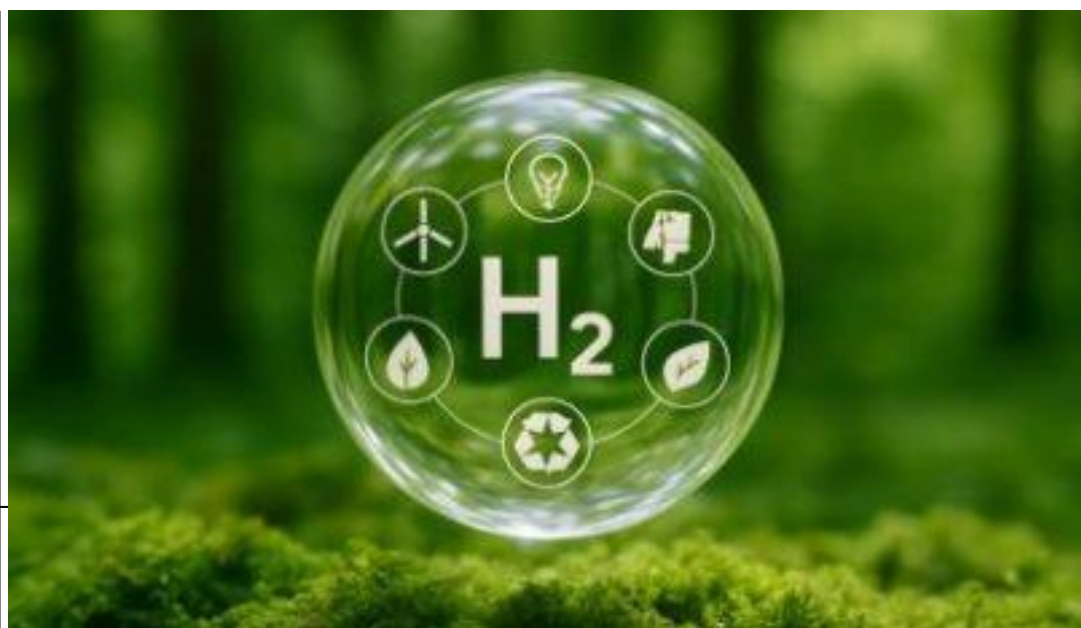


GREEN HYDROGEN

Technology Innovation Digest



CENTER of EXCELLENCE
for Green Hydrogen Ecosystem Development @ CSIR-NCL



Inside:

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Hydrogen Production Breakthroughs

Recent development in hydrogen production target high-efficiency electrolyzers and platinum free catalyst that are more cost-effective and efficient. A research team of Chalmers University of Technology, Sweden, have recently developed a novel method to produce hydrogen gas without the expensive and rare metal platinum. Using sunlight, water and tiny particles of electrically conductive plastic, researcher showed efficient synthesis of hydrogen, sustainably.

Clyde Hydrogen recently reported its strategy of employing a decoupled electrolysis process to make uses of hydrogen as an alternative to fossil fuels significantly safer, easier and less expensive than current conventional systems. Crucially, Clyde Hydrogen's method can store the hydrogen in a non-gaseous form and directly connected to renewable power, resolving many of the industry's major challenges and providing a viable long-term energy solution.

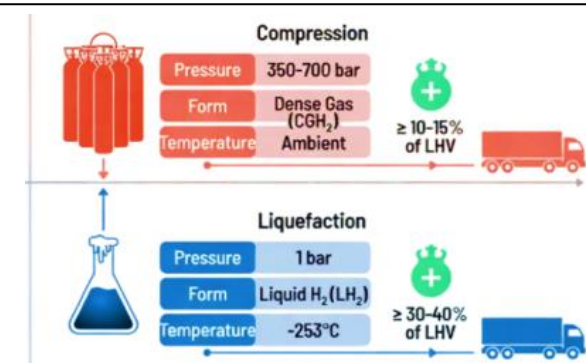
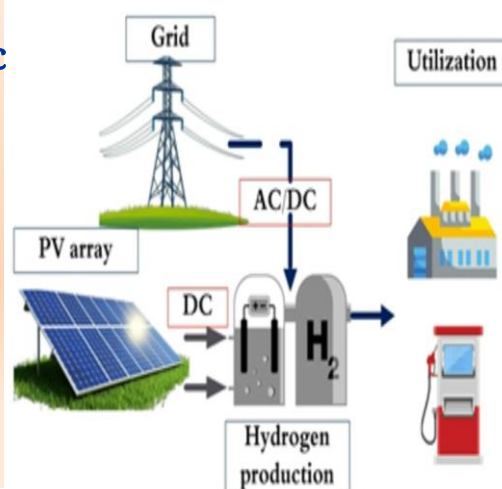
A new method developed by University of Illinois in Chicago, USA, makes use of solar or wind power, water and biochar, a type of agricultural waste. Their techniques requires 600% less energy to separate the hydrogen molecules from the water.

Source: <https://doi.org/10.1002/adma.202507702> <https://www.renewableinstitute.org/us-scientists-produce-hydrogen-using-600-less-energy-in-new-breakthrough/>, <https://www.chemengonline.com/clyde-hydrogen-announces-hydrogen-production-breakthrough/?printmode=1>

Recent advances in hydrogen production technologies: environmental and economic perspectives

This review summarizes recent advancements, challenges, and future prospects in hydrogen generation, storage, and transportation, highlighting innovative approaches across the value chain. It compares conventional and renewable production methods such as biomass gasification, photocatalysis, and water electrolysis in terms of efficiency, cost, and environmental impact, and examines control strategies for improving solar-based hydrogen systems. It also covers applications in industry, transportation, and integration with microgrids and smart grids etc.

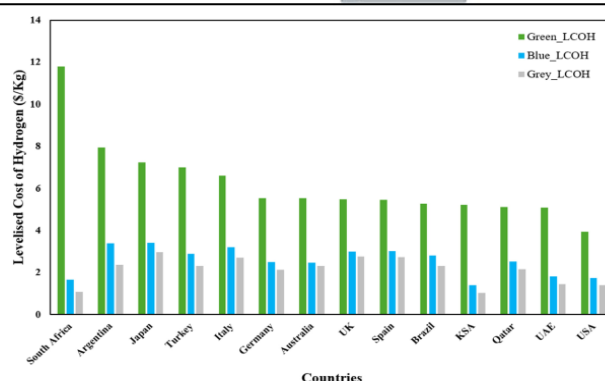
[Read More...](#)



Optimizing hydrogen logistics: A techno-economic comparison of compressed and liquid hydrogen systems

This review examines the practical and economic challenges of hydrogen transport, focusing on compressed gaseous hydrogen and liquefied hydrogen across road, rail, pipeline, and maritime modes. Based on a comprehensive survey of recent literature, it evaluates hydrogen's thermophysical properties affect energy requirements, and infrastructure decisions throughout the entire delivery chain.

[Read more...](#)



Hydrogen: Challenges and Opportunities for Storage and Transportation in the Clean Energy Economy

Focusing on recent technological advances and persistent challenges in hydrogen production, storage, and transportation, this article presents a comprehensive assessment of the current state of the hydrogen economy. Unlike prior studies that address these aspects in isolation, it adopts an integrated perspective linking technological, economic, and infrastructure dimensions across the hydrogen value chain.

[Read more...](#)

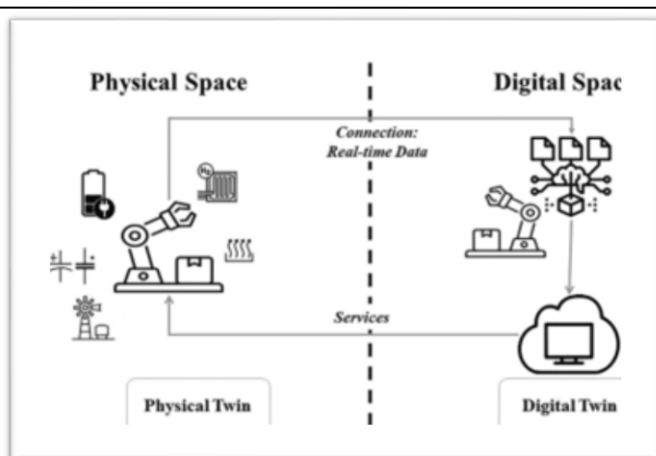
Cost-effective strategies and technologies for green hydrogen production

This review examines the primary hydrogen production methods. The environmental impacts of the various hydrogen production technologies are also assessed, with emphasis on their roles in the transition to a sustainable energy system. Furthermore, this review explores the prospects of solar hydrogen production via photocatalysis. Specifically, the potential role of solar hydrogen as an alternative to green hydrogen is discussed, along with the challenges in classifying solar hydrogen as 'green,' considering its reliance on renewable energy sources and its extremely low carbon footprint.

[Read more...](#)

From grey to “Green”: Modelling the non-energy uses of hydrogen for the EU energy transition

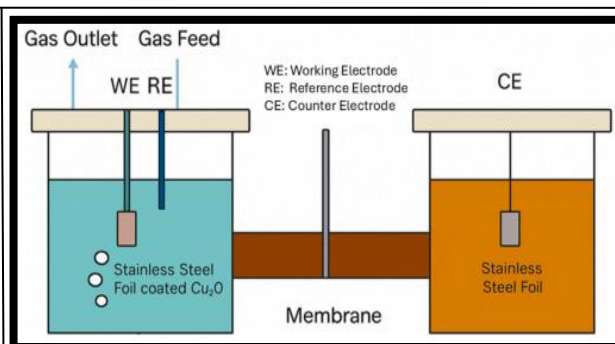
This article presents a dynamic, recursive modelling framework to analyze the transition from fossil-based to green hydrogen for industrial feedstock applications. A bottom-up System Dynamics model is developed and applied to the European Union to capture long-term interactions between hydrogen demand, production, and decarbonisation pathways across key sectors such as steel, chemicals, and refining. The study reveals that large-scale deployment of electrolytic hydrogen can significantly reduce CO₂ emissions, but requires rapid grid decarbonisation and substantial renewable expansion to be effective. The proposed modelling approach and scenario analysis provide valuable insights for policy design and can guide the integration of green hydrogen in industrial systems. [Read more...](#)



Lab-scale green hydrogen and fuel cell micro grid digital twin

This work reports a lab-scale green hydrogen microgrid integrated with a digital twin to improve system performance and control. The microgrid combines solar PV, battery storage, an electrolyze for hydrogen production, and a fuel cell for energy generation, all connected through a real-time cyber-physical interface. The proposed digital twin framework provides an efficient and low-cost platform that can support optimization and future development of hydrogen-based microgrid systems. [Read more...](#)

[Read more...](#)

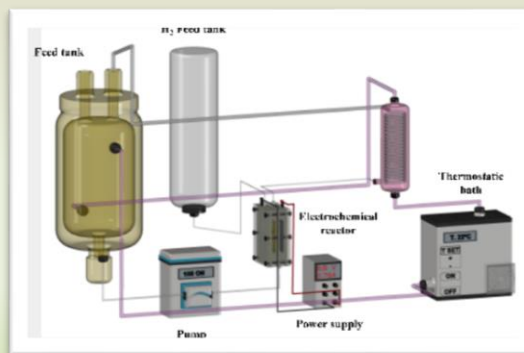


Green methanol production using green hydrogen and oceanic carbon dioxide: an experimental study

This study introduces an integrated electrochemical system for green methanol production using oceanic carbon dioxide and hydrogen. The system demonstrates successful methanol synthesis with promising yields under optimized conditions, validating a complete pathway from marine carbon to liquid fuel. The proposed integrated reactor design offers a sustainable and scalable approach for carbon capture and utilization. [Read more...](#)

Enhancing Nano plastics removal and green hydrogen recovery through photovoltaic-driven hybrid electrochemical treatment of urban treated wastewater

This work explores a hybrid electrochemical approach powered by solar energy to treat wastewater while simultaneously producing green hydrogen. Using a boron-doped diamond anode and a Ni-Fe stainless-steel cathode, the system effectively breaks down polystyrene nano plastics and achieves significant mineralization of organic content. The study demonstrates a practical and sustainable way to combine pollutant removal with energy recovery, which could be useful for similar wastewater treatment systems. [Read more...](#)



Coupled Multi-phase Oxidation-Reducing For Production of Chemicals (NewHydrogen, UC Santa Barbara joint patent)

NewHydrogen and the University of California, Santa Barbara have announced that they have filed a PCT application that further expands the basis for the NewHydrogen's ThermoLoop thermochemical water splitting process together with new material compositions discovered by the UCSB technology team and the new isothermal hydrogen process. This invention utilizes Large Language Models (LLMs) and artificial intelligence to search for mixed-metal oxides, including further regenerable materials, that can be employed within specific temperature ranges. This technology empowers the hydrogen production at temperatures below 1000°C, which avoids large temperature fluctuations compared to previous methods. [Read More...](#)

Toyota Plans to Make Hydrogen Combustion More Effective



Toyota engineers have integrated additional ventilation in the form of Positive Crankcase Ventilation (PCV) valves. This valve acts as an air introduction valve, which will induce air into the crankcase from the intake to aid ventilation while preventing backflow. This innovation has decoded the hydrogen combustion engine problem by addressing the need for improved ventilation and moisture control. [Read More...](#)

Device and method for producing green hydrogen by pyrolysis and gasification of biomass

Patent Number: CN120758262B

Xuke Hydrogen Alcohol Beijing Liquid Sunshine Research Institute Co Ltd. has disclosed the invention of a device and method for preparing green hydrogen by using gasification of biomass and pyrolysis. It contains a pyrolysis reaction device. In the present invention, pyrolysis technology is used to convert biomass raw materials into biochar, oil, and gas. [Read More...](#)

MXene-supported iridium catalyst and preparation method and application thereof

Patent Number: CN121295230A

Su Zhoushiyanshi's laboratory in China has disclosed an invention related to MXene-Iridium-supported catalyst for hydrogen production by water electrolysis. The catalyst has excellent electrochemical stability along with good water decomposition efficiency when applied to the PEM electrocatalytic water anode. The synthesis steps started with dispersing the iridium salt and the pretreated MXene material in water, followed by a hydrothermal reaction. [Read More...](#)



Title: Liquid Organic Hydrogen Carrier (LOHC) system for hydrogen storage and transport

MIT World Peace University (MIT-WPU), in collaboration with Ohm Cleantech Pvt Ltd (OCPL), has filed an invention that involves a two-stage chemical phase, i.e., hydrogenation and dehydrogenation phases. The system operates at 130°C and at a low pressure of 56 bar. The hydrogenated liquid has stored nearly 11,000 L of hydrogen within just 15.6 L of the carrier gas. In the dehydrogenation phase, the team has successfully recovered 86% of the stored hydrogen. [Read More...](#)



Progress of Green Hydrogen Mission

Published by Ministry of New and Renewable Energy of India

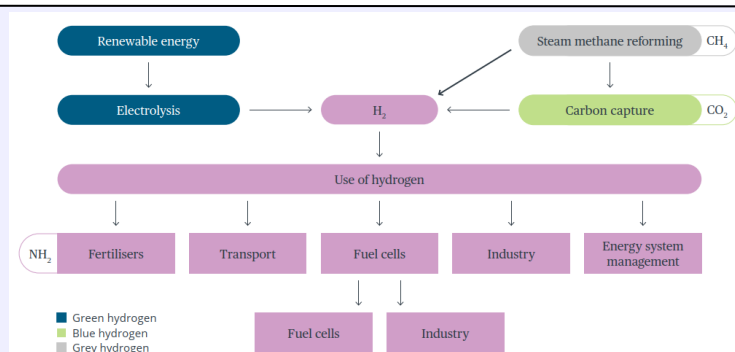
The National Green Hydrogen Mission aims to make India a global hub for green hydrogen production, use, and export, with strong progress across the value chain. It includes 3000 MW electrolyzer manufacturing capacity, 8.62 lakh tonnes/year hydrogen production, and green ammonia supply at competitive prices. Pilot projects in steel, transport, and shipping, along with Hydrogen Valley clusters and major port-based hubs, support real-world deployment. Overall, NGHM is boosting India's cost competitiveness, infrastructure, and global positioning in the green hydrogen sector.

[Read more...](#)

Scenarios Towards Viksit Bharat And Net Zero “Sectoral Insights: Industry”

Published by Niti Aayog On 2nd February 2026

The NITI Aayog report “Scenarios Towards Viksit Bharat and Net Zero Sectoral Insights: Industry (2026)” outlines a strategic pathway for decarbonising India's industrial sector while advancing its vision of a developed economy by 2047 and achieving net-zero emissions by 2070. It identifies industry as a major emitter (~24% of GHG emissions), with heavy reliance on fossil fuels (~83%), particularly in steel, cement, and chemicals. Through two scenarios Current Policy and Net Zero it projects significant growth in industrial demand and underscores the need for electrification, renewable energy adoption, circular economy practices, and emerging solutions such as green hydrogen and carbon capture. [Read more...](#)



International green hydrogen report 2026

Published by Bird and Bird On 23rd March 2026

The report highlights that green hydrogen is a critical enabler of global decarbonisation and energy transition, with countries including India developing strong policy frameworks, investments, and infrastructure to scale its adoption. India's National Green Hydrogen Mission targets at least 5 MTPA production by 2030, supported by incentives (SIGHT scheme), R&D funding, pilot projects, and hydrogen hubs to improve cost competitiveness and enable large-scale deployment. The report emphasizes hydrogen's key role in hard-to-abate sectors like steel, transport, refining, and energy storage, while also noting that despite rapid policy progress, challenges such as high costs, infrastructure gaps, supply chain development, and regulatory alignment remain significant barriers. Overall, green hydrogen is positioned as a future clean fuel with strong growth potential, but its success depends on technological advancements, coordinated policy support, and scaling of infrastructure and markets.

[Read more...](#)



JSW Energy Karnataka Hydrogen Project

JSW Energy Limited has developed its first and India's largest green hydrogen manufacturing plant in Karnataka, which will provide 3600 tonnes of H₂ annually to the DRI unit for low-carbon steel production. The plant operates on 25-27 MW renewable energy sourced from captive solar and wind assets utilizing an alkaline electrolyser. [Read More...](#)

INOX Air Products Chittorgarh Hydrogen Plant

INOX Air Products (INOXAP), announced the successful commissioning of its inaugural Green hydrogen manufacturing plant at Asahi India Glass Limited's (AIS) greenfield float glass facility at Soniyana in Chittorgarh, Rajasthan. Through the electrolysis process, this plant may produce up to 190 tonnes of green hydrogen annually. INOXAP is in charge of AIS facility's design, engineering, installation, operations, and ongoing supply of green hydrogen. AIS has made a investment in solar plant, which provides renewable energy for the production of Green hydrogen, which then will be used in AIS's float glass manufacturing process.

[Read More...](#)



NeuEN–Numaligarh Refinery Pilot

NeuEN Green Energy is a 50:50 joint venture between BPCL and Sembcorp Industries Ltd secured a contract to supply 10,000 tonnes per annum of green hydrogen to Numaligarh Refinery Ltd. (NRL).

NeuEN will establish a green hydrogen generation facility at NRL's refinery in Assam, with commercial operations planned in 2028. Sembcorp has a 7.6 GW renewable energy portfolio in India and is concentrating on expanding green hydrogen and its derivatives as part of its decarbonization plan.

[Read More...](#)

Hero Future Energies/ Rockman Industries Tirupati Hydrogen Plant

A new facility will combine PNG/LPG with green hydrogen for use in industrial furnaces. The recently opened facility combines green hydrogen blending with PNG/LPG for industrial furnace applications. This project represents a significant step toward industrial decarbonization. [Read More...](#)



NTPC Green Energy Chidambaranar Port Hydrogen Project

The Rs 3.87 crore prototype facility, with a capacity of 10 Nm³/h, will produce green hydrogen for local purposes like street lights and an EV charging station. With the addition of a 400 KW rooftop solar power plant, the port currently has the highest rooftop capacity of any Indian port, measuring 1.04 MW. [Read More...](#)



Spearheading the intersection of technological innovation and commercial viability

Hygenco is building a strategic partnership (Project Photon Leap) with Sterlite Technologies Limited (STL). The alliance will help in supplying green hydrogen to power STL's Glass Preform Plant in Aurangabad. The project is expected to use solar and wind-based renewable energy for hydrogen production, with a reduction of carbon emissions by approximately 30% annually. Other assignments undertaken by Hygenco are Project Steel One, with an aim to reduce CO₂ emissions by 2,700 t/yr. The produced hydrogen is planned to replace ammonia in Jindal Stainless's in-house annealing of stainless steel. [Read more...](#)



Indian start-up, Newtrace, develops advanced technologies for green hydrogen production

A climate-tech start-up, Newtrace, is developing and commercializing innovative electrolyzer systems that utilize renewable energy to create ultrapure hydrogen efficiently. Volatgen, a high-performance electrode technology developed by Newtrace is dimensionally and mechanically compatible with existing alkaline electrolyser stacks. The technology is designed in such a way that it increases the electrolyzers efficiency, resulting in increased hydrogen output per unit of electricity. Its accomplished task includes deployment of membrane-less electrolyzers with India's leading hydrogen producers, such as BPCL and ONGC. [Read more...](#)



From driving self-reliance (Atmanirbhar) to helping India in achieving Global Green Hydrogen Leadership, Greenzo Energy paves the way



The focus of the organization is to work and develop on technology related to electrolyzers and green hydrogen projects. It has marked a significant step in decarbonizing heavy industries by being awarded a prestigious 3 MW electrolyzer supply contract by Jindal Stainless Limited (JSL). The organization had accomplished in dispatching a 1 MW alkaline electrolyzer to Oswal Group. According to the latest information, the system is currently being commissioned and will be completely operational in 2025, allowing large-scale production of clean hydrogen. [Read more...](#)

With the plan of avoiding 1 billion tonnes of CO₂ emissions, Lhyfe aims to become a green unicorn



A premier European green hydrogen producer, Lhyfe, has achieved major milestones, including the world's first industrial-scale wind-connected plant (2021), the first offshore pilot project (2022), and rapid scaling with multiple operational sites in France and Germany. Its current plans include building production sites in Vaggeryd and Jordberga, supported by Sweden's Klimatklivet fund. These 10 MW projects would become Sweden's two largest green hydrogen production sites dedicated to the bulk market. Lhyfe has partnered with Swedish hydrogen specialist Euromekanik and Norwegian electrolyser manufacturer, Hystar, to complete this decisive FEED (Front-End Engineering Design) phase. [Read more...](#)

FUNDING OPPORTUNITIES

Under the National Mission, MECON Limited opened a significant call for Green Hydrogen Pilot Projects



The Ministry of New and Renewable Energy (MNRE) collaborated with the Ministry of Steel and issued a notable call for pilot projects using Green Hydrogen in hard-to-abate sectors such as Iron and Steel. The scheme is part of the National Green Hydrogen Mission, and the proposals have been invited through an Expression of Interest (EOI). MECON Limited has been selected as the implementing agency with a total remaining budget of around ₹290 crores. The key aspects of this call involve the production of 100% hydrogen-based Direct Reduced Iron (DRI), the use of hydrogen in blast furnaces to reduce coal consumption, and injecting hydrogen in a vertical shaft-based DRI making unit. The call was publicized on March 24, 2026, and the deadline for the bid submission was on April 8, 2026, at 3:00 PM IST. [Tender Link...](#)

India–Netherlands Hydrogen Fellowship Programme



The Department of Science and Technology (DST) has announced the India–Netherlands Hydrogen Fellowship Programme for Human and Technical Capacity Building. The programme will focus on strengthening the technical expertise and human capital needed for the expansion and execution of India's emerging hydrogen economy. This partnership also aligns with India's 2070 Net-Zero goals. Professionals from recognized Indian R&D Institutes and Universities (full-time, regular faculty members) and those with qualified approval from the University of Groningen can apply under the scheme. The application portal was opened on February 6, 2026, with the last date of submitting online only applications through the DST Online portal on April 10, 2026. [Proposal Link...](#)

Horizon Europe 2026 Call



The key priorities that are being addressed in the call (identified by the [Strategic Research Agenda](#)) includes different sectors of innovation and research. These preferences have direct or indirect impact towards the achievement of the objectives of the Clean Hydrogen JU. The total budget for the Call for Proposals is estimated to be EUR 105 million, including EUR 25 million allocated to the two Hydrogen Valleys topics. The topics are grouped into 2 Coordination and Support Action (CSA), 15 Research and Innovation Actions (RIA) and 4 Innovation Actions (IA). Lump sum grants are used to carry out the Call for Proposals 2026. The last date for the proposal submission is 15 April 2026, 17:00 (CEST). [Proposal Link...](#)