TROY TECHNICAL

HYDROGEN ENERGY
WEEKLY REPORT

October 31 - November 6, 2026 | Issue 2026-W44

Delivered hydrogen economics, infrastructure readiness and bankable demand

13	10
ANALYZED ARTICLES	PRIORITY THEMES

Issued 2026-11-06 | English edition | fixed approved cover artwork



Hydrogen Energy: the boundary moved from isolated claims to qualification evidence

13 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | POWER & FEEDSTOCK

Alkaline Electrolysis: LUT University 1,000 V System Cost Analysis

Researchers at LUT University have achieved a record 1,000 V in a series-connected alkaline electrolysis system to reduce total investment costs by 10-15%.

SIGNAL 02 | PRODUCTION

Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap

Kawasaki Heavy Industries has begun developing liquid hydrogen loading arms with diameters of at least 12 inches, targeting a commercial launch in fiscal 2033.

SIGNAL 03 | STORAGE & TRANSPORT

Hydrogen Storage and Production: LCOHS and Industry Updates 2026

Australian researchers found that hydrogen turbines can reduce the levelized cost of hydrogen storage (LCOHS) to approximately $0.62/kg under specific geological conditions.

SIGNAL 04 | END USE

Envision Green Ammonia: First VLAC Bunkering and Value Chain

Envision has successfully supplied certified green ammonia for the bunkering of the Terra Clove, the world's first Very Large Ammonia Carrier (VLAC) featuring dual-fuel ammonia propulsion.

DECISION

Focus this week's management attention on delivered hydrogen economics, infrastructure readiness and bankable demand. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: compare projects by contracted demand, energy source, conversion loss, logistics and policy support.
2. Suppliers: tie materials and equipment performance to uptime, safety, maintenance and delivered cost.
3. Executives: track offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Five numbers or evidence anchors that require conditions

15%
A01

SOURCE-BOUND CONDITION
Researchers at LUT University have achieved a record 1,000 V in a series-connected alkaline electrolysis system to reduce total investment costs by 10-15%.

100%
A12

SOURCE-BOUND CONDITION
Nippon Steel has successfully produced over 1,000t of direct reduced iron (DRI) using 100% hydrogen and low-grade iron ore.

80 hours
A04

SOURCE-BOUND CONDITION
The material demonstrated stable performance for 80 hours in simulated seawater, offering a lower-energy, cost-effective alternative to catalysts relying on rare metals.

83.09%
A07

SOURCE-BOUND CONDITION
The catalyst achieved a Faradaic efficiency of 83.09% at 1.60 V, demonstrating a pathway for high-value chemical upcycling from plastic waste.

57%
A10

SOURCE-BOUND CONDITION
The engine features a 57% increase in volumetric power density and a lifetime exceeding 25,000 operating hours to reduce lifecycle costs for transit operators.

HOW TO USE THESE NUMBERS
Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Power & feedstock

P01/P06

Researchers at LUT University have achieved a record 1,000 V in a series-connected alkaline electrolysis system to reduce.

2

Production

P02/P07

Kawasaki Heavy Industries has begun developing liquid hydrogen loading arms with diameters of at least 12 inches, targeting a.

3

Storage & transport

P03/P08

Australian researchers found that hydrogen turbines can reduce the levelized cost of hydrogen storage (LCOHS) to.

4

End use

P04/P09

Envision has successfully supplied certified green ammonia for the bunkering of the Terra Clove, the world's first Very Large.

5

Market & policy

P05/P10

Nippon Steel has successfully produced over 1,000t of direct reduced iron (DRI) using 100% hydrogen and low-grade iron ore.

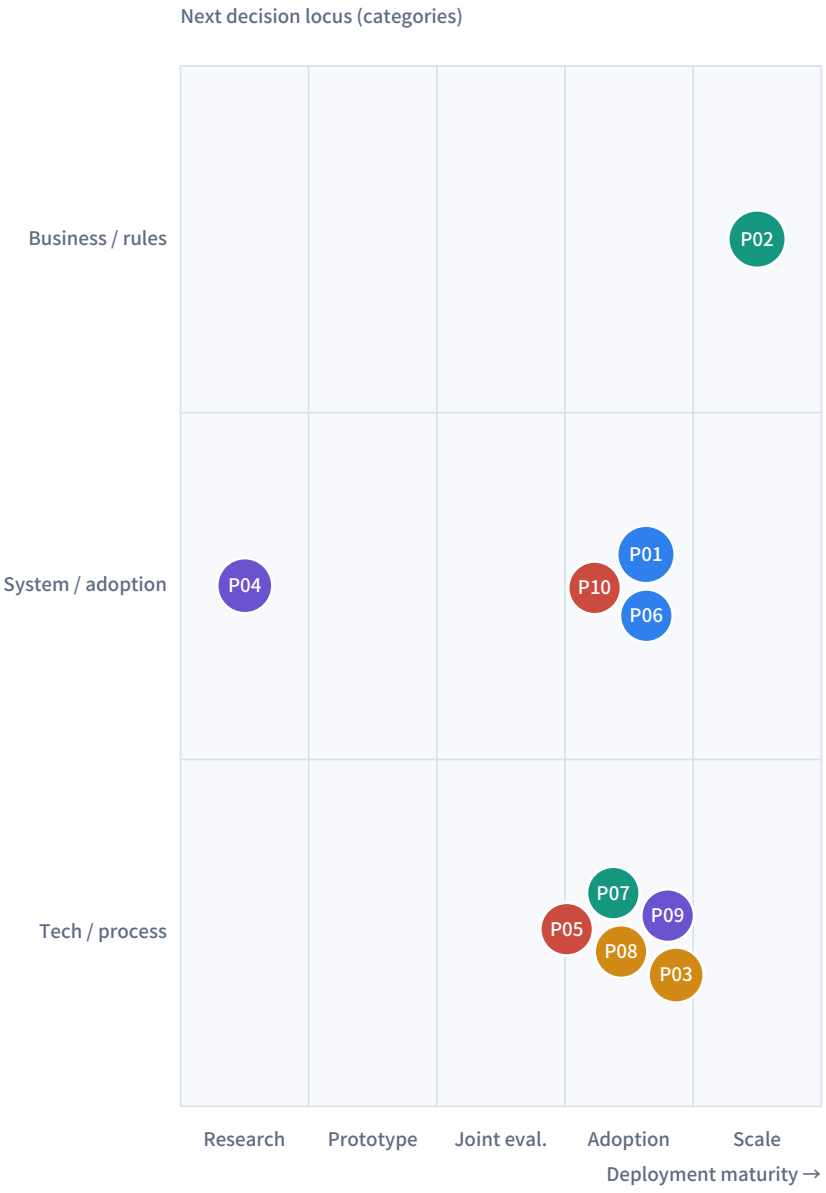
EVIDENCE REQUIRED AT EACH HANDOFF

Power & feedstock to Production	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck offtake, power price, efficiency, utilization, permitting, transport and subsidy.
Production to Storage & transport	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck offtake, power price, efficiency, utilization, permitting, transport and subsidy.
Storage & transport to End use	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck offtake, power price, efficiency, utilization, permitting, transport and subsidy.
End use to Market & policy	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck offtake, power price, efficiency, utilization, permitting, transport and subsidy.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented offtake, power price, efficiency, utilization, permitting, transport and subsidy.

Priority map: maturity and next decision locus



P01	Alkaline Electrolysis: LUT University 1,000 V System Cost Analysis System / adoption | cue: System
P02	Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap Business / rules | cue: capacity
P03	Hydrogen Storage and Production: LCOHS and Industry Updates 2026 Tech / process | cue: no system/business cue
P04	Envision Green Ammonia: First VLAC Bunkering and Value Chain System / adoption | cue: application
P05	Nippon Steel: 100% Hydrogen-Based DRI Production Timeline Tech / process | cue: no system/business cue
P06	QDMP-PVA-MeNPBI AEM: High-Conductivity Specs for AEMWE System / adoption | cue: commercial
P07	Mitsui Kinzoku MOF Glass: Hydrogen Production at 170°C Specs Tech / process | cue: no system/business cue
P08	University of Sharjah Catalyst: Seawater Hydrogen Production Specs Tech / process | cue: no system/business cue
P09	Ir/NiSe Catalyst: PET Waste to Formate and Hydrogen Production Tech / process | cue: no system/business cue
P10	Ballard FCmove®-SC: Specs and Solaris Urbino 12 Bus Integration System / adoption | cue: Integration

REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems). Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01 Alkaline Electrolysis: LUT University 1,000 V System Cost Analysis

A01 | Power & feedstock | Product adoption

2026-11-02

FACT

Researchers at LUT University have achieved a record 1,000 V in a series-connected alkaline electrolysis system to reduce total investment costs by 10-15%. By lowering current requirements and electrical losses, the system targets the power electronics segment which typically represents one-quarter of plant investment costs.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 22/25 | MATURITY 4/5 | DECISION LOCUS: SYSTEM / ADOPTION

P02 Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap

A13 | Production | Scale-up

2026-11-04

FACT

Kawasaki Heavy Industries has begun developing liquid hydrogen loading arms with diameters of at least 12 inches, targeting a commercial launch in fiscal 2033. The equipment is designed to provide approximately four times the handling capacity of 6-inch models to support larger-scale maritime hydrogen supply chains.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 22/25 | MATURITY 5/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03 Hydrogen Storage and Production: LCOHS and Industry Updates 2026

A02 | Storage & transport | Product adoption

2026-11-06

FACT

Australian researchers found that hydrogen turbines can reduce the levelized cost of hydrogen storage (LCOHS) to approximately $0.62/kg under specific geological conditions. Meanwhile, global industry activity shows a mix of significant project exits by Air Products and strategic expansions in Germany, Denmark, and Japan.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 21/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P04 Envision Green Ammonia: First VLAC Bunkering and Value Chain

A11 | End use | Research

2026-11-03

FACT

Envision has successfully supplied certified green ammonia for the bunkering of the Terra Clove, the world's first Very Large Ammonia Carrier (VLAC) featuring dual-fuel ammonia propulsion. This achievement connects the full value chain from renewable hydrogen synthesis to large-scale marine application. The milestone demonstrates the scalability of green ammonia as a viable fuel for maritime decarbonization.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 21/25 | MATURITY 1/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05 Nippon Steel: 100% Hydrogen-Based DRI Production Timeline

A12 | Market & policy | Product adoption

2026-11-04

FACT

Nippon Steel has successfully produced over 1,000t of direct reduced iron (DRI) using 100% hydrogen and low-grade iron ore. This achievement demonstrates a viable path toward decarbonizing steel production by utilizing abundant low-grade ores and eliminating CO2 emissions from the reduction process.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P06 QDMP-PVA-MeNPBI AEM: High-Conductivity Specs for AEMWE

A09 | Power & feedstock | Product adoption

2026-11-03

FACT

Researchers have developed a crosslinked-grafted-blended polybenzimidazole membrane (QDMP-PVA-MeNPBI) that achieves a hydroxide ion conductivity of 150.3 mS·cm-1. This material significantly outperforms commercial FAA-3 membranes in both ionic conductivity and current density, offering enhanced stability for hydrogen production via water electrolysis.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: SYSTEM / ADOPTION

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07 Mitsui Kinzoku MOF Glass: Hydrogen Production at 170°C Specs

A05 | Production | Product adoption

2026-11-05

FACT

Mitsui Kinzoku and Kyoto University have demonstrated hydrogen production via water electrolysis using steam at 170°C. This was achieved through a newly developed proton-conducting MOF glass composite membrane designed for the 150-250°C temperature range. The technology enables the utilization of industrial waste heat and steam for hydrogen generation.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P08 University of Sharjah Catalyst: Seawater Hydrogen Production Specs

A04 | Storage & transport | Product adoption

2026-10-31

FACT

Researchers at the University of Sharjah have developed a corrosion-resistant catalyst composed of nickel hydroxide, cerium oxide, and phosphate for direct seawater electrolysis. The material demonstrated stable performance for 80 hours in simulated seawater, offering a lower-energy, cost-effective alternative to catalysts relying on rare metals.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09 Ir/NiSe Catalyst: PET Waste to Formate and Hydrogen Production

A07 | End use | Product adoption

2026-11-06

FACT

Researchers at Gyeongsang National University developed an Ir/NiSe electrochemical catalyst that converts ethylene glycol from waste PET into formate and hydrogen. The catalyst achieved a Faradaic efficiency of 83.09% at 1.60 V, demonstrating a pathway for high-value chemical upcycling from plastic waste.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: TECH / PROCESS

P10 Ballard FCmove®-SC: Specs and Solaris Urbino 12 Bus Integration

A10 | Market & policy | Product adoption

2026-11-05

FACT

Ballard Power Systems has integrated its FCmove®-SC fuel cell engine into the series-production of the next-generation Solaris Urbino 12 hydrogen bus. The engine features a 57% increase in volumetric power density and a lifetime exceeding 25,000 operating hours to reduce lifecycle costs for transit operators.

WHY IT MATTERS

The decision relevance is delivered hydrogen economics, infrastructure readiness and bankable demand. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, tie materials and equipment performance to uptime, safety, maintenance and delivered cost.

ACTION

Within 30 days, compare projects by contracted demand, energy source, conversion loss, logistics and policy support; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: offtake, power price, efficiency, utilization, permitting, transport and subsidy.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: SYSTEM / ADOPTION

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW | 0-30 DAYS	NEXT | 1-12 MONTHS	LATER | 1-5 YEARS
Operating companies	compare projects by contracted demand, energy source, conversion loss, logistics and policy support	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	tie materials and equipment performance to uptime, safety, maintenance and delivered cost	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map offtake, power price, efficiency, utilization, permitting, transport and subsidy.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW | 0-30 DAYS
Evidence ledger
Owner: Strategy + quality
Deliverable: claim, source, condition, owner

NOW | 0-30 DAYS
Risk screen
Owner: Procurement + legal
Deliverable: unknowns, alternatives, stop

NEXT | 1-12 MONTHS
Joint qualification
Owner: R&D + supplier
Deliverable: process window and failure data

NEXT | 1-12 MONTHS
Commercial gate
Owner: Business + finance
Deliverable: unit economics and capacity

LATER | 1-5 YEARS
Platform strategy
Owner: Executive team
Deliverable: portfolio and interface roadmap

LATER | 1-5 YEARS
Service layer
Owner: Operations + channel
Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	**Quality**	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	**R&D**	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	**Business**	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	**Operations**	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-13

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	Alkaline Electrolysis: LUT University 1,000 V System Cost Analysis	https://www.pv-magazine-india.com/2026/11/02/the-hydrogen-stream-finnish-researchers-increase-voltage-in-alkaline-systems-to-cut-costs-by-10-15/
A02	Hydrogen Storage and Production: LCOHS and Industry Updates 2026	https://www.pv-magazine.com/2026/11/06/the-hydrogen-stream-h2-turbines-can-push-lcohs-to-around-0-62-kg/
A03	IBS Platinum Catalyst: 63% Reduction in Pt Use for Hydrogen	https://biz.heraldcorp.com/article/10922985
A04	University of Sharjah Catalyst: Seawater Hydrogen Production Specs	https://igrownews.com/university-of-sharjah-latest-news/
A05	Mitsui Kinzoku MOF Glass: Hydrogen Production at 170°C Specs	https://jp.ibtimes.com/mitsui-kinzoku-demonstrates-hydrogen-production-170c-mof-glass-105126
A06	Cr(OH)x-Pt/GaN Catalyst: Neutral Seawater Hydrogen Production Specs	https://bioengineer.org/triple-interface-catalyst-pumps-hydrogen-fast-in-neutral-seawater/
A07	Ir/NiSe Catalyst: PET Waste to Formate and Hydrogen Production	https://www.cnbnews.com/news/articleView.html?idxno=1022736
A08	Zinc-Based Hydrogen Synthesis: Reversible Energy Carrier Specs	https://finance.sina.com.cn/tech/roll/2026-11-02/doc-inixhnmi2570174.shtml
A09	QDMP-PVA-MeNPBI AEM: High-Conductivity Specs for AEMWE	https://doi.org/10.21203/rs.3.rs-11324035/v1
A10	Ballard FCmove®-SC: Specs and Solaris Urbino 12 Bus Integration	https://www.prnewswire.com/news-releases/ballard-fcmove-sc-fuel-cell-engine-makes-series-production-debut-in-next-generation-solaris-urbino-12-hydrogen-bus-302930349.html
A11	Envision Green Ammonia: First VLAC Bunkering and Value Chain	https://www.adnkronos.com/immediapress/pr-newswire/envision-green-ammonia-successfully-fuels-the-worlds-first-vlac_1xCw86hTcjoruyGW7KWsRH
A12	Nippon Steel: 100% Hydrogen-Based DRI Production Timeline	https://news.mynavi.jp/techplus/article/20261104-5255319/
A13	Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap	https://jp.ibtimes.com/kawasaki-develops-12-inch-plus-liquid-hydrogen-loading-arms-105110

HydrogenEnergy — Selected Articles

Date: 2026-11-08

Articles: 13

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#07 Ir/NiSe Catalyst: PET Waste to Formate and Hydrogen Production

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#09 QDMP-PVA-MeNPBI AEM: High-Conductivity Specs for AEMWE

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#13 Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap

#01 Alkaline Electrolysis: LUT University 1,000 V System Cost Analysis

Published November 02, 2026 pv magazine India India



OVERVIEW

Researchers at LUT University have achieved a record 1,000 V in a series-connected alkaline electrolysis system to reduce total investment costs by 10-15%. By lowering current requirements and electrical losses, the system targets the power electronics segment which typically represents one-quarter of plant investment costs.

IN DEPTH

Key Findings

LUT University researchers have demonstrated a record voltage of 1,000 V in a series-connected alkaline electrolysis system. This increase in voltage is designed to reduce current requirements and electrical losses, thereby lowering the costs associated with power supply and power electronics. Because power electronics account for approximately one-quarter of a hydrogen plant's investment costs, halving these specific expenses could reduce total system investment by 10% to 15%.

Technical Details

The research utilized ABB power electronics and electrolyser stacks provided by Stargate Hydrogen, an Estonia-based company. This high-voltage approach contrasts with industrial alkaline electrolysers, which typically operate within a voltage range of 200–400 V. Future research will focus on the following areas to enable the scale-up of high-voltage electrolysis:

- Optimising system design and modelling.
- Minimising stray currents.

Global Hydrogen and Ammonia Infrastructure

Parallel developments in the hydrogen economy include a binding agreement between Japan’s Jera and India’s AM Green for the annual supply of approximately 70,000 metric tons of green ammonia over five years. Production is expected to begin in 2028-2029 at AM Green’s Kakinada facility, with the fuel intended for ammonia-powered car carriers. Additionally, the European Commission has launched the T-MED Investment Platform with up to €4.5 billion in guarantee capacity, supporting projects such as the Niat and Rasgha Wind Projects in Egypt to provide 500 MW of onshore wind for future hydrogen production.

Economic and Environmental Trade-offs

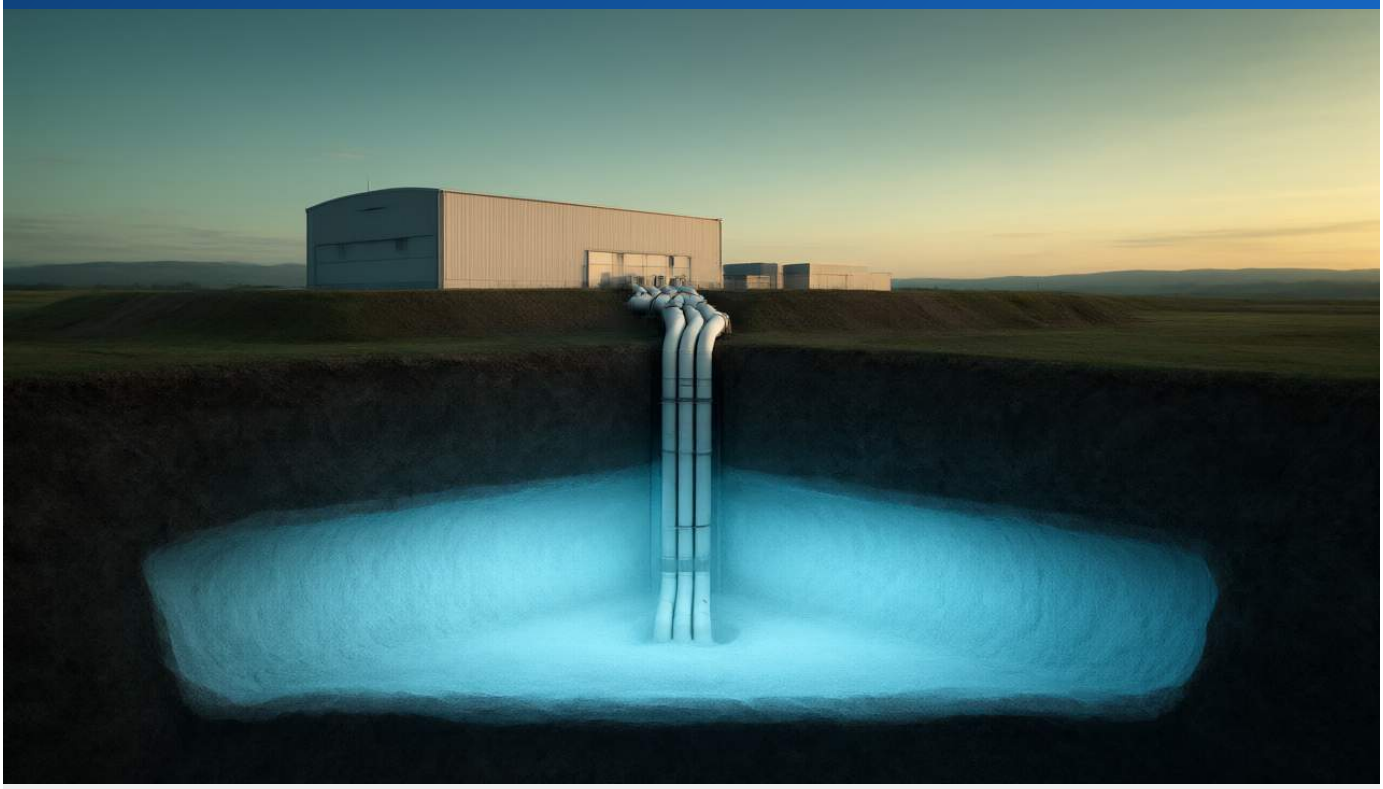
A study from the University of Trieste compared PEM water electrolysis (PEMWE) supply chains between Italy and Oman. The analysis found that importing hydrogen from Oman is more cost-effective, with a levelized cost of hydrogen (LCOH) of €7.84/kg compared to €10.22/kg for domestic Italian production. However, domestic production offers a lower carbon footprint (2.26 kg of CO_2 equivalent per kg) than imports (2.62 kg). Electrolysis was identified as the primary driver for both costs (74.4% of LCOH) and emissions (81% of the carbon footprint).

Source: https://www.pv-magazine-india.com/2026/11/02/the-hydrogen-stream-finnish-researchers-increase-voltage-in-alkaline-systems-to-cut-costs-by-10-15/

Collected: November 07, 2026 | Automated Research System (AI)

#02 Hydrogen Storage and Production: LCOHS and Industry Updates 2026

Published November 06, 2026 pv magazine USA



OVERVIEW

Australian researchers found that hydrogen turbines can reduce the levelized cost of hydrogen storage (LCOHS) to approximately $0.62/kg under specific geological conditions. Meanwhile, global industry activity shows a mix of significant project exits by Air Products and strategic expansions in Germany, Denmark, and Japan.

IN DEPTH

Key Findings

Hydrogen gas turbines may offer lower capital expenditure and a levelized cost of hydrogen storage (LCOHS) of around AUD 0.90/kg ($0.62/kg) compared to fuel cells when used as backup power during low solar availability. This finding stems from a feasibility assessment of solar-driven underground hydrogen storage (UHS) published in *Applied Energy*.

Technical Details of UHS Modeling

The research modeled an integrated system including hydrogen injection, geological storage, purification, and pipeline delivery. The LCOHS figure was achieved under the following modeled conditions:

- 10% porosity
- 50 mD permeability
- 30-year project lifetime
- 7% discount rate

The study noted that higher permeability improves recovery rates and injectivity but may increase compression and purification needs. Conversely, lower porosity can improve gas displacement but requires higher injection pressures and increases equipment costs.

Global Industry Developments

Corporate and governmental activities in the hydrogen sector show divergent trends:

- **Air Products:** Recorded pre-tax charges of approximately $3.2 billion in fiscal year 2026 due to project exits, including a clean energy complex in Louisiana and a green hydrogen facility in Casa Grande, Arizona.
- **Everfuel:** Signed a €245 million grant agreement with the German government for Project Frigg in Denmark, receiving production support of €0.98/kg of renewable hydrogen. The project is designed to scale up to 2 GW of electrolyzer capacity.

- **Germany:** Awarded contracts for 11 hydrogen-ready combined-cycle gas turbines (CCGTs) totaling 5.1 GW. RWE secured 2.1 GW in the first long-term capacity auction.
- **Nippon Steel:** Produced over 1,000 metric tons of direct reduced iron (DRI) using 100% hydrogen at its Hasaki Research and Development Center, operating for over 300 continuous hours.
- **Asahi Kasei and Power to Hydrogen (P2H2):** Signed an MoU to evaluate the commercialization and scale-up of anion exchange membrane (AEM) water electrolysis systems.

Significance and Outlook

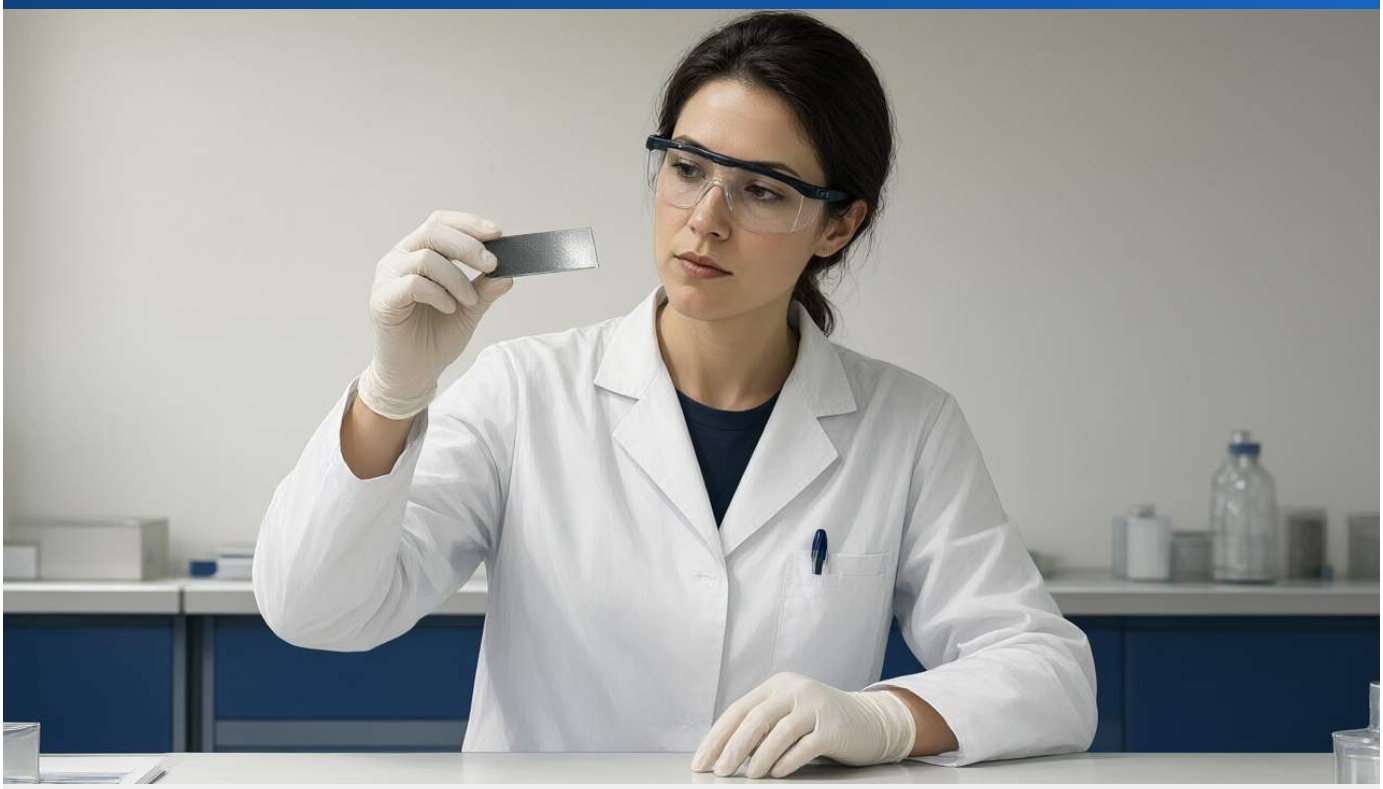
The optimization of integrated reservoir and surface systems is critical for making large-scale UHS commercially viable. While some developers face restructuring charges, the deployment of hydrogen-ready turbines in Germany and the advancement of AEM electrolysis and hydrogen-based iron reduction indicate a continued push toward industrial-scale integration.

Source: https://www.pv-magazine.com/2026/11/06/the-hydrogen-stream-h2-turbines-can-push-lcohs-to-around-0-62-kg/

Collected: November 07, 2026 | Automated Research System (AI)

#03 IBS Platinum Catalyst: 63% Reduction in Pt Use for Hydrogen

Published November 02, 2026 The Korea Herald (Herald Corp) South Korea



OVERVIEW

Researchers from the Institute for Basic Science (IBS) and partner universities have developed a high-density catalyst that reduces platinum use by 63% while improving durability. By utilizing a reticular coordination strategy, the team achieved a platinum content of 14.9% with atomic-level dispersion, significantly lowering voltage degradation in water electrolysis.

IN DEPTH

Key Findings

A joint research team led by the Institute for Basic Science (IBS) has synthesized a next-generation catalyst that reduces platinum (Pt) consumption by 63% compared to conventional commercial catalysts. When applied to a proton exchange membrane water electrolysis device, the catalyst operated stably for 500 hours. Notably, the rate of voltage increase—a primary indicator of performance degradation—was reduced to approximately one-quarter of the rate seen in commercial alternatives.

Technical Details

The team employed a "reticular coordination" strategy to overcome the limitations of single-atom catalysts, which typically require platinum content to remain below 1% to prevent atomic clustering. The process involves the following steps:

- **Pre-design:** Using metal-organic frameworks to fix individual platinum atoms into a cerium-oxygen lattice.
- **Conversion:** Applying heat treatment to convert the structure into ceria (cerium oxide).
- **Composition:** This method resulted in a high-density catalyst with 14.9% platinum content dispersed at the atomic level.

The catalyst demonstrated high thermal stability, suppressing particle growth even after treatment at 300 to 500 degrees Celsius in a hydrogen environment, due to strong bonding between the platinum and the ceria substrate.

Background and Context

Platinum is essential for hydrogen production and automotive exhaust purification due to its high performance, but its high cost limits economic viability. While single-atom catalysts aim to reduce costs, increasing the metal content usually leads to clustering, which degrades both stability and efficiency.

Significance and Outlook

The research, published in *Nature Synthesis* on October 22, suggests applications beyond hydrogen production, including chemical feedstock production and automotive exhaust purification. The team plans to apply this synthesis strategy to other precious metals, such as rhodium and iridium, and test its efficacy in high-temperature environments like three-way catalytic converters and dry methane reforming.

Source: https://biz.heraldcorp.com/article/10922985

Collected: November 07, 2026 | Automated Research System (AI)

#04 University of Sharjah Catalyst: Seawater Hydrogen Production Specs

Published October 31, 2026　iGrow News　アラブ首長国連邦



OVERVIEW

Researchers at the University of Sharjah have developed a corrosion-resistant catalyst composed of nickel hydroxide, cerium oxide, and phosphate for direct seawater electrolysis. The material demonstrated stable performance for 80 hours in simulated seawater, offering a lower-energy, cost-effective alternative to catalysts relying on rare metals.

IN DEPTH

Key Findings

A research team at the University of Sharjah has developed a catalyst capable of splitting seawater into hydrogen and oxygen with increased corrosion resistance and lower energy requirements. In stress tests using simulated seawater, the catalyst operated at high output for approximately 80 hours without loss of performance. The findings were published in the journal Chemical Communications and publicized by the university on October 26, 2026.

Technical Details

The catalyst utilizes a combination of three relatively inexpensive and widely available materials: nickel hydroxide, cerium oxide, and phosphate. This composition avoids the use of rare and costly metals such as iridium or platinum. Technical advantages include:

- **Structural Morphology:** The material forms small, tightly packed, pyramid-shaped nanostructures, providing a larger active surface area compared to plain nickel hydroxide.
- **Selectivity:** The addition of cerium oxide and phosphate makes the catalyst more selective for oxygen evolution, reducing the production of toxic chlorine and other byproducts caused by chloride ions.
- **Durability:** The combined system exhibits significantly less corrosion than versions lacking either cerium oxide or phosphate.

Background and Context

Standard water electrolysis typically requires purified water, which is costly to produce and scarce in many regions. While seawater is abundant, chloride ions typically degrade metal catalysts and interfere with the oxygen-evolution reaction. This research addresses the practical bottleneck of using untreated or lightly treated seawater to avoid the infrastructure burden of desalination.

Significance and Outlook

The use of abundant materials makes this catalyst more realistic for industrial-scale manufacturing than many current alternatives. While Dr. Tanveer Ul Haq notes that 80 hours of stability is short of industrial requirements and the technology is not yet a commercial product, it serves as a documented step toward scalable green hydrogen production. Such a development is particularly relevant for coastal industrial facilities and island nations seeking to decarbonize sectors like shipping, steelmaking, and heavy trucking using renewable electricity.

Source: https://igrownews.com/university-of-sharjah-latest-news/

Collected: November 07, 2026 | Automated Research System (AI)

#05 Mitsui Kinzoku MOF Glass: Hydrogen Production at 170°C Specs

Published November 05, 2026 IBTimes Japan Japan



OVERVIEW

Mitsui Kinzoku and Kyoto University have demonstrated hydrogen production via water electrolysis using steam at 170°C. This was achieved through a newly developed proton-conducting MOF glass composite membrane designed for the 150–250°C temperature range. The technology enables the utilization of industrial waste heat and steam for hydrogen generation.

IN DEPTH

Key Findings

Mitsui Kinzoku and Kyoto University have successfully demonstrated hydrogen production through water electrolysis using steam at 170°C. The researchers developed a proton-conducting glass membrane based on metal-organic frameworks (MOFs) to facilitate this process. This achievement addresses a critical gap in electrolyte materials capable of operating within an intermediate temperature range of approximately 150–250°C.

Technical Details

The developed material is a proton-conducting MOF glass composite membrane. MOFs are porous materials consisting of organic molecules and metal ions. In the electrolysis process, protons (hydrogen ions formed when hydrogen atoms lose electrons) derived from water pass through this electrolyte membrane to be converted into hydrogen. The research specifically focuses on the electrolyte component of the production system rather than the entire system architecture.

Background and Context

The project was conducted through Co-Mit Lab, a co-creation materials research program established at Kyoto University's Graduate School of Science in April 2026. The research team included Professor Satoshi Horike from the Graduate School of Science. The findings were published in the Journal of the American Chemical Society on October 21, 2026, and officially announced by the company on November 5, 2026.

Significance and Outlook

The primary application for this technology is the production of hydrogen using industrial steam and waste heat generated at industrial sites, as the membrane functions in a temperature range relevant to these resources. Beyond water electrolysis, the company identifies the following potential applications:

- Fuel cells
- Other energy-conversion technologies

Because MOF glass is suitable for shaping and processing and can incorporate various functional molecules, there is significant scope for adapting the material to diverse technical uses.

Source: https://jp.ibtimes.com/mitsui-kinzoku-demonstrates-hydrogen-production-170c-mof-glass-105126

Collected: November 07, 2026 | Automated Research System (AI)

#06 Cr(OH)x–Pt/GaN Catalyst: Neutral Seawater Hydrogen Production Specs

Published November 04, 2026 BIOENGINEER.ORG USA



OVERVIEW

A triple-interface catalyst architecture enables fast hydrogen pumping in neutral seawater, achieving a photocurrent density of approximately 100 milliamperes per square centimetre under concentrated sunlight. This design overcomes reaction kinetics bottlenecks by spatially separating water activation and hydrogen transfer, marking a step toward practical solar-driven ocean hydrogen production.

IN DEPTH

Key Findings

A research team led by Zetian Mi has developed a photocathode using atomically dispersed chromium hydroxide clusters on platinum-decorated gallium nitride (GaN) nanowires for the photoelectrochemical splitting of neutral seawater. Under concentrated sunlight and neutral saline conditions, the catalyst delivered a photocurrent density of around 100 milliamperes per square centimetre at 0 volts versus the reversible hydrogen electrode, maintaining operation for over 50 hours.

Technical Details

The system utilizes a triple-interface architecture defined as Cr(OH)x–Pt//Cr(OH)x–GaN//Pt–GaN. Unlike conventional single-interface systems, this design couples water activation, hydrogen transfer, and platinum–hydrogen formation across adjacent interfaces. The subnanometre scale of the atomically dispersed chromium hydroxide species allows hydrogen intermediates to be handed off efficiently between the platinum and gallium nitride surfaces.

The team also tested a hydrazine-assisted seawater photoelectrolyser. In this configuration, a chemical oxidant at the anode side reduces energetic demands, allowing the photocathode to reach a bias-free photocurrent density of roughly 70 milliamperes per square centimetre.

Background & Context

Hydrogen production from neutral water is typically hindered by sluggish reaction kinetics caused by limited hydrogen supply and transfer to active sites. While the reported figures are significant, the 70 milliampere result reflects an assisted process rather than a fully spontaneous one because hydrazine acts as an energy carrier. Additionally, the 50-hour stability period is substantial for neutral saline environments but remains below the multi-year lifetimes required for commercial deployment.

Significance & Outlook

This research, published in Nature Synthesis on 30 October 2026, shifts the focus of catalyst design from discovering new elements to solving architectural problems of spacing and sequencing interfaces. This "hydrogen-pumping" motif provides a design principle applicable to other semiconductor and catalyst combinations. The next critical test will be whether this architecture can be scaled from laboratory-scale nanowire arrays to full-size photoelectrochemical stacks.

Source: https://bioengineer.org/triple-interface-catalyst-pumps-hydrogen-fast-in-neutral-seawater/

Collected: November 07, 2026 | Automated Research System (AI)

#07 Ir/NiSe Catalyst: PET Waste to Formate and Hydrogen Production

Published November 06, 2026 CNB뉴스 South Korea



OVERVIEW

Researchers at Gyeongsang National University developed an Ir/NiSe electrochemical catalyst that converts ethylene glycol from waste PET into formate and hydrogen. The catalyst achieved a Faradaic efficiency of 83.09% at 1.60 V, demonstrating a pathway for high-value chemical upcycling from plastic waste.

IN DEPTH

Key Findings

A research team led by Professor Myung-Ryong Choi at Gyeongsang National University has developed an electrochemical catalyst capable of efficiently converting ethylene glycol—a byproduct of waste plastic decomposition—into formate while simultaneously producing hydrogen. Using the developed catalyst, the team recorded a Faradaic efficiency of 83.09% and a formate production rate of 1248 μmol cm^{-2} h^{-1} at 1.60 V, outperforming existing nickel selenide catalysts.

Technical Details

The catalyst (Ir/NiSe) was synthesized using the Liquid Pulse Laser Irradiation (PLIL) method to create nickel selenide (NiSe), followed by the atomic-level dispersion of iridium (Ir) bonded with selenium (Se) into the nickel sites. The electron-withdrawing properties of iridium alter the electronic structure of the surrounding nickel, which promotes the generation of nickel oxyhydroxide (NiOOH), the active substance that facilitates the electrochemical oxidation of ethylene glycol.

The research team identified the primary reaction pathway: ethylene glycol undergoes double adsorption onto the catalyst, converting into glyoxal as an intermediate before finally becoming formate. Furthermore, the team established an electrochemical system combining ethylene glycol oxidation with a hydrogen evolution reaction to produce both formate and hydrogen. They also successfully recovered terephthalic acid (TPA) and potassium diformate (KDF) from the waste PET decomposition liquid.

Background & Context

Polyethylene terephthalate (PET), commonly used in plastic bottles and fibers, can be decomposed to obtain ethylene glycol. As environmental pollution from plastics increases, there is a growing need for resource recovery technologies that transform waste into useful industrial chemical raw materials rather than simple recycling.

Significance & Outlook

This research demonstrates the technical possibility of linking waste plastic recycling to the production of energy and high-value chemicals. The results were published online on August 20 in the journal *Angewandte Chemie International Edition* (IF 17.6). The project was funded by the Ministry of Education's Basic Science Research Capacity Strengthening Program with support from the National Research Facilities and Equipment Center (NFEC) of the Korea Basic Science Institute (KBSI).

Source: https://www.cnbnews.com/news/articleView.html?idxno=1022736

Collected: November 07, 2026 | Automated Research System (AI)

#08 Zinc-Based Hydrogen Synthesis: Reversible Energy Carrier Specs

Published November 02, 2026 新浪科技（中国科学报） China



OVERVIEW

Researchers at Tsinghua University's Shenzhen International Graduate School have developed a reversible energy carrier system that redefines metal zinc as a hydrogen storage medium. The system achieves a volumetric hydrogen capacity of 137.9 to 218.4 kg/m³ using a self-driven contact catalysis architecture.

IN DEPTH

Key Findings

A research team led by Associate Professor Zhou Guangmin has proposed a new path for hydrogen synthesis using a reversible energy carrier. By redefining metal zinc—commonly used in aqueous battery energy storage—as a "hydrogen storage carrier," the team developed a zinc-based hydrogen supply system. The system demonstrates a volumetric hydrogen capacity ranging from 137.9 to 218.4 kg/m³, a figure that exceeds liquid hydrogen and most existing hydrogen storage systems.

Technical Details

The team utilized a machine learning-assisted screening strategy to evaluate a ligand library of 874 candidate molecules. Combined with density functional theory calculations, lactate was identified as the critical ligand. In alkaline media, lactate coordinates with divalent zinc ions produced during the reaction to form highly soluble complexes. This mechanism overcomes the solubility limits caused by zinc oxide formation, increasing the concentration of soluble divalent zinc ions to 1.12 mol/L.

The hardware consists of a "no external circuit + self-driven" contact catalysis system. Internal electron transfer occurs between the zinc fuel and the hydrogen evolution catalyst layer via the container wall, eliminating the need for external power sources, wires, or complex battery management systems. The system operates stably between 0 and 80°C with a Faradaic efficiency of 99%.

Background and Context

The scale-up of green hydrogen is currently hindered by storage and transport bottlenecks. Traditional high-pressure gaseous storage presents safety risks, while low-temperature liquid storage involves high energy consumption and evaporation losses. Liquid organic hydrogen carriers offer advantages at ambient temperature and pressure, but their dehydrogenation typically requires high temperatures and is prone to side reactions.

Significance and Outlook

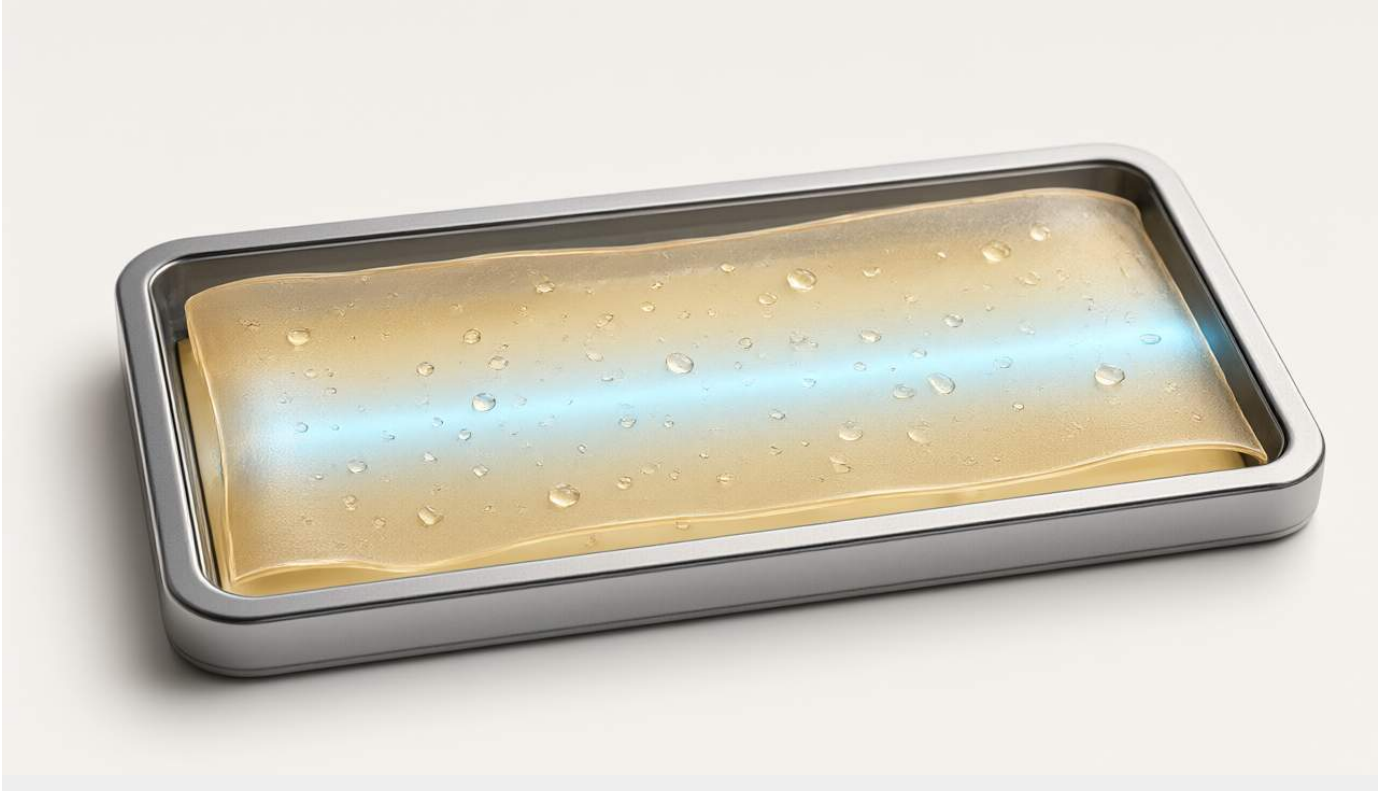
This solid-state zinc carrier system proves the scientific feasibility of high-density, on-demand hydrogen supply at ambient temperature and pressure. The modular nature of the system allows for scale expansion through series connection, making it suitable for distributed hydrogen supply in fuel cell vehicles, portable power sources, and remote microgrids. The findings provide a new benchmark for balancing energy density and system complexity compared to ammonia-based or liquid organic hydrogen carriers.

Source: https://finance.sina.com.cn/tech/roll/2026-11-02/doc-inixhnmi2570174.shtml

Collected: November 07, 2026 | Automated Research System (AI)

#09 QDMP-PVA-MeNPBI AEM: High-Conductivity Specs for AEMWE

Published November 03, 2026　Research Square（プレプリント）



OVERVIEW

Researchers have developed a crosslinked-grafted-blended polybenzimidazole membrane (QDMP-PVA-MeNPBI) that achieves a hydroxide ion conductivity of 150.3 $mS \cdot cm^{-1}$. This material significantly outperforms commercial FAA-3 membranes in both ionic conductivity and current density, offering enhanced stability for hydrogen production via water electrolysis.

IN DEPTH

Key Findings

The QDMP-PVA-MeNPBI membrane demonstrates a peak hydroxide ion conductivity of 150.3 $mS \cdot cm^{-1}$, which is 1.79 times higher than the 84.0 $mS \cdot cm^{-1}$ recorded for the commercial FAA-3 membrane and significantly higher than the 91.3 $mS \cdot cm^{-1}$ of the pristine MeNPBI membrane. In water electrolysis applications at 2.10V, the QDMP-PVA-MeNPBI membrane delivered a current density of 3.37 $A \cdot cm^{-2}$, four times the 0.84 $A \cdot cm^{-2}$ achieved by the FAA-3 membrane.

Technical Details

The membrane was developed through a multi-step chemical process:

- **Grafting:** Methyl groups were grafted onto the pyrrole and pyridine nitrogen atoms of Poly[2,2′-(1,4-naphthalene)-5,5′-bibenzimidazole] (NPBI) to create MeNPBI, improving solubility and ionic conductivity.
- **Blending:** MeNPBI was mixed with polyvinyl alcohol (PVA) at various molar ratios. The PVA-MeNPBI-4:1 configuration specifically showed a hydroxide ion conductivity of 138.2 $mS \cdot cm^{-1}$.
- **Crosslinking:** A cationic crosslinker, 3-Hexyl spacers N,N-Dimethylpiperidinium cations (QDMP), was introduced via the Menshutkin reaction to produce the final QDMP-PVA-MeNPBI AEM.

Mechanical testing showed the resulting membrane possesses a tensile strength of 57.1 MPa and an elongation at break of 63.4%.

Background and Context

Anion exchange membranes (AEMs) are critical components in anion exchange membrane water electrolysis (AEMWE). The efficiency and operational lifetime of hydrogen production electrolyzers depend heavily on the membrane's ability to maintain high ionic conductivity and mechanical stability under harsh alkaline conditions.

Significance and Outlook

The QDMP-PVA-MeNPBI membrane exhibits high chemical durability, retaining 92.4% of its initial conductivity after immersion in 1 M KOH at 80°C for 500 hours. These combined improvements in ion exchange capacity, mechanical stability, and current density indicate significant potential for the application of this material in industrial-scale AEMWE for hydrogen production.

Source: https://doi.org/10.21203/rs.3.rs-11324035/v1

Collected: November 07, 2026 | Automated Research System (AI)

#10 Ballard FCmove®-SC: Specs and Solaris Urbino 12 Bus Integration

Published November 05, 2026 Ballard Power Systems (PR Newswire) Canada



OVERVIEW

Ballard Power Systems has integrated its FCmove®-SC fuel cell engine into the series-production of the next-generation Solaris Urbino 12 hydrogen bus. The engine features a 57% increase in volumetric power density and a lifetime exceeding 25,000 operating hours to reduce lifecycle costs for transit operators.

IN DEPTH

Key Findings

The FCmove®-SC fuel cell engine has made its series-production debut in the Solaris Urbino 12 hydrogen transit bus. This integration is the result of an extended long-term supply agreement between Ballard Power Systems and Solaris, focusing on a compact architecture designed for city transit duty cycles to improve vehicle integration and reduce operational costs.

Technical Details

The FCmove®-SC provides up to 80kW of rated power with a peak efficiency of 57%. Technical improvements over previous iterations include:

- **Power Density:** A 57% increase in volumetric power density achieved through integrated DC/DC packaging.
- **Integration:** An internal power controller and DC/DC converter reduce external interfaces.
- **Thermal Management:** Maximum radiator outlet temperature has been increased from 60°C to 75°C, allowing for reduced cooling requirements and better use of waste heat for cabin heating.
- **Maintenance:** A 40% reduction in total part count to simplify servicing.
- **Durability and Safety:** A specified lifetime exceeding 25,000 operating hours, freeze-start capability down to −30°C, and revised internal stack-enclosure geometry for passive hydrogen-related risk protection.

In the Solaris Urbino 12, the fuel cell acts as the primary energy source for a centrally mounted traction motor, supported by a traction battery for peak demand and regenerative braking energy storage.

Background & Context

Ballard has supplied fuel cell engines for over 2,500 buses globally, with total operations exceeding 300 million kilometres. To support these fleets, Ballard provides Fleet360°, a service offering that includes remote performance monitoring, data analytics, and maintenance planning.

Significance & Outlook

The new vehicle architecture removes the conventional engine tower to increase rear seating capacity and utilizes roof-mounted components to improve service access. By combining the FCmove®-SC with integrated Energy-as-a-Service solutions—including hydrogen production and refuelling—Ballard aims to lower the barrier for public transit operators to deploy zero-emission fleets at scale.

Source: https://www.prnewswire.com/news-releases/ballard-fcmove-sc-fuel-cell-engine-makes-series-production-debut-in-next-generation-solaris-urbino-12-hydrogen-bus-302930349.html

Collected: November 07, 2026 | Automated Research System (AI)

#11 Envision Green Ammonia: First VLAC Bunkering and Value Chain

Published November 03, 2026 Envision (PR Newswire / Adnkronos) China



OVERVIEW

Envision has successfully supplied certified green ammonia for the bunkering of the Terra Clove, the world's first Very Large Ammonia Carrier (VLAC) featuring dual-fuel ammonia propulsion. This achievement connects the full value chain from renewable hydrogen synthesis to large-scale marine application. The milestone demonstrates the scalability of green ammonia as a viable fuel for maritime decarbonization.

IN DEPTH

Key Findings

Envision has completed the bunkering of the Terra Clove, the first Very Large Ammonia Carrier (VLAC) equipped with dual-fuel ammonia propulsion. This operation marks the first time a green ammonia value chain has been fully integrated from production and transportation to downstream marine fuel application on a large scale.

Technical Details

The Terra Clove is owned by Eastern Pacific Shipping (EPS) and was constructed by HD Hyundai Heavy Industries (HHI). The vessel utilizes an ammonia dual-fuel Everllence engine, allowing it to operate on green ammonia to reduce lifecycle greenhouse gas emissions while maintaining the flexibility to use conventional marine fuels.

The fuel supplied for this operation is certified green ammonia produced at Envision's Chifeng Green Hydrogen and Ammonia Industrial Park in Inner Mongolia. Technical specifications of the production site and fuel include:

- Current production capacity: 320,000 tons of green ammonia annually.
- Planned total capacity: 1.52 million tons.
- Certification: Bureau Veritas certified to ISO standards.
- Compliance: Meets RFNBO and ISCC requirements.

Background and Context

This bunkering event follows a previous milestone in February 2026, when Envision executed its first commercial green ammonia shipment. That delivery moved product from Chifeng to LOTTE Fine Chemical at Ulsan Port, South Korea, establishing the first end-to-end commercial delivery of green ammonia from renewable hydrogen synthesis to international maritime logistics.

Significance and Outlook

The successful deployment of fuel to the Terra Clove confirms that green ammonia is a scalable and viable marine fuel for the current industry. By connecting production, international logistics, and vessel application, Envision has demonstrated a functional model for the maritime industry's transition toward net-zero emissions. The partnership between Envision, EPS, and LOTTE Fine Chemical serves as a proof-of-concept for the integration of certified green fuels into global shipping operations.

Source: https://www.adnkronos.com/immediapress/pr-newswire/envision-green-ammonia-successfully-fuels-the-worlds-first-vlac_1xCw86hTcjoruyGW7KWsRH

Collected: November 07, 2026 | Automated Research System (AI)

#12 Nippon Steel: 100% Hydrogen-Based DRI Production Timeline

Published November 04, 2026　マイナビニュース TECH+　Japan



OVERVIEW

Nippon Steel has successfully produced over 1,000t of direct reduced iron (DRI) using 100% hydrogen and low-grade iron ore. This achievement demonstrates a viable path toward decarbonizing steel production by utilizing abundant low-grade ores and eliminating CO2 emissions from the reduction process.

IN DEPTH

Key Findings

Nippon Steel announced on November 4 that it has successfully conducted trial production of direct reduced iron (DRI) using 100% hydrogen as the reducing agent. The trials were performed at the Hasaki Research and Development Center, where the company achieved continuous operation for over 300 hours, producing a cumulative total of more than 1,000t of reduced iron.

Technical Details

The process utilized a shaft-type trial reduction furnace that began operation in March 2026, featuring a height of approximately 60m and a production capacity of 1t/h. Unlike existing commercial reduction furnaces that require high-grade iron ore (direct reduction grade pellets), this trial used lower-grade iron ore (blast furnace grade pellets).

To overcome technical hurdles, Nippon Steel implemented two specific technologies:

- **Thermal Compensation Technology:** This maintains furnace temperatures to counteract the endothermic nature of hydrogen-only reduction, which typically causes temperature drops.
- **Operational Technology:** This prevents the powdering of low-grade iron ore during reduction, which otherwise impairs gas permeability and reaction control within the furnace.

Background & Context

Current global DRI production reaches approximately 100 million tons per year, but relies primarily on natural gas, which emits CO2. While hydrogen reduction offers a carbon-neutral alternative, the reliance on high-grade ore is a bottleneck due to limited supply. Establishing a method to use abundant low-grade ore is critical for securing future iron sources.

This project is part of the "Nippon Steel Carbon Neutral Vision 2050" and is supported by the Green Innovation Fund from NEDO. The development is being carried out by a consortium consisting of Nippon Steel, JFE Steel, and the National Institute for Materials Science.

Significance & Outlook

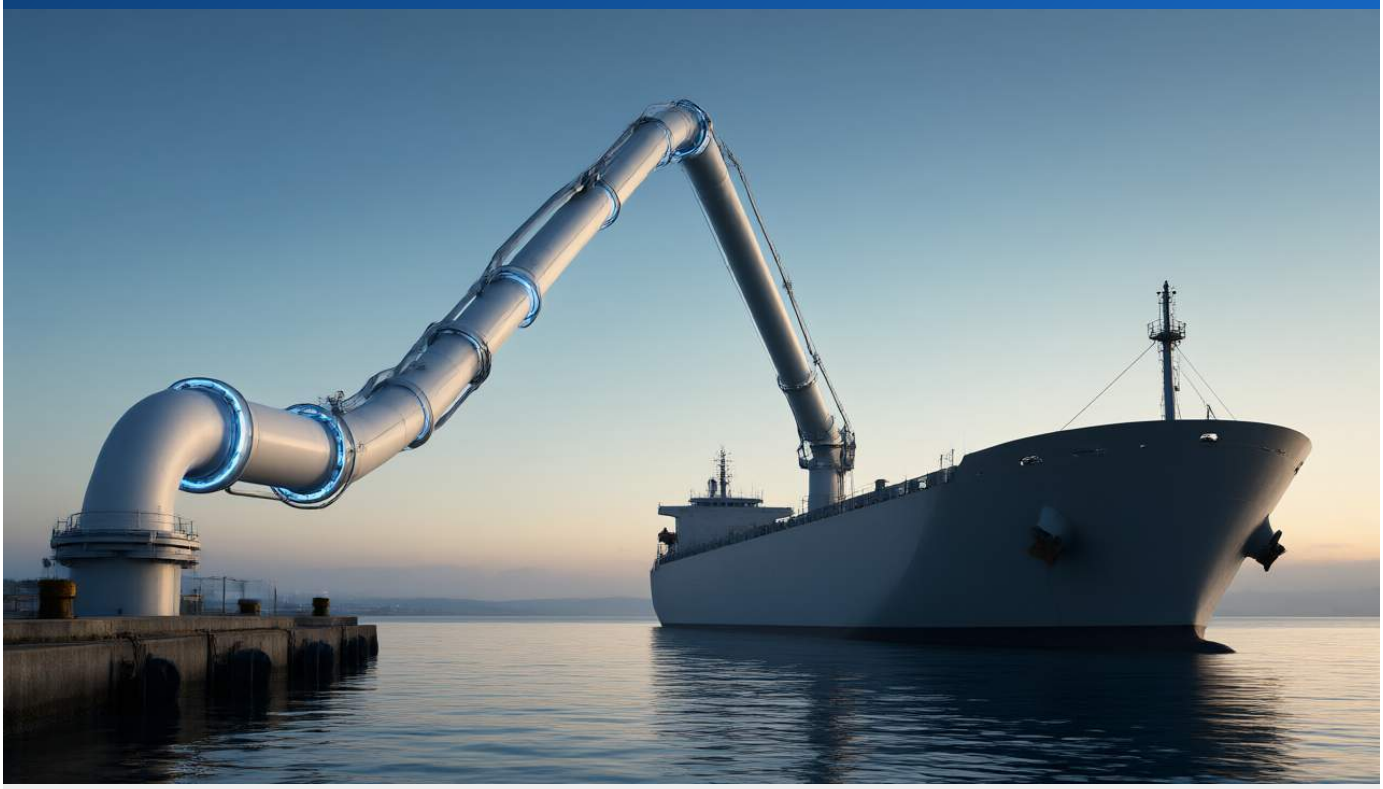
The company will continue testing to optimize operational conditions and establish direct reduction technology. Starting in fiscal 2027, Nippon Steel will advance development including scale-up technologies, with the goal of establishing full-scale commercial technology by around 2040.

Source: https://news.mynavi.jp/techplus/article/20261104-5255319/

Collected: November 07, 2026 | Automated Research System (AI)

#13 Kawasaki Heavy Industries: 12-inch Liquid Hydrogen Loading Arm Roadmap

Published November 04, 2026 IBTimes Japan Japan



OVERVIEW

Kawasaki Heavy Industries has begun developing liquid hydrogen loading arms with diameters of at least 12 inches, targeting a commercial launch in fiscal 2033. The equipment is designed to provide approximately four times the handling capacity of 6-inch models to support larger-scale maritime hydrogen supply chains.

IN DEPTH

Key Findings

Kawasaki Heavy Industries announced on November 4, 2026, the development of liquid hydrogen loading arms with diameters of at least 12 inches. If completed to these dimensions, the equipment is expected to be the world's largest loading arms for liquid hydrogen. The company targets a commercial launch for the system in fiscal 2033.

Technical Details

The 12-inch design utilizes a flange-type ship-shore connection. Based on the ratio of pipe cross-sectional areas at equal flow velocity, the target handling capacity is approximately four times that of a 6-inch model. Development is focused on compliance with ISO 24132, the international standard for liquid hydrogen loading arms. Engineering efforts are currently addressing structural, fluid-flow, operational, and maintenance challenges associated with the increased size of the equipment.

Background and Context

This project builds upon the technology used in a commercial-specification 6-inch loading arm developed jointly with TB Global Technologies (a Tokyo Boeki Holdings group company), which was completed on October 14, 2026. The 6-inch lineage began with a 2018 pilot model used at the Hy touch Kobe demonstration terminal in 2022. Commercial version development started in August 2023, with liquid hydrogen testing conducted at the Japan Aerospace Exploration Agency's Noshiro Rocket Testing Center from August 2025 through July 2026. The 6-inch equipment obtained ISO 24132 certification.

Significance and Outlook

As hydrogen supply chains expand, larger liquid hydrogen carriers require higher-capacity ship-to-shore equipment to ensure the efficient transport and receipt of large volumes from overseas. To demonstrate commercial supply-chain capabilities, three 6-inch arms are scheduled for installation at the Kawasaki LH2 Terminal being built by Japan Suiso Energy in Kanagawa Prefecture. These will handle transfers involving a 40,000-cubic-metre liquid hydrogen carrier.

Source: https://jp.ibtimes.com/kawasaki-develops-12-inch-plus-liquid-hydrogen-loading-arms-105110

Collected: November 07, 2026 | Automated Research System (AI)