

Key Developments in Jan '24

Green Hydrogen Monthly Executive Brief

January 2024

Amish

Amish.A@varkaconsulting.com

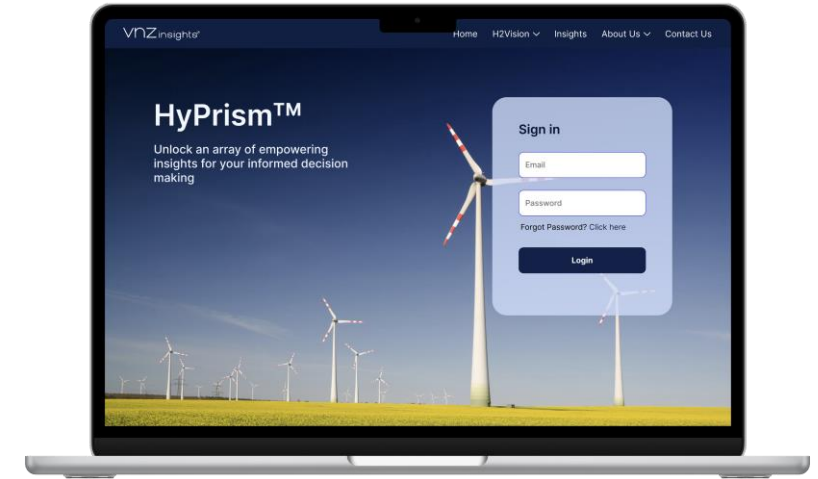
Introducing HyPrism™

HyPrism™ from VNZ Insights is a **Business Intelligence platform** providing access to original insights and thought leadership on green hydrogen auctions, value chain, project pipeline, electrolyser plant technology, and the supply chain.

Request for a detailed brochure

Visit Website

Email Us



Outlooks

Flagship reports for functional strategy

Customer, competitor and supply chain profiles

Proprietary datasets

News, Monthly briefings and Analyst notes

Summary (1/2)

Policy updates



Indian agency - **SECI** announced winners of tender of setting up green H2 production facilities

India's **MNRE** announces subsidies to support green hydrogen for ammonia and oil refining

Clean Hydrogen Partnership launches ~122 muSD call for projects across the whole hydrogen value chain

Egypt's parliament passes **green hydrogen subsidy law** and approved by the President

Projects



Esbjerg 1GW green hydrogen project granted **environmental approval**

Tecnimont awarded **FEED contract** from **Fortescue** for a green ammonia plant in Norway

MoU signed between **Government of Gujarat** and **Torrent Power** to develop a green ammonia /H2 facility

BASF bags German **funding approval** for 54 MW electrolysis project

Mitsubishi plans 80,000 tonnes per year **green H2 plant** in Netherlands

Técnicas Reunidas to execute **design engineering** for green ammonia plants in Norway

Edify Energy secures **48mUSD Federal Government funding** for Townsville Green Hydrogen Hub

India's **INOX Air Products** signs **MoU** with **Maharashtra Government** for green ammonia production plant

Asset owner and EPC



Plug Power starts production of liquid green H2 at its Georgia plant

Renew Power planning to invest **3 bnUSD** in Kerala, India

Hygenco to invest **2.5 bnUSD** over 3 years to set up Green Hydrogen projects in India

APM Terminals Pipavav to develop green hydrogen **ecosystem** in India

NGEL signs **MoU** with **Government of Maharashtra** for development of Green Hydrogen Projects

Lhyfe and **Source Galileo** join forces for green hydrogen production in the UK and Ireland

Mitsubishi HC Capital to acquire **20%** stake in **European Energy**

FDE completes **acquisition** of majority stake in **Greenstat ASA**

Summary (2/2)

Electrolyser OEM updates



Delta secures **technology license** from **Ceres** to develop SOEC based fuel cell and electrolysis solutions

Cipher Neutron receives **funding** for research and electrolyser **order** from **Molymet**

Ecoclean starts series **production** of modular alkaline electrolysers on megawatt scale

Worley signs **MoU** with **ABB** and **IBM** to build and operate green hydrogen facilities more efficiently and at scale

Hydrexia, hydrogen solutions provider, and **Baowu Magnesium Technology** form strategic partnership

Metacon entered into an exclusive electrolyser OEM license and manufacturing **agreement** with **PERIC**

ENDURE consortium signed grant agreement with European Union to support its alkaline electrolysis **R&D project**

LONGi Hydrogen and **ACWA Power** partner on Green Hydrogen in Uzbekistan

Envision Energy collaborating with **BASF** in green hydrogen to accelerate renewable energy transition

H2U and **De Nora** enter into **R&D agreement** to discover high-performance materials for green hydrogen production

Metacon to setup electrolyser **manufacturing facility** in Europe based on **PERIC** technology

Enapter AG, and **Wolong Group** form **JV** for serving China market

Plug Signs **BEDP contract** for a 500MW electrolyser in Europe

Hyundai Motor and **Kia** to develop polymer electrolyte membrane with **W.L.Gore** for hydrogen fuel cell systems

Pall Corporation Introduces **SepraLYTE™ Liquid/Gas Coalescers** for Green Hydrogen Production

Nel Hydrogen signed a 10MW electrolyser **contract** with **Samsung C&T Corporation Engineering & Construction Group**

India based **Greenzo Energy** **launches** modular alkaline **electrolyser**

Shuangliang Eco-Energy System, received a **20MW electrolyser order** for a project in Oman

Ador Group forays into the green H2 ecosystem with its **new brand, Yonder** - DC Power Supply units

Electrolyser supply chain updates



Key updates

Policy and auctions

Indian agency - SECI announced winners of tender of setting up green H2 production facilities

- Awarded 3-year subsidy to water electrolysis based green H2 projects with combined capacity of 410,000 MTPA. Winners incl. Reliance, Welspun, HHP, Torrent Power, ACME, Greenko, & JSW. UPL and CESC to setup projects without subsidy
- Also awarded subsidy for 2,000 metric tonnes/annum to BPCL to setup biomass based facility

India's MNRE announces subsidies to support green hydrogen for ammonia and oil refining

- Announced two auctions in which demand will be aggregated from the industry and tender fixed payments for production and supply
- One auction will specifically subsidize green H2 producers supplying to oil refineries, while the other will pay to companies that produce green NH3, as long as the hydrogen is made in-house

Clean Hydrogen Partnership launches ~122 mUSD call for projects across the whole hydrogen value chain

- Total of ~122 mUSD will be made available through Horizon Europe for projects to cover R&I activities across the whole hydrogen value chain.
- Additional ~64 mUSD from the RePowerEU plan budget will be used to support different activities for increasing the number of Hydrogen Valleys across Europe.

Egypt's parliament passes green hydrogen subsidy law and approved by the President

- Bill offers companies 33-55% off on the tax paid on a project, as well as VAT exemptions on equipment & tools, used for project development
- Local content requirement of 20% for components used
- Mandates 70% local workforce requirement

Indian agency – SECI awarded subsidy for setting up 1.5GW electrolyser capacity

- In technology agnostic segment Reliance, John Cockerill & Jindal India each won 300MW/annum capacity with ~54mUSD incentive. Ohmium won 24mUSD for 137MW, Advait Infratech won ~17.9mUSD for 100MW and L&T won ~11mUSD subsidy for 63MW
- In indigenous segment, Homihydrogen won 18mUSD for 101.5MW, Adani New Industries won 35 mUSD for 198.5MW

Key updates

Projects

Esbjerg 1GW green hydrogen project granted environmental approval

- Project has been granted Environment approval with FID expected in 2025, commissioning & operations start planned for 2028
- H2 Energy planned to install 50 PEM electrolyzers to be supplied by Plug Power

Tecnimont awarded FEED contract from Fortescue for a green ammonia plant in Norway

- Scope of work includes the design of electrolyser integration, the air separation unit for nitrogen production, the ammonia production plant, storage and ship loading facilities.
- Tecnimont will also submit a proposal for the engineering, procurement and construction phase of the plant's construction.

MoU signed between Government of Gujarat and Torrent Power to develop a green ammonia /h2 facility

- Utility Torrent Power agreed to develop a green ammonia facility worth 866 mUSD for a capacity of 100 KTPA (kilo tonne per annum)
- Investment is part of a wider pledge to invest 5.7 bnUSD into power projects in the state

BASF bags German funding approval for 54 MW electrolysis project

- BASF received funding approval for a 54 MW PEM electrolyser that will produce up to 8,000 metric tons /year hydrogen for Hy4Chem-EI project
- Approvals received from the German Federal Ministry for Economic Affairs and Climate Action for up to ~134 mUSD, of which, ~40 mUSD will be financed by the government of Rhineland-Palatinate.

Mitsubishi plans 80,000tonnes per year green H2 plant in Netherlands

- Mitsubishi Corp plans to invest ~700 mUSD to build one large scale "green" hydrogen production plant with expected commissioning in 2029
- Eneco Diamond Hydrogen --- a JV between Mitsubishi and its Dutch subsidiary Eneco --- will handle production, with electricity generated from Eneco's large offshore wind farm used to power the electrolyser

Técnicas Reunidas to execute design engineering for green ammonia plants in Norway

- Fortescue selected Técnicas Reunidas to execute a FEED study for the development of a green hydrogen and ammonia production plant in the Nordgulen Fjord
- Project includes a 300 MW hydrogen production plant, and a green ammonia production plant with a nominal capacity of 675 tonnes per day

Edify Energy secures 48 mUSD Federal Government funding for Townsville Green Hydrogen Hub

- Secured grant funding through the Federal Government's Regional Hydrogen Hubs program
- Edify will build and operate the 17.6MW green H2 production plant

India's INOX Air Products signs MoU with Maharashtra Government for green ammonia production plant

- MoU signed with the government of Indian state Maharashtra for a 500,000 MMTPA of liquid green ammonia project
- Project is expected to be commissioned in 3 to 5 years

Key updates

Asset owners and EPCs

Plug Power starts production of liquid green H2 at its Georgia plant

- Plant is designed to produce 15 tons per day (TPD) of liquid electrolytic H2 – to power ~ 15,000 forklifts per day.
- Through eight 5-MW PEM electrolyzers, green H2 is produced and condensed into liquid form at -423F to be delivered to customers' H2 fueling stations through Plug's logistics network using Plug cryogenic trailers.

Renew Power planning to invest 3 bnUSD in Kerala, India

- Planning to develop 220KTPA green H2 production capacity for producing 1100KTPA green ammonia for export
- Project expected to use 2GW electrolyser and to be completed in three phases

Hygenco to invest 2.5 bnUSD over 3 years to set up Green Hydrogen projects in India

- Working on projects of 50-200 MW scale, actively developing project in over seven states where customers belong to refineries, steel, & fertilizers
- Hygenco is a pure-play Green Hydrogen platform largely operating on the Build-Own-Operate (BOO) business model

APM Terminals Pipavav to develop green hydrogen ecosystem

- Signed MoU with NTPC, and Welspun Group, to develop green hydrogen production and distribution facilities on land provided by the port, for both export and domestic use

NGEL signs MoU with Government of Maharashtra for development of Green Hydrogen Projects

- NTPC Green Energy Limited (NGEL) signed MoU with Government of Maharashtra for development of Green Hydrogen and derivatives (Green Ammonia, Green Methanol) of up to 1million ton capacity per annum
- ~1 bnUSD investment expected in next five years

Lhyfe and Source Galileo join forces for green hydrogen production in the UK and Ireland

- Collaborated to establish commercial-scale green hydrogen production sites in the UK
- Exploring opportunities in Ireland with focus on identifying consumers
- Initially will focus on using electricity from onshore renewable sources and in the longer term, they could harness the offshore wind in the UK and Ireland

Mitsubishi HC Capital to acquire 20% stake in European Energy

- Mitsubishi HC Capital will subscribe to ~72 million new shares in European Energy, and will purchase ~3 million shares making it the 2nd largest shareholder in European Energy, holding 20% of the share capital and voting rights
- Equity capital injection will contribute to the continued growth of the European Energy

FDE completes acquisition of majority stake in Greenstat ASA

- FDE acquired controlling stake in Greenstat ASA, a leading green energy operator based in Norway, with a strong focus on green hydrogen
- Acquisition builds on FDE's ongoing expansion into Norway since 2022 and further strengthens its portfolio of low-carbon solutions, supporting the group's long-term growth strategy

Key updates

Electrolyser OEMs (1/2)

Delta secures technology license from Ceres to develop SOEC based fuel cell and electrolysis solutions

- Delta Electronics will integrate Ceres' energy stack technology with its power electronics and thermal management technologies to develop SOEC fuel cell and electrolyser solutions
- Production expected to start at Delta's plant in Tainan City from 2026
- Long-term agreement covering technology transfer and licensing

Metacon entered into an exclusive electrolyser OEM license and manufacturing agreement with PERIC

- Agreement gives Metacon an exclusive right to build and sell pressurized alkaline electrolysis modules (stacks) based on PERIC technology in Europe
- Metacon get rights to build a 'Gigafactory' for the manufacturing of own electrolysis systems

Metacon to setup electrolyser manufacturing facility in Europe based on PERIC technology

- investigating the conditions and financing possibilities for building a factory in Sweden or in another country within the EU
- Planning for a production volume of up to 0.5 GW per year, based on 5 and 10 MW electrolysis modules with ambition to scale up to 1GW

Nel Hydrogen signed a 10MW electrolyser contract with Samsung C&T Corporation Engineering & Construction Group

- Nel signed a contract for supplying 10MW alkaline electrolyser equipment for about ~5.4 mUSD for Samsung C&T's off-grid green hydrogen production project in South Korea
- Scope for Nel includes alkaline stacks and balance-of-stacks (BoS)

Cipher Neutron receives funding for research and electrolyser order from Molymet

- Aim of the research collaboration is to promote the use of Rhenium as a catalyst in electrolysers. Molymet is leading Rhenium supplier globally
- Cipher Neutron to design AEM electrolyser with Balance of Plant, a turnkey solution for Molymet's Rhenium metal plant in Chile

ENDURE consortium, signed grant agreement with European Union to support its alkaline electrolysis R&D project

- With a total budget of 2.7 mUSD, project aim is to develop PGM-free alkaline stack with PEM-like performance & low degradation rate
- Project will be led by Stargate Hydrogen and will run for 3 years

Enapter AG, and Wolong Group form JV for serving China market

- Enapter (49% stake) grants license for the sale & production of AEM electrolysers in China, charging license fee of 3% of future sales.
- Wolong Group (51% stake) contributing ~2.1 mUSD and providing production resources and local personnel to set up production, sales and support.
- JV will acquire stacks from the Enapter and then produce the Enapter AEM electrolyser products locally in China

India based Greenzo Energy launches modular alkaline electrolyser

- Greenzo Energy's alkaline electrolyser, designed as a modular unit, will be available in capacities ranging from 0.5 MW to 5 MW, ensuring scalability to meet varying energy demands
- Greenzo plans to establish a state-of-the-art unit in Sanand GIDC, Ahmedabad, with a capacity of 250 MW per year.

Key updates

Electrolyser OEMs (2/2)

Ecoclean starts series production of modular alkaline electrolysers on megawatt scale

- Designed as modular units, electrolysers can be used to build cost-efficient systems with outputs of 1 to 20 MW near energy generator
- Compact electrolysers based on pressurized alkaline electrolysis with limited reliance on precious metal
- Developed and optimized by the Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW)

LONGi Hydrogen and ACWA Power partner on Green Hydrogen in Uzbekistan

- Longi won contract to supply PowerChina with 20MW of electrolysers for installation at ACWA Power's pilot green ammonia project in Uzbekistan
- Plant is set to be commissioned by the end of 2024 and will be producing 3,000 tonnes of renewable H2 for an existing ammonia facility in Tashkent

Plug Signs BEDP contract for a 500MW electrolyser in Europe

- signed a contract to deliver a Basic Engineering and Design Package
- BEDP scope includes engineering and plant integration details to allow a full plant front-end engineering design (FEED) study
- Plug expects to convert BEDP contract to firm electrolyser order depending

Shuangliang Eco-Energy System, received a 20MW electrolyser order for a project in Oman

- Received contract from Omani company United Solar Polysilicon, as part of a wider contract to supply to polysilicon plant in the Sohar Free Zone

Mingyang signed an agreement with IBCLNG to jointly develop a 25-MW electrolysis project in Thailand

- IBCLNG will source cutting-edge electrolysers from Mingyang Hydrogen.
- Mingyang will also provide technical expertise and personnel support to construct an integrated "generation, storage, and utilization" green hydrogen infrastructure in Thailand.

Key updates

Electrolyser supply chain

Worley signs MoU with ABB and IBM to build and operate green hydrogen facilities more efficiently and at scale

- Partnership for developing an integrated O&M solution for green H2 facilities at scale
- Combining Worley's engineering expertise with ABB's electrical and digitalization solutions and leveraging IBM's data management and systems integration capabilities

Envision Energy collaborating with BASF in green hydrogen to accelerate renewable energy transition

- Partnership will focus on e-methanol production from green H2 and CO2 more efficiently.
- Envision will integrate BASF's SYNSPIRE™ catalyst technology with its EnOS AIoT operating system to maximize the catalyst technology efficiency synchronizing e-methanol production with wind power availability

Hyundai Motor and Kia to develop polymer electrolyte membrane with W.L.Gore for hydrogen fuel cell systems

- Focus is on developing PEM fuel cell technology for commercial vehicles to improve durability & performance
- Gore brings advanced PEM, catalyst-coated membrane, and Membrane Electrode Assembly expertise while Hyundai/Kia contributes extensive fuel cell experience

Ador Group forays into the green H2 ecosystem with its new brand, Yonder - DC Power Supply units

- Yonder is India based, dedicated power electronics company focusing on serving green H2 market
- Yonder product offering includes IGBT and Thyristor rectifier-based power supply unit for small- and large-scale green H2 plants

Hydrexia, hydrogen solutions provider, and Baowu Magnesium Technology form strategic partnership

- Hydrexia is a purification & gas separation provider in China and Baowu Magnesium is light metal materials supplier
- Strategic partnership focusing on leveraging the technology, production, and industry resource strengths of both companies in the hydrogen industry

H2U and De Nora enter into R&D agreement to discover high-performance materials for green hydrogen production

- R&D partnership will focus on for identifying and developing low-cost, high-performance electrocatalysts for hydrogen production through water electrolysis

Pall Corporation Introduces SepraLYTE™ Liquid/Gas Coalescers for Green Hydrogen Production

- Pall Corporation, a supplier of filtration, separation and purification solutions, introduces SepraLYTE™ liquid/gas coalescers
- Solution designed to meet the increasing demand for efficient separation of electrolyte aerosols from gas in green hydrogen production processes

Disclaimer

VARKA Net Zero Advisory Private Limited (“VARKA”) reserves all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in part – is forbidden without prior written consent of VARKA. We reserve the right to make technical changes or modify the contents of this document without prior notification. These documents, including updates to them, remain subject to the copyright of VARKA and are made available to Clients of VARKA under the terms and conditions agreed between VARKA and those clients. The information contained herein has been obtained from sources believed to be reliable. VARKA disclaims all warranties as to the accuracy, completeness or adequacy of such information. VARKA shall have no liability for errors, omissions or inadequacies in the information contained herein or for the interpretations thereof. The opinions expressed in these materials are those of VARKA, and nothing contained in them constitutes an offer to buy or to sell securities, or investment advice. VARKA's products do not provide a comprehensive analysis of the financial position or prospects of any company or entity and nothing in any such product should be taken as comment regarding the value of the securities of any entity. If, notwithstanding the foregoing, you or any other person relies upon these materials, in any way, VARKA does not accept, and hereby disclaims to the extent permitted by law, all liability for any loss and damage suffered arising in connection with such reliance.

Please also note that the laws of certain jurisdictions may prohibit or regulate the dissemination of certain types of information contained in these materials, such as maps, and accordingly it is your responsibility to ensure that any dissemination of such information across national boundaries within your organization is permitted under the laws of the relevant jurisdiction.

Copyright 2024. VARKA Net Zero Advisory Private Limited. All rights reserved.