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WIRTSCHAFT

BRANCHENREPORT VEREINIGTE ARABISCHE EMIRATE

ERNEUERBARE ENERGIEN - HYDROGEN

BRANCHE UND MARKTSITUATION
MARKTSEGMENTE UND TRENDS
CHANCEN FÜR ÖSTERREICHISCHE UNTERNEHMEN

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Resümee

In the pursuit of a sustainable future, the global energy landscape is undergoing a transformative shift, with increasing emphasis on renewable and low-carbon alternatives. Hydrogen, a versatile and clean energy carrier, has emerged as a promising solution to combat climate change and revolutionize the energy sector. The United Arab Emirates (UAE) has positioned itself as a frontrunner in sustainable energy transformation, adopting visionary strategies and alliances to become a leading player in the hydrogen market. This comprehensive report delves into the growing importance of hydrogen, its cross-sectoral integration potential, and its crucial role in achieving global sustainable energy goals, in line with the objectives set forth in the Paris Agreement.

1. INTRODUCTION

1.1 Overview

In the pursuit of a sustainable future, the global energy landscape is undergoing a transformative shift, with increasing emphasis on renewable and low-carbon alternatives. Hydrogen, a versatile and clean energy carrier, has emerged as a promising solution to combat climate change and revolutionize the energy sector. The United Arab Emirates (UAE) has positioned itself as a frontrunner in sustainable energy transformation, adopting visionary strategies and alliances to become a leading player in the hydrogen market. This comprehensive report delves into the growing importance of hydrogen, its cross-sectoral integration potential, and its crucial role in achieving global sustainable energy goals, in line with the objectives set forth in the Paris Agreement.

1.2 Hydrogen's Game-Changing Versatility

Hydrogen's significance lies not only in its potential to decarbonize energy production but also in its ability to drive innovation and efficiency across various industries. As a clean energy carrier, hydrogen holds the promise of powering fuel cell electric vehicles (FCEVs) for sustainable transportation, while offering energy storage solutions to complement renewable sources like wind and solar. This versatility makes hydrogen a pivotal player in optimizing energy use, decarbonizing hard-to-abate sectors, and accelerating the global transition to a low-carbon economy.

1.3 Hydrogen Production Methods

Various methods are employed to produce hydrogen, each associated with a specific colour representing the production process. While grey hydrogen involves reforming fossil fuels and generates carbon emissions, blue hydrogen, coupled with Carbon Capture, Utilization, and Storage (CCUS) technology, captures and stores CO2, resulting in a lower carbon footprint. Green hydrogen, produced through electrolysis powered by renewable energy sources, stands out as the cleanest and most sustainable option. Other methods gaining traction include yellow hydrogen, which relies on nuclear energy, and turquoise hydrogen, utilizing methane pyrolysis with no emissions.

2. The UAE's Vision for a Hydrogen Hub

The UAE has unveiled an ambitious vision to become a leading hydrogen hub, targeting 25 % of the global hydrogen market share by 2030. **The National Hydrogen Strategy** aims to create a resilient supply chain, position the UAE as a major low-carbon hydrogen producer and supplier, promote innovation, and support nationwide decarbonization efforts. The establishment of the **Abu Dhabi Hydrogen Alliance, Hydrogen Leadership Roadmap**, and the approval of **the National Hydrogen Strategy 2050** showcase the UAE's commitment to a sustainable energy future.

As part of the UAE's National Hydrogen Strategy, H.E. Suhail Al Mazrouei, Minister of Energy, and Infrastructure, shared the UAE's vision to becoming a leading hydrogen production Hub by 2031. The vision is to:

- Develop a resilient hydrogen supply chain to support the growth of the local industry,
- Consolidate the UAE's role as a leading global producer and supplier of low carbon hydrogen,
- Promote innovation in industrial zones in the UAE,
- Establish a robust hydrogen economy that can support the country's nationwide decarbonization efforts.

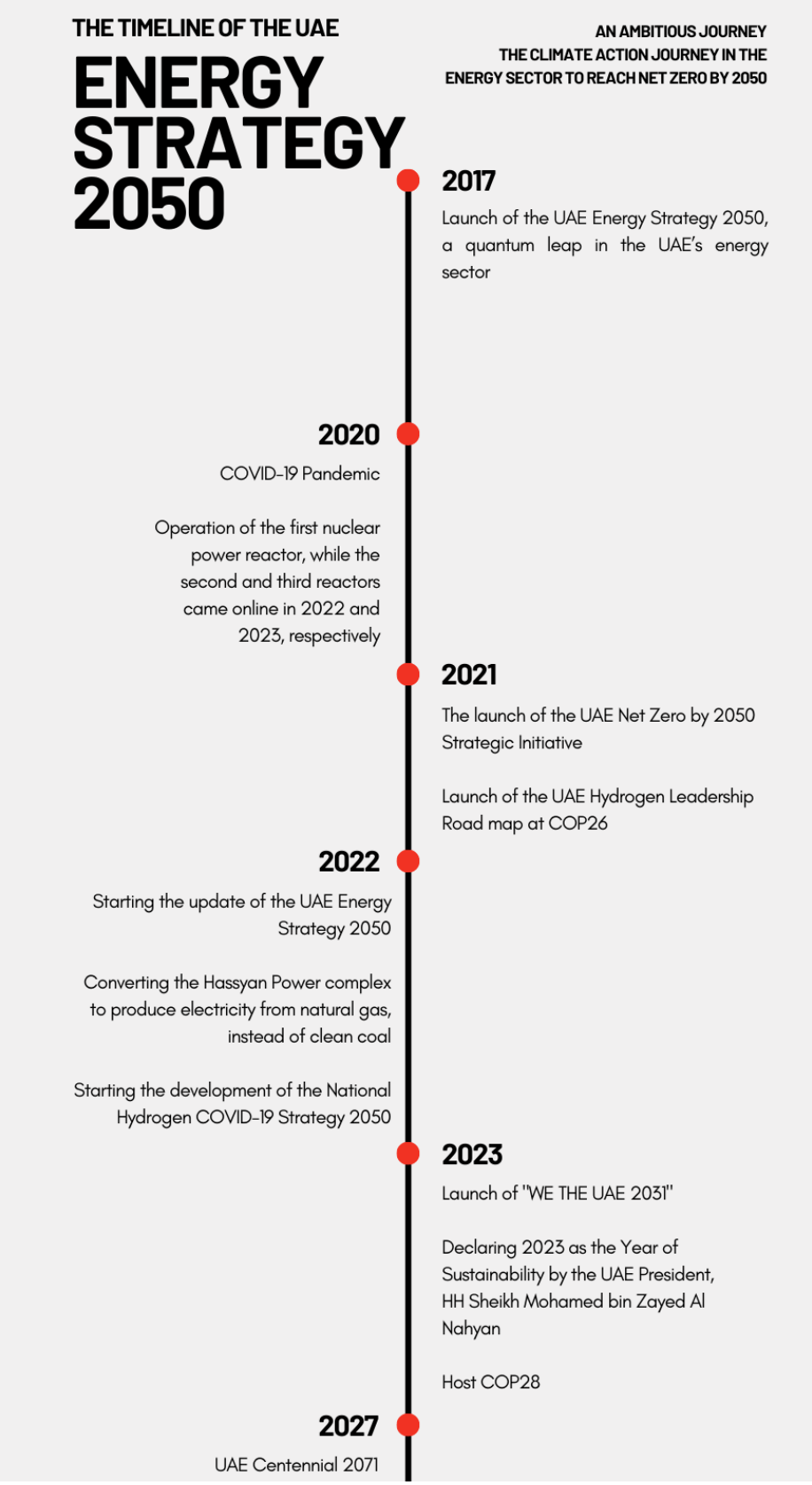

Table 1 – Source: Ministry of Energy and Infrastructure

Targets have been set for 2031 and 2050 as shown in Table 2 below:

National Hydrogen Strategy		
Target for Year 2031		**Target for Year 2050**
25%	Reduce Emissions In Hard-To-Abate Sectors By	100%
1.4 MTPA	Hydrogen Production Per Year	15 MTPA
Establishing a Hydrogen R&D Center	Hydrogen Center	A Globally Recognized Innovation Center for Hydrogen
2 Hydrogen Oases	Establishing Several Hydrogen Oases in the UAE	5 Hydrogen Oases

Table 2 – Source: Ministry of Energy and Infrastructure

2.1 Masdar's Pioneering Green Hydrogen Business

Masdar, Abu Dhabi's renewable energy company, is spearheading the green hydrogen revolution. With strategic investments and partnerships, Masdar aims to produce up to 1 million tonnes of green hydrogen per annum by 2030. The company is actively engaged in green hydrogen projects across sectors like aviation, ammonia, steel, maritime, power, refining, and heavy-duty transportation. Notable projects include collaboration with Siemens Energy, TotalEnergies, and Marubeni Corporation for sustainable aviation fuels and acquiring a stake in bp's HyGreen Teesside green hydrogen project.

2.1.1 List of Publicly Announced Projects by Masdar

1. In partnership with Siemens Energy, TotalEnergies, Marubeni Corporation, Department of Energy in Abu Dhabi, Etihad Airways, Lufthansa Group and Khalifa University, Masdar is leading the development of a demonstration project to produce green hydrogen and sustainable aviation fuels (SAF).
2. Masdar, BP, and ADNOC have formed a UK-UAE new energy partnership that includes four agreements, of which Masdar is party to two:
    a. Masdar, BP, and ADNOC, along with Etihad and Tadweer, have agreed to explore the production of sustainable aviation fuels in the UAE using solar-to-green hydrogen and waste gasification.
    b. Masdar has agreed to acquire a stake in BP proposed green hydrogen project, HyGreen Teesside, which is to produce 60 megawatts (MW) electrical input of hydrogen at start-up in 2025, increasing to up to 500 MWe by 2030.
3. Masdar and ENGIE formed a US$5 billion strategic alliance to help drive UAE's green hydrogen economy, which includes:
    a. Development of a 200 MW green hydrogen plant in the UAE with Masdar, Engie, and Fertiglobe.

4. Masdar, Hassan Allam Utilities, and Infinity Power signed agreements with the General Authority for Suez Canal Economic Zone, the New and Renewable Energy Authority, the Egyptian Electricity Transmission Company, and The Sovereign Fund of Egypt, related to the development of 4-gigawatt (GW) capacity green hydrogen plants in Egypt, which includes:
    a. Development of a 2 GW green hydrogen project in the Suez Canal Economic Zone.
5. Masdar is developing a 2,000 MW capacity integrated offshore wind and green hydrogen project in Azerbaijan, as part of a 4,000 MW project agreement between Masdar and the Ministry of Energy of the Republic of Azerbaijan.

2.1.2 Other Relevant Announcements

1. UAE to Launch National Hydrogen Strategy - The Emirates is determined to attain net zero emissions by 2050 and holds a positive outlook on hydrogen, actively developing a detailed plan to establish its position as a clean fuel exporter and harness its future possibilities. Presently, the UAE is involved in 28 hydrogen projects, with seven having successfully secured financing. Looking at the global scenario, the International Energy Agency estimates that around 520 million tonnes of hydrogen will be necessary to meet net-zero objectives by 2050.
2. UAE Has 6 Hydrogen Projects Worth $1.7bln Under Development - The UAE is actively progressing with six hydrogen projects, valued at USD 1.66 billion. The country is poised to play a significant role in the global low-carbon hydrogen market, with the potential to supply 25 % by 2030, as cited in EIC's November 2022 country report. Recognizing the increasing importance of hydrogen, the UAE introduced the Hydrogen Leadership Roadmap during COP26. Furthermore, the nation formed the Abu Dhabi Hydrogen Alliance in January 2021, comprising key entities such as Mubadala Investment Company, ADQ, ADNOC, and the Ministry of Energy and Infrastructure. Among the pilot projects is one at the Mohammed bin Rashid (MBR) solar park, expected to produce approximately 20.5 kilograms of hydrogen per hour at 1.25 MWe of peak power.
3. ADNOC in Hydrogen - ADNOC currently produces more than 300 kt per year of hydrogen in its downstream facilities, primarily for industrial use. The company intends to further enhance hydrogen production to reach 500 kt annually and is actively exploring various growth opportunities. In May 2021, ADNOC unveiled plans for a massive "blue" ammonia production facility with a capacity of 1 million tons per annum in Ruwais, Abu Dhabi. The project, now in the design phase, will be situated within the TA'ZIZ industrial ecosystem and chemicals hub. A final investment decision is expected in 2022, and the facility aims to commence operations by 2025. Additionally, in June 2021, it was announced that Fertiglobe, a joint venture between ADNOC and OCI, would also participate in this ambitious venture.
4. DEWA Green Hydrogen Plant - The Middle East's first solar-driven hydrogen electrolysis facility - The UAE has unveiled its strategic initiative, Net Zero by 2050, with a primary focus on clean energy to combat climate change and reduce greenhouse gas emissions. In pursuit of this goal, Siemens Energy, the Dubai Electricity and Water Authority (DEWA), and Expo 2020 Dubai have joined forces to build the region's inaugural solar-powered green hydrogen plant at the Mohammed bin Rashid Al Maktoum Solar Park in Dubai. This pioneering project is set to pave the way for green hydrogen's significant role in the global energy transition and the decarbonization of the economy.

3. Navigating Hydrogen's Challenges: From Production to Transportation

Hydrogen transportation presents a delicate balance between its impressive energy-to-weight ratio and its limited energy density per volume. While hydrogen storage in large spaces like underground caverns proves suitable for applications like electricity grids, the same approach becomes impractical for exporting or using

hydrogen as fuel. To overcome this challenge and make hydrogen transport more viable, compression or liquefaction methods are employed, increasing its energy density, and facilitating more efficient transportation. The UAE has taken steps towards solving this challenge by signing a memorandum of understanding (MoU) signed between Masdar, Port of Amsterdam, SkyNRG, Evos Amsterdam and Zenith Energy to explore the development of a green hydrogen supply chain between Abu Dhabi and Amsterdam to support Dutch and European markets.

Despite the potential benefits, the hydrogen industry faces hurdles concerning certification and standards, particularly in the production of blue or green hydrogen. Different safety, quality, and technical standards adopted by various organizations, such as China, ISO, and IEC, add complexity to the process. For instance, China sets purity requirements for hydrogen used in fuel cell vehicles, while the EU is developing strict hydrogen purity requirements.

Safety is also a top concern, given hydrogen's flammability and potential oxygen displacement. Efforts are underway to enhance hydrogen's safety, especially in applications like fuel cells and transportation, through substantial research and development investments, fostering its role as a secure and reliable energy source as we progress towards a greener future.

4. Opportunities for Global Collaboration

4.1 Establishing a Research Facility in the UAE By 2031

The United Arab Emirates (UAE) is taking a progressive step towards sustainable energy solutions by planning to establish a state-of-the-art research facility centered around hydrogen production by 2031. Recognizing Austria's well-established expertise in this sector, an exceptional opportunity for collaboration between the two nations arises. This partnership could foster an exchange of knowledge and innovative practices, leveraging Austria's advanced capabilities in hydrogen technology to support the development of the facility in the UAE.

Proposing a collaborative initiative between Austria's leading research center and the UAE government holds the potential to expedite the establishment of this critical facility. Through this partnership, we aim to channel our combined strengths, research capabilities, and technological advancements to drive ground-breaking developments in hydrogen production methodologies and applications. By working together, we can accelerate the shift towards a sustainable and low-carbon energy landscape, contributing significantly to global efforts in combating climate change and ensuring energy security for future generations.

This proposed collaboration not only represents a strategic alliance between both nations but also embodies a shared commitment to sustainability and responsible energy practices. As the global demand for clean and renewable energy intensifies, it is essential to foster such collaborative endeavours that will pave the way for a cleaner, greener, and more prosperous future for both our countries and the entire international community.

4.2 Sourcing Hydrogen from the UAE

Austrian organizations have a significant opportunity to explore the UAE as a potential supplier of green hydrogen, thanks to the impressive advancements made by Masdar, the UAE's leading clean energy company, in green hydrogen production and export. Masdar's commitment to sustainability and renewable energy aligns perfectly with the UAE's ambitious vision of capturing 25 % of the global hydrogen market share by 2030, making it an enticing prospect for Austrian entities seeking strategic partnerships for importing green hydrogen.

By tapping into the UAE's vast renewable energy potential and its aspirations to become a major player in the hydrogen market, Austrian organizations can secure a reliable and environmentally friendly source of hydrogen. This move will accelerate the decarbonization of their operations and contribute to a sustainable energy transition. The collaboration between the UAE's hydrogen ambitions and Austria's pursuit of sustainable energy solutions presents a win-win proposition, fostering a resilient global energy landscape in line with climate goals and promoting mutual growth and progress.

In fact, in early 2023, Masdar and Austria's VERBUND signed an MoU to explore green hydrogen production for the central European market, further solidifying the potential for meaningful collaboration between the two nations.

4.3 UAE as a Market for Austrian Technologies Related to Hydrogen Production

As the UAE makes remarkable strides in hydrogen production, there exists a significant opportunity to not only focus on production but also to develop a robust supply chain for exporting hydrogen. Embracing readily available solutions and technologies in this field can pave the way for a fruitful collaboration between the two governments, with valuable support from the private sector.

By capitalizing on existing technologies and best practices, both the UAE and Austria can expedite the implementation of hydrogen production-related solutions, including the establishment of a well-functioning supply chain for hydrogen export. Sharing knowledge and expertise in critical areas like electrolysis, storage, and distribution will not only enhance operational efficiency but also accelerate the adoption of green hydrogen.

5. Conclusion

As the UAE embraces hydrogen as a game-changer in the global energy landscape, the nation's vision for a sustainable future gains momentum. Driven by strategic investments, innovative projects, cross-sectoral integration, and international partnerships the UAE is poised to become a leading hydrogen hub. Collaborating with like-minded nations will reinforce the pursuit of a cleaner and greener energy ecosystem, powering economies, industries, and transportation sustainably. Through shared expertise, investment, and commitment to a low-carbon future, the hydrogen revolution can drive positive change on a global scale, transforming aspirations into reality for generations to come.

6. Appendix

6.1 Renewable Energy Stakeholders in the UAE

Sr.No.	Entity	Contact Details
1	Ministry of Energy and Infrastructure (MOEI)	E: info@moei.gov.ae W: www.moei.gov.ae
2	Ministry of Industry and Advanced Technology (MoIAT)	E: investments@moiat.gov.ae W: www.moiat.gov.ae
3	Masdar	T: +971 2 653 3333 W: www.masdar.ae
4	ADNOC	T: +971 2 707 0000 W: www.adnoc.ae
5	Abu Dhabi Department of Energy (DoE)	T: +971 2 207 0777 W: www.doe.gov.ae
6	Mubadala Investment Company	T: +971 2 413 0000 E: contact@mubadala.com W: www.mubadala.com
7	Abu Dhabi Developmental Holding Company PJSC (ADQ)	W: www.adq.ae
8	TAQA	T: +971 2 691 4900 E: info@taqa.com W: www.taqa.com
9	Khalifa University	T: +971 2 312 3333 W: www.ku.ac.ae
10	Siemens Energy	T: +971 2 616 5100 E: communications.ae@siemens-energy.com W: www.siemens-energy.com/mea
11	TotalEnergies	E: shareholders@totalenergies.com W: totalenergies.com/united-arab-emirates
12	BP	T: +971 2 493 5555 W: www.bp.com
13	ENGIE	E: info.ecmescat@engie.com W: www.engie.com

6.2 Resources

6.2.1 Official Reports

1	UAE Hydrogen Leadership Roadmap
2	UAE Energy Strategy 2050
3	Hydrogen From Hype to Reality Report
4	We the UAE 2031
5	DEWA Green Hydrogen Plant - The Middle East's first solar-driven hydrogen electrolysis facility

6.2.2 Articles

1	National Hydrogen Strategy
2	Sharif Al Olama announces completion of phase one of UAE's National Hydrogen Strategy
3	UAE Cabinet approves national energy and hydrogen strategies
4	Green Hydrogen - Masdar
5	Abu Dhabi Hydrogen Alliance
6	Hydrogen policy and regulatory framework
7	Minister Of Energy and Infrastructure Reveals Details of The Updated UAE Energy Strategy 2050 And the National Hydrogen Strategy

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