

# Key Developments in Feb '24

Green Hydrogen Monthly Executive Brief

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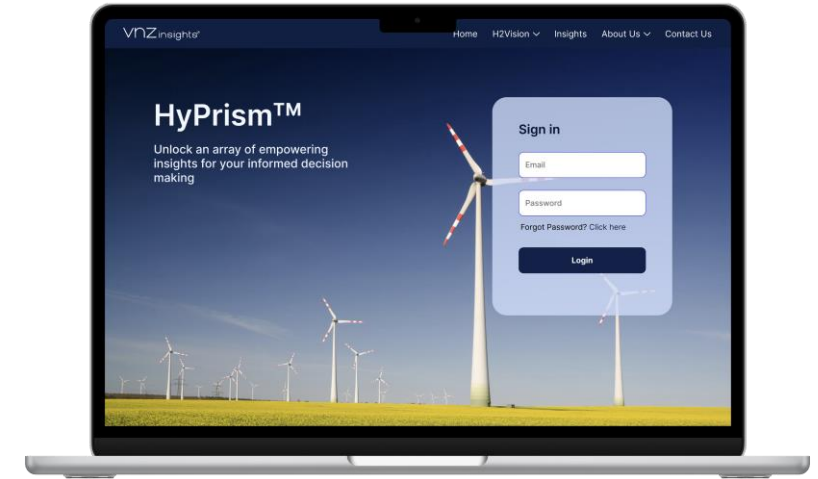
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# Summary (I/II)

## Policy updates



**EU approves 7.54 bnUSD** state aid for hydrogen across **33 IPCEI** hydrogen infrastructure projects

**UK** backs **seven** hydrogen production **projects** with **26.7mUSD** funding

**US Department of Energy** announces **20mUSD** to **16 projects** working on **geological hydrogen** exploration

**Germany** to support the production of green hydrogen in **Algeria** and its **export to Europe**

## Projects' updates



**Chevron** announces its **first** solar to hydrogen production **project** in California's **Central Valley**

**Lhyfe** launches its **first UK project** with plans for **20MW** green hydrogen plant

**Fusion Fuel** receives **IPCEI approval** from European Commission for **630 MW HEVO-Portugal project** under Hy2Infra program

**P2X Solutions** to develop **Oulun Energia's** industrial-scale hydrogen plant in Finland

**Sunfire** successfully installs first industrial-scale **electrolysis plant** in Finland

**SeRenE** secures **390mUSD financing** for revolutionary green hydrogen project in **Malaysia**

**Lhyfe** begins **construction** of green hydrogen plant in **Brake, Germany**

**Charbone Hydrogène** finalizes arrangements with **Sorel-Tracy** to construct a green H2 project in **Quebec, Canada**

**Greenstat** makes **investment decision** for **Agder Hydrogen Hub, Norway**

**L&T commissions** first **indigenously manufactured** hydrogen electrolyser at **Hazira, India**

**CIAL, BPCL** to establish **green hydrogen plant** at **Cochin Airport, India**

**JSW Neo Energy** receives **Letter of Award** to **establish** green hydrogen production **facility**

**Axpo** joins forces with **Infinite Green Energy** on large-scale green hydrogen **project in Italy**

**NTPC Green Energy** signs **land lease agreement** with **APIIC** for setting up green hydrogen production facility

**ACME, Avaada** begin work on green hydrogen and ammonia projects in the Indian state of **Odisha**

**World Energy GH2** and **Canada Government** sign **agreement** to develop green hydrogen project

# Summary (II/II)

## Asset Developer updates



Clean energy provider **GeoPura** raises **70mUSD** to accelerate green hydrogen development

**OMV Petrom** signs financing for two green hydrogen production projects at **Petrobraz** refinery

**Petrobras** to invest **18.4 mSUD** in green hydrogen project study in **Brazil**

**Wood** selected as owner's engineer for world-leading green hydrogen project in **Spain**

## Electrolyser OEM updates

**Green Hydrogen Systems(GHS)** signs order for **8.1 MW** of electrolyser capacity

**H TEC SYSTEMS** to deliver **PEM** electrolyser to Spanish project developer **SailH2**

**Plug Power** signs **BEDP contract** for a 500MW Electrolyser in Europe

**HydrogenPro** receives **FEED study** for 300 MW project in the US

**Nel** realigns relationship with **Nikola** and will support Fortescue on its 80 MW **Phoenix Hydrogen Hub**

**Chiyoda Corporation** and **Toyota** jointly developing large-scale **electrolysis** system

**Ceres** and **AtkinsRéalis** to design modularised green hydrogen **production system**

**BPCL** indigenously developed an **alkaline electrolyser**

**De Nora** marks entry in the electrolyser OEM segment with **supply order** of its **Dragonfly Electrolyser**

**SunHydrogen** and **COTEC** of South Korea advance to next phase of production for **1m<sup>2</sup> Green Hydrogen Panels**

**Gensol Engineering & Matrix Gas Consortium** win **PLI Bid** for hydrogen electrolyser manufacturing in India

**Genvia** partners with **Airbus** for **SOEC technology** usage in **e-Sustainable Aviation Fuels**

## Electrolyser supply chain updates



**Bekaert** and **Toshiba** sign a **global partnership agreement** on **MEA technology** for PEM electrolysers

**De Nora** receives order from **thyssenkrupp nucera** for supply of **700MW electrolyser cells**

**Agfa** awarded grant from the **EU Innovation Fund** for **membrane production plant**

**Agfa** advances sustainable innovation through **strategic collaboration** with **VITO**

# Key updates

## Policy and auctions

### **EU approves 7.54 bnUSD state aid for hydrogen across 33 IPCEI hydrogen infrastructure projects**

- ~3.2GW of ELY capacity, ~2,700 km of new & repurposed hydrogen pipelines and 370 GWh of hydrogen storage plus related port infrastructure would be supported across the IPCEI projects
- Clusters of projects seeking support were prepared by seven member states: France, Germany, Italy, the Netherlands, Poland, Portugal and Slovakia

### **EU approves 4.94bnUSD in German state funds for hydrogen projects**

- Funding approved for 24 green hydrogen projects in Germany
- Funding approval by European Commission (EC) is part of the Important Project of Common European Interest (IPCEI) Hydrogen program

### **UK backs seven hydrogen production projects with 26.7mUSD**

- Four projects will develop plans for new hydrogen production plants, to supply cleaner fuel to companies across a range of industries
- Three projects will be producing home-grown hydrogen for industry and transport

### **US Department of Energy announces 20mUSD to 16 projects working on for geological hydrogen exploration**

- 16 teams announced are set to receive funding through two Advanced Research Projects Agency-Energy (ARPA-E) Exploratory Topics on geologic hydrogen
- Funding will be used across 8 states to accelerate the natural subsurface generation of hydrogen

### **Germany to support the production of green hydrogen in Algeria and its export to Europe**

- Signed a declaration of intent to cooperate on green hydrogen, with a focus on supporting the build-out of infrastructure in Algeria
- Germany will provide 21.5 mUSD funding to build a 50MW pilot project

# Key updates

## Projects (I/II)

### **Chevron announces its first solar to hydrogen production project in California's Central Valley**

- Through the business unit Chevron New Energies, Chevron planning to develop a 5MW hydrogen production project in Central Valley
- Facility is designed to produce two tons of low-carbon intensity hydrogen per day

### **Lhyfe launches its first UK project with plans for 20MW green hydrogen plant**

- Proposed facility in the North-East of England is receiving support from Shepherd Offshore, a leading maritime and energy service provider
- Plant will have capacity of producing up to eight tonnes of green hydrogen per day.

### **Fusion Fuel receives IPCEI approval from European Commission for 630 MW HEVO-Portugal project under Hy2Infra program**

- Project would produce 62,000 tonnes of green hydrogen per annum.
- Off-take of the project includes green ammonia production and export from the Port of Sines to the Port of Rotterdam (Netherlands). Balance green hydrogen would be consumed by industrial customers in the domestic Portuguese market

### **P2X Solutions to develop Oulun Energia's industrial-scale hydrogen plant project in Finland**

- Enersense's associated company P2X Solutions selected by Oulun Energia
- Project would include an electrolysis plant 100 MW size, a carbon capture plant, storage, and processing plant to produce methane or methanol
- Plant currently going through feasibility studies with expected FID in 2025 and commissioning in 2028

### **Sunfire successfully installs first industrial-scale electrolysis plant in Finland**

- Sunfire completed the installation work of the pressurized alkaline electrolyser, at the Harjavalta plant
- Project commissioning expected in the second half of 2024
- At full capacity, plant will produce up to 400 kg of green hydrogen per hour

### **SeRenE secures 390mUSD financing for revolutionary green hydrogen project in Malaysia**

- Semarak Renewable Energy Sdn Bhd (SeRenE), a key player in Malaysia's renewable energy sector, secured a financing package for green H2 project
- Project, based in Perak, focuses on green hydrogen production using floating photovoltaic power generation

### **Lhyfe begins construction of green hydrogen plant in Brake, Lower Saxony, Germany**

- Project is expected to be operational by the end of 2024
- Plant will have an installed 10MW electrolysis capacity and will produce up to 1,150 tonnes of green hydrogen per annum

### **Charbone Hydrogène finalizes arrangements with Sorel-Tracy to construct a green H2 project in Quebec**

- Phase 1 of the development of the Sorel-Tracy green H2 plant, with a production capacity of around 200 kg, expected to begin in H1 2024
- Charbone partnered with renewable energy construction leader, EBC Inc., to lead the project construction incl. project management and procurement of key components



# Key updates Projects (II/II)

## Greenstat makes investment decision for Agder Hydrogen Hub

- Greenstat taken over Everfuel's shares in the project and has made a final investment decision to develop a 20MW hydrogen production plant at Fiskå, Kristiansand, Norway
- Also signed a lease agreement with Elkem for the project land

## L&T commissions first indigenously manufactured Hydrogen Electrolyser at Hazira, India

- Project includes a electrolyser with rated power capacity of 1 MW (expandable to 2 MW), which can produce 200 Nm<sup>3</sup>/h of hydrogen.
- Plant equipped with 2 stacks & an Electrolyser Processing Unit ML-400
- L&T Electrolysers Limited, is manufacturing pressurised alkaline electrolysers using McPhys' tech

## CIAL, BPCL to establish 1st green hydrogen plant at Cochin Airport, India

- Collaboration between CIAL and BPCL will focus on setting up green hydrogen plant and fueling station within airport premises
- Under the agreement, BPCL will oversee development of integrated green hydrogen plant and fueling station at the airport
- CIAL will provide suitable land, water and green energy resources

## JSW Neo Energy receives Letter of Award(LoA) to establish green hydrogen production facility

- LoA awarded to establish a 6.5 KTPA (Kilotons per annum) green hydrogen production facility.
- LoA was granted following an auction conducted by the SECI, auction result announced in January 2024
- Commissioning of JSW Neo Energy's green hydrogen facility is anticipated within 30 months

## Axpo joins forces with Infinite Green Energy on large-scale green hydrogen project in Italy

- Entered into a Joint Development Agreement (JDA) with Australian company Infinite Green Energy.
- Partnership focus in on advanced design, and investment in the plant
- Valle Peligna Hydrogen Project will operate with 30MW electrolyser and will be able to produce 4,200 tonnes of hydrogen annually

## NTPC Green Energy signs land lease agreement with APIIC for setting up green hydrogen production facility

- Project includes construction of India's largest green hydrogen production facility (1,200 tons per day) in Visakhapatnam, Andhra Pradesh
- Green hydrogen will be further converter to derivatives such as green ammonia and green methanol, primarily catering to various export markets

## ACME, Avaada begin work on green hydrogen and ammonia projects in the Indian state of Odisha

- Project construction started for 2 green hydrogen projects in Odisha
- ACME Cleantech developing 1.1 mtpa green ammonia plant and
- Avaada Green working on 0.5 mtpa green hydrogen/ammonia facility at Gopalpur Industrial Park.

## World Energy GH2 and Canada Government sign agreement to develop green hydrogen project

- Agreement provides 95mUSD credit support for the development of Project Nujio'qonik
- Project Nujio'qonik will produce ~210,000 tonnes of green hydrogen per year (1.2 million tonnes of green ammonia) with the first phase expected to produce ~400,000 tonnes of green ammonia for export

# Key updates

## Asset owners and EPCs

### Clean energy provider GeoPura raises 70mUSD to accelerate green hydrogen development

- Proceeds from the financing round will be used to increase the manufacture and supply of its HPUs, which replace traditional diesel generators.
- GeoPura will also expand its production of green hydrogen, along with storage and distribution assets, through HyMarnham Power

### OMV Petrom signs financing for two green hydrogen production projects at Petrobrazil refinery

- Contracts were signed with the Romanian Ministry of Energy for a funding amount of ~54mUSD
- Funding will be used for two green hydrogen projects with capacity of 20MW and 35MW

### Petrobras to invest 18.4 mUSD in green hydrogen project study

- Announced an investment of 18.4 mUSD for a research project focused on the production of green hydrogen
- Aims to establish a pilot electrolysis plant for the generation of green hydrogen in the state of Rio Grande do Norte, Brazil

### Wood selected as owner's engineer for world-leading green hydrogen project in Spain

- Wood will be leading the technical aspects of Catalina's green hydrogen generation plant including technology selection, preliminary studies, front end engineering and design (FEED) and EPC tendering support
- 500MW electrolysis project is being developed by Copenhagen Infrastructure Energy Transition Fund I K/S



# Key updates

## Electrolyser OEMs (I/II)

### Green Hydrogen Systems(GHS) signs order for 8.1 MW of electrolyser capacity

- Received order for nine units of the HyProvide® A-series electrolyser from an existing customer in UK
- Deliveries expected in 2024-25
- Scope also includes providing electrolyser maintenance support

### H TEC SYSTEMS to deliver PEM electrolyser to Spanish project developer SailH2

- H-TEC to provide 1MW PEM electrolyser ME450 for HUB LA ISLA H2 project in Spain
- H-TEC SYSTEMS will deliver the electrolyser in September 2024

### Plug Power signs BEDP contract for a 500MW Electrolyser in Europe

- Secured a contract to deliver a Basic Engineering and Design Package (BEDP), increases Plug's total BEDP contracts to 4.1 gigawatts (GW)
- Under the BEDP package, Plug provides engineering details to facilitate efficient front-end engineering design (FEED) studies for potential hydrogen production plants

### HydrogenPro receives FEED study for 300 MW project in the US

- For an undisclosed client, HydrogenPro to provide Front-End Engineering Design (FEED) services for Green Ammonia Facility in Texas.

### Nel realigns relationship with Nikola and will support Fortescue on its 80 MW Phoenix Hydrogen Hub

- Nel and Nikola to cancel the old supply agreement of 85MW electrolyser. New agreement for 110 alkaline stacks (80MW) and related BoS equipment.
- Nel will receive ~9mUSD from Nikola for changed scope
- Nel will also receive ~11mUSD from Fortescue for updated guarantees & warranties for the equipment & changes in the scope of delivery

### Chiyoda Corporation and Toyota Jointly developing large-scale electrolysis system

- New electrolysis system will be built using Toyota's fuel cell technology and Chiyoda's plant engineering expertise
- 5 MW-class equipment will be used as the basic unit for the product development focus is on smaller floor size and high efficiency
- Companies planning to introduce the system in 2025

### Ceres and AtkinsRéalis to design modularised green hydrogen production system

- Ceres Power partnered with AtkinsRéalis (design, engineering & project management company), to deliver the FEED for multi-megawatt modularized system based on Ceres's SOEC technology
- Aims to create a blueprint of the optimum system architecture for a 100MW+ electrolyser system as a building block for gigawatt-scale plants

### BPCL indigenously developed an alkaline electrolyser

- BPCL developed the electrolyser in collaboration with Bhabha Atomic Research Centre (BARC)
- In addition to electrolyser development, BPCL planning to develop a 5 MW green hydrogen plant at Bina Refinery

# Key updates

## Electrolyser OEMs (II/II)

### De Nora marks entry in the electrolyser OEM segment with supply order of its Dragonfly Electrolyser

- De Nora will supply the new 1MW capacity Dragonfly® on-site electrolytic hydrogen generation system
- De Nora is one of the partners in the European project "HyTecHeat"

### SunHydrogen and COTEC of South Korea Advance to Next Phase of Production for 1m<sup>2</sup> Green Hydrogen Panels

- Companies are working to scale up SunHydrogen's technology to produce 1 square meter (1m<sup>2</sup>) green H<sub>2</sub> panels
- COTEC's expertise in electroplating is seen as valuable for scaling up SunHydrogen's technology

### Gensol Engineering & Matrix Gas Consortium win PLI Bid for hydrogen electrolyser manufacturing

- Awarded manufacturing capacity of 63MW per annum by SECI under SIGHT PLI scheme's Tranche-I
- Subsidy awarded post withdrawal by Jindal India Limited for 300MW capacity which was later allotted to Gensol & Matrix consortium(63MW) and L&T(additional 237MW to reach to 300MW cumulative)

### Genvia partners with Airbus for SOEC technology usage in e-Sustainable Aviation Fuels

- Aim is to model & quantify the technical & commercial benefits of Genvia's SOEC technology for e-SAF™ through several production pathway architectures evaluation
- Technology maturity of components will also be evaluated in the study
- Initial concept study will be conducted in the first half of 2024

# Key updates

## Electrolyser supply chain

### **Bekaert and Toshiba sign a global partnership agreement on MEA technology for PEM electrolyzers**

- Agreement focus is on utilizing Bekaert's expertise in PTL with Toshiba's iridium-saving technology for MEA, to reduce iridium usage by 90% in the production of PEM electrolyzers
- Bekaert will be commercializing the MEA production while Toshiba will license its iridium-saving MEA technology to Bekaert, granting them the ability to manufacture and distribute

### **De Nora receives order from thyssenkrupp nucera for supply of 700MW electrolyser cells**

- As part of their strategic collaboration, De Nora received order from Thyssenkrupp Nucera
- De Nora to supply electrolyser cells for thyssenkrupp nucera's alkaline electrolyser for 700MW H2Green Steel project in Sweden

### **Agfa advances sustainable innovation through strategic collaboration with VITO**

- VITO and Agfa will work on developing novel porous gas separator membranes to improve electrolyser performance and reduce overall hydrogen production cost
- Agfa and VITO will be actively pursuing funding opportunities to further boost their joint research

### **Agfa awarded grant from the EU Innovation Fund for membrane production plant**

- Agfa awarded ~11.8mUSD from EU Innovation Fund for its GIGA-SCALES project
- Funding will support Agfa in the establishment of industrial-scale ZIRFON membranes production plant in Mortsel, Belgium
- Plant expected to be operational by 2025 with 20GW/year membrane production capacity

### **Heraeus Precious Metals and Sibanye-Stillwater to explore new applications with palladium**

- Aim is to develop markets for palladium & support the hydrogen sector with technical innovations. Project will be equally funded by both parties
- Heraeus contributing its technical expertise in scaling up & optimizing catalytic processes while Sibanye, leading producers of PGMs focusing identifying innovative applications and develop new markets for PGMs

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