, from the 2040s onward, greater quantities of both green hydrogen and yellow hydrogen connected to the grid are anticipated.

Blue hydrogen can be produced in Saudi Arabia, the United Arab Emirates, and Oman thanks to their massive solar and wind power potential and natural gas supplies. For example, in Egypt, Masdar and Hassan Allam Utilities have signed an MOU to develop 4 GW of electrolyser capacity by 2030, and in Saudi Arabia, a number of industrial companies and state-linked energy companies like ADNOC, ACWA Power, and Aramco have signed MOUs for projects like the NEOM Helios Green Fuels project.

Broader Output On Production

The Middle East appears to have an advantage in producing all colours of hydrogen, however, there are still discrepancies amongst studies. With its enormous, cheap hydrocarbon deposits and excellent geological formations for storing CO₂, for example, the Middle East has a distinct advantage in manufacturing grey and blue hydrogen, as reported by the International Energy Agency (IEA). According to the government agency, the cost of fuel accounts for the largest share of the total cost of producing hydrogen, and in the near future, hydrogen produced from fossil fuels will continue to be the

Middle East and North Africa primary energy consumption by source



most cost-competitive choice. According to another report by Strategy&, the Middle East has a leg up on the rest of the world when it comes to green hydrogen because of its abundance of renewable energy sources, especially solar power.

Blue hydrogen will help the Middle East make the most of its oil and gas resources, paving the way for the area to become a clean hydrogen provider. The additional expense of carbon capture and storage, which is still in its infancy, will make this a costly endeavour.

The economic case for green hydrogen in the Middle East is not as strong without a significant technological advances. The costs are at least three times higher than blue hydrogen, making it difficult to fund. Green hydrogen, despite not requiring oil or gas for production, would have to be supported by fossil fuel earnings due to the region's heavy reliance on these sources of

income. The greater the scope of the Middle East's green initiatives, the greater the region's reliance on oil and gas income will be to finance them.

Unlike the other members of the Gulf Cooperation Council, Qatar has publicly said that hydrogen is not now on its agenda, despite having the third-largest proven gas reserves in the world after Russia and Iran. Minister of State for Energy Affairs Saad Sherida al-Kaabi of Qatar told S&P Platts in May 2020 that his country was keeping an eye on hydrogen and other forms of sustainable energy. But he also warned that significant technological and financial hurdles stand in the way of widespread deployment of such solutions.

Hydrogen is a simple and abundant element, so why hasn't it already taken over the world's



Noor Abu Dhabi solar facility // NS Energy

energy systems? There are various reasons for this. The issue of cost is crucial.

A Significant Amount Of Clean Hydrogen Will Be Produced In The Middle East

Green hydrogen has the potential to displace fossil fuels as a primary energy source in the Middle Eastern region, where they are now used for approximately three-quarters of global greenhouse gas emissions in the transportation, electricity, and heating sectors.

Although there are still considerable obstacles to overcome, the region appears to be in an excellent position to play a leading role in realising green hydrogen's promise. A 2022 Strategy& research indicates that the cost of producing solar, wind, and green hydrogen in the Gulf is around one-third of the world average, and that Gulf solar panels produce double the electricity that those in Germany do.

The 1.2 GW Noor Abu Dhabi solar facility is the world's largest single-site solar plant, and the 2 GW Al Dhafra solar plant will go live in the emirate this year. When Dhafra secured its finance in December 2020, it achieved a solar industry low price of US \$0.0132/kWh, a new

record low. The Mohammed bin Rashid Al Maktoum Solar Park in Dubai has a 1.6 GW capacity now and will increase to 5 GW by 2030.

Green hydrogen production is one of the goals of Gulf politicians. In order for the Gulf Cooperation Council (GCC) countries to diversify their economies, they should take advantage of their competitive advantage of low-cost renewable energy resources. This potential can be attributed to two main aspects of the region's energy supply system: (1) an abundance of high-yield renewable resources, and (2) a financially viable model for private investment.

At now, hydrogen is often created through a chemical process involving gas or coal, which results in significant carbon emissions. Only about two percent of the world's hydrogen is "green hydrogen," which is produced by electrolyzers running on renewable electricity to separate water into its oxygen and hydrogen components.

Hydrogen has many applications, including usage as a fuel (with water as the only byproduct), energy storage (for use with renewable power sources), and material production.

A Lot Riding On Hydrogen

Murray Douglas, Wood Mackenzie's Head of Hydrogen Research, has predicted that the Middle East will emerge as a leading participant in the clean hydrogen market. Over half of the overall cost of a green hydrogen project may come from energy.

The more competitive a project is, in general, Douglas said, the lower the cost of electricity.

The Saudi Arabian government has committed US \$5 billion to the construction of the world's largest green hydrogen plant, which will use solar and wind energy to generate 650 tonnes of hydrogen each day. In 2026, production will begin.

Wood Mackenzie projects that demand for low-carbon hydrogen, which includes blue hydrogen that collects and stores carbon created when manufacturing the gas using conventional techniques, will increase from less than 100 Mt in 2022 to 223 Mt in 2050. Investment opportunities in green hydrogen production are estimated to be US \$600 billion by the consultants.

The governments in the Gulf region appear to be in agreement. The United Arab Emirates' energy minister stated in January that his country plans to produce hydrogen using electrolysis and natural gas in order to grab around 25% of the worldwide hydrogen market.

Douglas stated, "Whether that's feasible depends on the timeframe." The great draw of hydrogen is that you may enhance your diversity of supply due to supposedly lower entry barriers.

This is especially appealing to policymakers in Europe and East Asia, where the hydrogen market is still relatively young.

For too long, the European Union has relied on a single source, Russia, for 43 percent of its gas. UAE's efforts to corner a quarter of the global hydrogen market may not be well received by the EU, which prefers to buy from a wide variety of providers.

Together with Emirates Steel, the Abu Dhabi National Energy Company (TAQA) plans to develop green hydrogen for use in the production of green steel. A green ammonia plant on an industrial scale is in the "advanced stage" of development by TAQA and Abu Dhabi Ports Co, both of which are majority controlled by the government of the emirate. Clean solar hydrogen will be processed there. Green hydrogen will also be produced at Dubai's solar park.

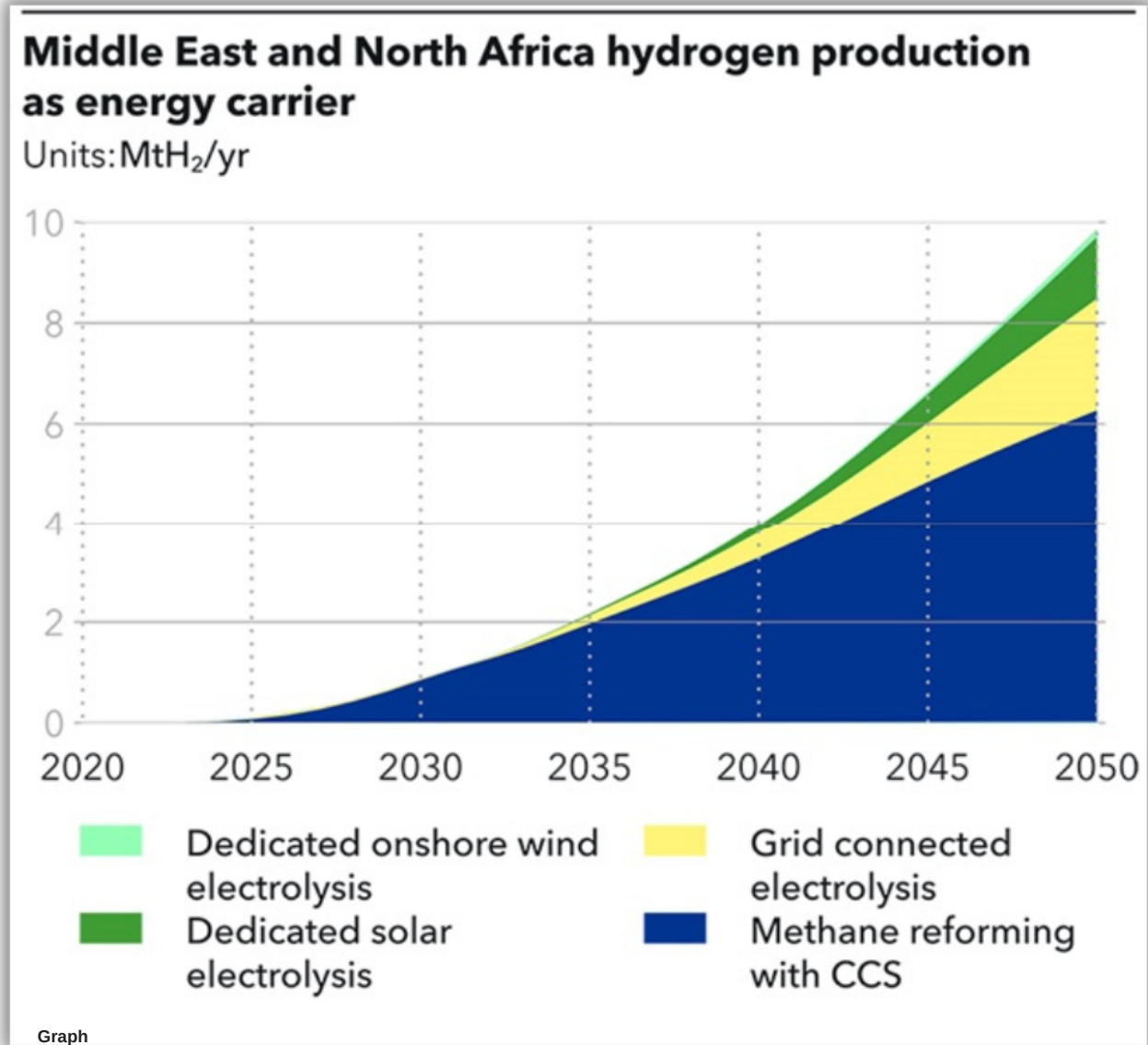
Oman and BP have a deal from January that will see them create green hydrogen projects by 2030. As part of the agreement, the oil giant will analyse data from wind and solar farms covering 8,000 square kilometres to find the best spots to set up shop.

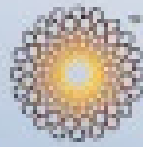
According to Wood Mackenzie's calculations, Egypt's declared hydrogen project capacity as of June 30 was around 1.5 million tonnes per year.

As Douglas pointed out, "Egypt has the resources in terms of solar and wind potential," but the country is confronting severe economic and fiscal issues that it has historically found very hard to overcome.

The public's attention has been piqued previously, therefore analysts should tread carefully when making predictions regarding hydrogen's future success. However, the economic case for hydrogen's inclusion in the energy mix is nearly making itself, and lobbying

for hydrogen is at an all-time high with strong political support. The United Arab Emirates (UAE) uses liquid hydrogen to power its Mars expeditions. It would be wonderful if this same fuel source made the UAE (and other petrostates) the world's leading renewable energy producers.





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THE CLEAN ENERGY DREAMS OF THE MIDDLE EAST ARE BEING FUELED BY HYDROGEN

The Gulf states have clearly mapped out a plan to fulfil their promise to future generations by ensuring their continued economic growth and progress towards their stated objective of reducing greenhouse gas emissions. The region's goal is to go from being a major hydrocarbon producer to one of the leading clean energy suppliers. The sun, the land, the ocean, and the proximity to major consumer hubs, as well as domestic demand, are all there.

More than 680 major hydrogen infrastructure projects have been announced around the world. Almost half of these initiatives take place in Europe. Although China's Asian initiatives are more numerous, the Middle East and North Africa also feature prominently.

To be sure, the Middle East is gearing up to be a sizable decarbonization cluster, and its location makes it a natural focal point for energy transition discussions. Every significant participant from North Africa to the Gulf has their own set of pledges,



Sudair solar project in Saudi Arabia_Energy and Utility

clean energy pathways, and a clear hydrogen advantage. With such large quantities of cheap renewable resources, countries like Saudi Arabia, Oman, and the United Arab Emirates could easily dominate the global hydrogen market.

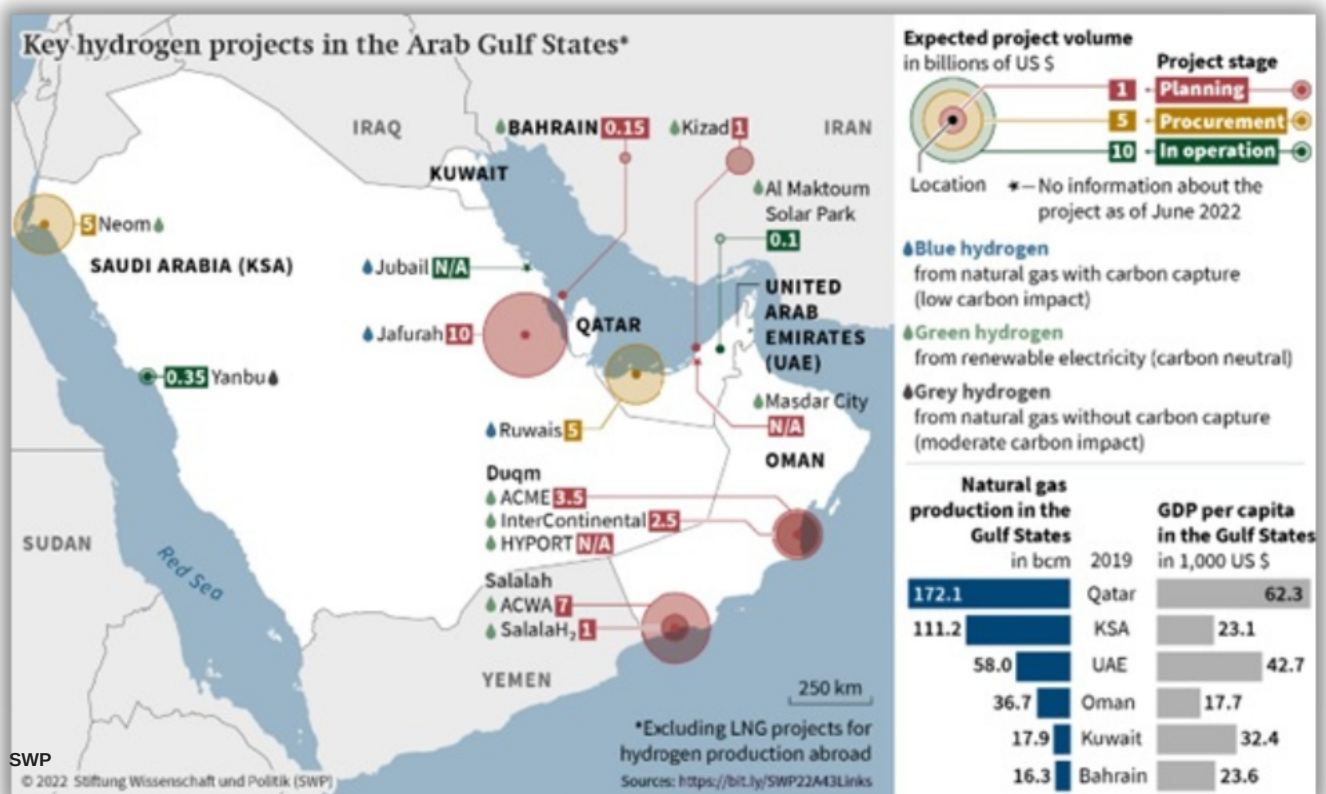
Saudi Arabia's Vision 2030 programme now includes ambitious hydrogen-related goals. Aramco pioneered the shipment of blue ammonia to Japan in 2020, sending 40 tonnes to the country. The Green Hydrogen Project at NEOM will be the world's largest utility-size commercial hydrogen facility, using 4 GW of renewable energy to manufacture green ammonia. It will be powered by Acwa Power and Air products. Several such massive initiatives are currently in the planning stages.

The goal is not to limit the aspiration to the frontiers of Saudi Arabia alone, but rather to work in tandem with other nations.

Acwa Power is a current example, having signed on with an Uzbek green hydrogen factory to produce 3,000 metric tonnes per year of green hydrogen. Located 45 km outside of Tashkent, the capital, in Chirchiq, the facility will be linked to an existing ammonia plant there. To achieve this goal, we have entered into supply agreements with Korea Electric Power Corporation and are planning to construct a green hydrogen facility in Sokhna, Egypt.

Middle East Gearing Up To Lead Global Competition

The Middle East hopes to dominate the green hydrogen market at the expense of its primary competitors, Europe and Asia. There will be a flurry of new UAE projects announced that year. Engie, a French energy company, and Masdar, a renewable energy firm based in Abu Dhabi,





Oman Oil Petrol Station // Oman Oil

have announced a US \$5 billion investment in the UAE's green hydrogen industry, with a goal of doubling the country's electrolyser capacity by 2030. Additionally, Dubai unveiled the "first industrial scale" green hydrogen factory in the Middle East. The United Arab Emirates has announced that by 2030, it intends to capture 25 percent of the global low-carbon hydrogen market. Meanwhile, Saudi Arabia signed a US \$7 billion green hydrogen production deal with ACWA Power, Omanoil, and Air Products in Oman's Salalah free zone. By 2040, Oman plans to have 30GW of renewable and sustainable hydrogen powering its economy.

The market for green hydrogen in the region has grown rapidly since 2021. Saudi Arabia has made significant investments in R&D, lowering the price of producing green hydrogen and making it a more competitive option. The state's goal is to become the world's lowest-cost generator of green hydrogen at US \$1 per kilogramme.

Siemens has identified 46 possible green hydrogen projects in the region with a combined worth of US \$92 billion, and many private enterprises are eager to get in on the action. The major investment opportunity was seen in Saudi Arabia, the United Arab Emirates, and Oman.

In addition to green hydrogen, the United Arab Emirates aspires to boost the share of renewable energy in its energy mix to 75% by 2050. Before COP28, the Al Dhafra Solar Project in Abu Dhabi will be fully operational. A total of 160,000 homes will be able to get their power needs met by the solar farm's 2 GW output. The Emirati government-owned businesses TAQA and Masdar own 60% of the project, with EDF Renewables and China's Jinko Power Technology owning the other 40%. The corporations anticipate the project will result in the creation of 4,000 new jobs. Other significant solar projects, such as Dubai's US \$3.9 billion, 950-MW Noor Energy 1 farm and Abu Dhabi's Hatta Wind Power Project, will help support this initiative.

By 2030, Saudi Arabia hopes to derive half of its energy needs from renewable resources. The Sudair Solar Power Plant in Riyadh, with its capacity of 1,500 MW, and the Manah I and II solar power facilities in Manah will be major contributors to this trend. Saudi Arabia can decarbonize its oil and gas activities by investing in carbon capture and storage (CCS) technologies. And probably most audacious of all, Saudi Arabia plans to build a futuristic megacity they've dubbed NEOM. The Kingdom plans to invest US \$80 billion into the construction of the megaproject in the country's northwest, expanding the size of the country's population to that of Belgium. The goal is to build a place of the future where 95 percent of the land is set aside for nature and there are no automobiles, roads or greenhouse gas emissions. Building of the metropolis has begun, despite widespread scepticism about its feasibility.

Thanks to massive investments in the future of the region's renewables and persistent focus on its well-established oil and gas industry, the Middle East is poised to become an energy powerhouse. With their ambitious ambitions for green hydrogen, solar, wind, and other renewable energy sources, Saudi Arabia and the United Arab Emirates (UAE) are poised to become regional leaders in the transition to green energy.

The Role Of Hydrogen In Stimulating Economic Development

Hydrogen has many advantages beyond meeting the country's rising demand for consumption.

Middle East might take the lead in developing and implementing innovative sustainable energy solutions. The Middle East and North Africa (MENA) is ideally situated to embrace the hydrogen economy due to its ready access to cheap solar power.

Furthermore, the area has a great deal of accumulated expertise in the field of energy. Oil prices are expected to fall over the long term. The area may reinvent itself to become a leading global exporter of green hydrogen if it moves fast and with purpose, shifting its attention to the developing hydrogen sector. There are now planned green hydrogen projects in the MENA region with an estimated value of US \$42 billion. In an effort to bring the price of green hydrogen down to less than US \$2 per kilogramme by 2026, ACWA Power, a regional developer, has recently formed a cooperation with other companies.

The largest green hydrogen project in the world is also being developed in Saudi Arabia. To produce 650 metric tonnes of hydrogen per day via electrolysis, as well as nitrogen by air separation, and 1.2 million metric tonnes of green ammonia annually, NEOM, Air Products, and ACWA Power have formed a joint venture to integrate four gigawatts of renewable power from solar, wind, and storage. It is anticipated that the project will go live in 2025.

Facilitating The Quick Spread Of Hydrogen Technology

Since 1970, Mitsubishi Power has dedicated itself to the study and development of hydrogen-related technology. To get closer to the region's 2025 target of full hydrogen ready in its massive, industrial J-class gas turbines, in 2018 the company created a 30 percent hydrogen mixture combustion technology.

With this technique, gas-powered turbines can be converted to run on hydrogen fuel efficiently and at a minimal cost. With its cutting-edge carbon capture, utilisation, and storage technology, the region can get to zero net CO2 emissions in under two decades.

Those units that are hydrogen-ready will need minimum modification and expenditure to upgrade to state-of-the-art units as the region makes progress towards its goal of 100 percent hydrogen-fueled firing by 2030. Increased regional demand for hydrogen as a result of this shift will spur technological advancement and lead to further lower prices.

Smooth Transition

The worldwide energy transformation involves more than just the localised generation of clean power; it also involves the collection, transmission, and distribution of energy.

The Middle East is well-positioned to dominate the global green hydrogen industry thanks to its wealth of renewable resources, favourable location, and massive ongoing investments in logistical infrastructure. It has the potential for large-scale green hydrogen generation and the ability to export that hydrogen around the world to meet rising demand.

Leading The Change

While the worldwide average for hydrogen production costs is around US \$7 per kg, Saudi Arabia consistently keeps its prices at or below US \$2 per kg. This also applies to the production of environmentally friendly hydrogen, which is difficult to achieve elsewhere at affordable prices. Rates of US \$1 per kg should be consistently feasible in Saudi Arabia in the long



TAQA // TAQA

run, according to a forecast released this month by the King Abdullah Petroleum Studies and Research Centre (KAPSARC), making them easily the cheapest in the world.

The US \$5 billion NEOM green hydrogen project has been under construction since March. With production set to begin in 2026, the plant will have the potential to produce 650 metric tonnes of carbon-free hydrogen per day, lending credence to Saudi Arabia's earnestness in its pursuit of leadership in the rapidly growing green hydrogen market in the Middle East.

Scaling Up

While Saudi Arabia has the ability to create green hydrogen at the lowest cost, other Middle Eastern countries with equal advantages and a similarly strong political will are not far behind.

All indicators point to significant growth in both the value of ongoing investments and the number of proposed projects in the Middle East, despite the fact that estimates for both tend to fluctuate widely. In August, Siemens discovered 46 green hydrogen projects in the MENA region with a combined value of US \$92 billion. Last month, MEED estimated that the region's 50+ projects had invested over US \$150 billion.



Dhafra Solar Project // NS Energy

In comparison to Saudi Arabia's US \$10.5 billion and United Arab Emirates' US \$10.28 billion, Egypt's current investment level of US \$63.8 billion is more than six times higher. Oman comes in second with projects worth US \$49.1 billion.

Given Egypt's ready access to wind and solar energy and its ongoing multi-billion-dollar port upgrade projects, it is evident that the country is dedicated to being a major player in the regional rivalry to obtain green hydrogen supplier status and the development of the broader global market. There is a race to determine which country in the region can become the pioneer in the field of green hydrogen first.

Rising Green Hydrogen Demand

As hydrogen production becomes more efficient and cost-effective, so too must the infrastructure built to permit its widespread usage around the world.

However, the potential for hydrogen generation in the Middle East goes much beyond mere efficiency and meeting demand. Its strategic location makes it possible to export green hydrogen to European and Asian markets, and its abundant natural resources provide fuel for renewable energy.

Investing in technological innovation is necessary for the region as a whole to reach its goal of a net-zero carbon future by making renewable energy sources, such as hydrogen, more accessible and affordable.

In order to fully realise the region's potential for green hydrogen, this means that new ports, with larger and more advanced infrastructure, are needed in the MENA region.

Digital technologies are expected to be deeply integrated into plant operations in the future, which experts believe will allow for performance optimisation, predictive maintenance scheduling for equipment, and selective automated decision-making in matters of operation and maintenance, as well as risk reduction, to maximise the profitability of gas-turbine combined cycle power plants.



Neom Green Hydrogen at Oxagon // Construction Week