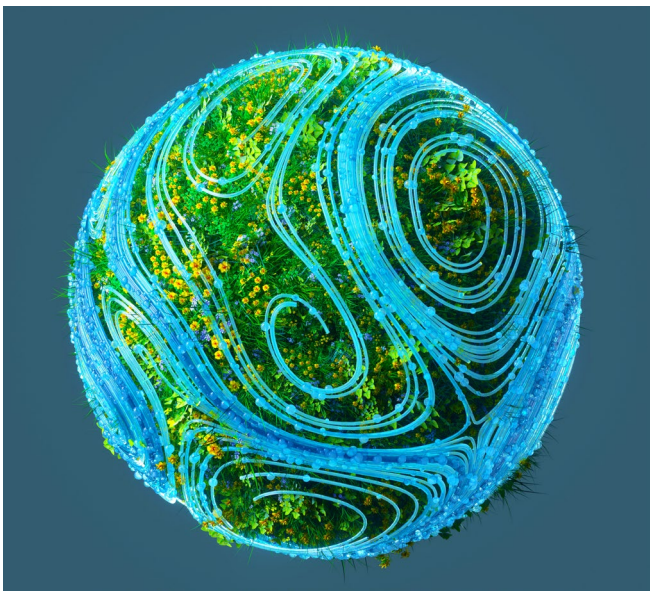
FUELLING THE FUTURE OF GREEN ENERGY

A UNIQUE DEVELOPMENT PROJECT is looking to set new standards in sustainable energy and green hydrogen production.



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▲ **NEOM's Hydrogen and e-Fuels Applied Research Institute will support the translation of novel ideas for the energy sector, and collaborate to close knowledge gaps.**

Decarbonizing energy production may be the most urgent challenge of our time. NEOM, the massive development project in Saudi Arabia's Tabuk province, aims to point towards a more sustainable future, and green energy is at its heart. Wind and solar will be the primary sources of electricity across the entire project, and hydrogen will help fuel the region's success.

"We must invest in the technologies that will make our commitment to sustainability a reality," says Donal Bradley, executive director of NEOM's Education, Research and Innovation Foundation.

The foundation is establishing several flagship applied research institutes (ARIs) at NEOM, focused on strategic priorities for innovation. The Hydrogen and e-Fuels ARI will support the translation of ideas and novel technologies for the energy sector, while working with industry and society to identify knowledge gaps.

"NEOM IS A UNIQUE PLACE TO TRIAL SOLUTIONS."

"Even the most advanced technologies available now won't get us where we need to be. A comprehensive research network at NEOM is imperative," says Benjamin Queisser, head of technology and innovation for hydrogen and green fuels at ENOWA, NEOM's energy and water subsidiary. "We're encouraging entrepreneurs to join this network — NEOM is a unique place to trial solutions in a sizeable built-in market."

HYDROGEN INNOVATION

ENOWA recently established the Hydrogen Innovation Development Centre, whose staff will work with ARI researchers to scale up new technologies. NEOM will also host the world's largest carbon-free hydrogen production plant, which is being built in partnership with Air Products and ACWA Power.

Hydrogen fuel is produced by splitting water into hydrogen and oxygen using an electric current — a process called electrolysis. To make the hydrogen truly sustainable, the entire manufacturing process must be renewably powered. NEOM's plant will use a combination of solar and wind energy.

"We chose NEOM's location for the favourable weather conditions," says Queisser. "Strong sunshine throughout the day and coastal winds at night provide the potential for 24-hour electricity generation."

The plant aims to produce up to 600 tonnes of hydrogen daily by the end of 2026. The hydrogen will be stored for transport as green ammonia. ARI researchers will analyse the whole hydrogen production chain, from improving the efficiency of electrolysis to minimizing energy loss during hydrogen gas conversion.

"This brings opportunities for research across multiple disciplines," says Bradley. "We hope to optimize green ammonia for shipping and examine options for carbon-neutral aviation based on hydrogen and carbon dioxide-derived sustainable fuels."

Improvements to the physical components of hydrogen production and fuel cells are also needed. The electrolyser, with all its subcomponents, constitutes at least 50% of the overall cost of producing hydrogen. The ARI teams will form partnerships to explore materials that could improve electrolysis, including alkaline polymer electrolyte membranes and solid oxide electrolyser cells. To have the strongest impact, argues ENOWA's managing director of hydrogen and green fuels Roland Kaeppner, hydrogen production must make its case economically as well as environmentally.

"ENOWA will help fulfil Saudi's Vision 2030 goals and the Paris agreement, not least by providing a blueprint for a hydrogen and green fuels economy," Kaeppner says. "To become net-zero or even reverse negative climate effects will cost money. The major challenge for green hydrogen is market activation and proving it can work economically." ■

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