

# Key Developments in Apr '24

Green Hydrogen Monthly Executive Brief

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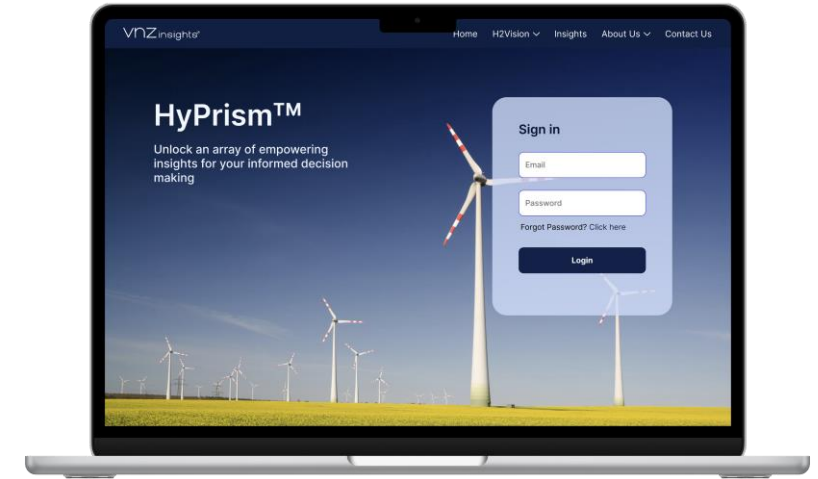
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# Summary (I/II)

## Policy updates



**European Hydrogen Bank auction results** provides ~780 mUSD subsidy for renewable hydrogen production in Europe

**Netherlands awards ~268 mUSD** in subsidies to seven green hydrogen projects

**US awards ~336 mUSD** of investment tax credits for new hydrogen-equipment manufacturing facilities

**Hydrom announces winners** of Oman's second round of green hydrogen auction

## Projects' updates



**MOL inaugurates** the green hydrogen plant in Hungary

**Axpo and Rhienergie open** largest green hydrogen production plant in Switzerland

**5 MW** hydrogen production plant in Bavaria of Germany ceremonially inaugurated

**SJVN launches India's** first multi-purpose green hydrogen pilot project

**EverWind Fuels** announces completion of FEED for its 1st phase 240,000 tonnes per annum green hydrogen to ammonia plant

**Splitwaters** selected by Akna Energy for 20 MW green hydrogen plant to supply turnkey electrolysis solution

**Salzgitter and Uniper** sign pre-contract for supply and purchase of green hydrogen

**EXSOTHyC research project** started, tackling green hydrogen production costs via material innovation

## Asset owner and EPC updates



**Lhyfe** announces the launch of the first green hydrogen marketplace, on its online portal **Lhyfe Heroes**

**Green Energy Park** raises 30 mUSD in initial equity funding for green hydrogen project in Brazil

**Alpiq** acquires a majority stake in the Finnish hydrogen pioneer **P2X Solutions**

**TES** announces the successful fundraising of ~152 mUSD to support the development of its key e-NG projects

**JGC Awarded FEED Contract** for green hydrogen/methylcyclohexane production plant in Malaysia

**INA** has signed two contracts – for construction of a green hydrogen plant in Croatia

**Lhyfe** and Swiss Steel Group subsidiary **Ugitech** signed MoU to decarbonize the Steel Group's operations using green hydrogen

**J-POWER** and **Yamna** sign a MoU for joint development and investment in green hydrogen and ammonia projects globally

# Summary (II/II)

## Electrolyser OEM and supply chain updates

**HyStor Energy** places GW-scale **capacity reservation** with **Nel Hydrogen**

**Accelera electrolyzers** to **power Chevron** solar-to-hydrogen project

**Hygen Energy** announces **strategic-partnership** with **ITM Power** as **preferred supplier** for **200 MW** capacity

**ANDRITZ** acquires **stake** in Norwegian tech-company **HydrogenPro**

**TOPSOE** announces plans for new **US SOEC electrolyser factory** for clean hydrogen

**Fortescue** officially **opens electrolyser facility** in Gladstone, Australia

**Stiesdal Hydrogen** and **Danfoss** **sign** commercial agreement on hydrogen **electrolyser production**

**Elcogen** closes its funding round, **raising** overall **~142 mUSD**

**Sunfire** to conduct **FEED study** for **500 MW** green hydrogen project

**Plug Power** signs two **BEDP Contracts** for **350 MW** electrolyzers across Europe and US

**Doral** announces **strategic** green hydrogen **agreement** with **Verdogy**

**Green Hydrogen Systems** and **BWSC** **sign collaborative agreement** on green hydrogen projects

**Ohmium** partners with **Tata Projects** to advance green hydrogen initiatives in **India**

**H2 Green Mining** and **Ohmium** **sign agreement** to boost green hydrogen in **Chile**

**Hoeller Electrolyzer GmbH** seeks **investors** and strategic partners

**MHI** begins **operation** of **SOEC test module** at Takasago Hydrogen Park

**SolydEra, Bosal, VDL** **collaborated** to accelerate electrolyser industrialization

German manufacturing giant **Bosch** begun shipping **prototypes** of its new **1.2 MW PEM electrolyzers** to pilot customers

**Godrej & Boyce** contributes to one of the world's largest green hydrogen production facility with **cooling systems**

**Green Power IGBT PWM rectifier** was successfully put into **operation** at PetroChina's project



# Key updates

## Policy and auctions

### European Hydrogen Bank auction provides ~780 mUSD for renewable hydrogen production in Europe

- 7 projects selected with combined capacity of 1502 MW located in 4 countries – Portugal (700 MW) Spain (595 MW), Norway (117 MW) and Finland (90 MW).
- Selected projects submitted bids between 0.4 USD and 0.5 USD per kilogram of renewable hydrogen produced.

### Netherlands awards ~268 mUSD in subsidies to seven green hydrogen projects

- Under the OWE Subsidy scheme, 101 MW capacity awarded incentives through competitive bidding process.
- Winning project includes RWE's Eemshydrogen facility, VoltH2's Delfzijl plant, H2 Hollandia, and Van Kessel Olie's plant in Oude Tonge.
- Winners are required to commission their electrolyzers by 2028.

### US awards ~336 mUSD of investment tax credits for new hydrogen-equipment manufacturing facilities.

- ~240 mUSD subsidy awarded to 5 electrolyser OEMs – Topsoe (135.9 mUSD), Nel (41 mUSD), Accelera by Cummins (10.6 mUSD), John Cockerill (34.15 mUSD), Electric Hydrogen (18.35 mUSD).
- Rest of the ~96.6 mUSD incentive awarded to two fuel cell OEMs - Ballard Power Systems and Nuvera; and 1 to CO2 electrolyser OEM Twelve Benefit.

### Hydrom announces winners of Oman's second round of green hydrogen auction

- Hydrom awarded exclusive development rights for land blocks in the Dhofar region for GW-scale green hydrogen projects by two international consortia.
- First winning consortium includes EDF, J-Power and Yamna, planning 178,000 tonnes / year green hydrogen.
- Second consortium includes Fortescue and Actis planning 200,000 tonnes / year of green hydrogen production.

### European Commission approves ~380 mUSD German State aid scheme to support renewable hydrogen production

- Approved funding will be used to support the production of renewable hydrogen through the European Hydrogen Bank's "Auctions-as-a-Service" tool.
- Approved scheme will support the construction of up to 90 MW electrolysis capacity.

### Government of Alberta announced funding for hydrogen through Alberta Innovates and Emissions Reduction Alberta

- Alberta Innovates, in partnership with Natural Resources Canada, is committing 22.5 mUSD for 20 early-stage projects.
- Emissions Reduction Alberta with funding from the Technology Innovation and Emissions Reduction (TIER) program, is committing 34.5 mUSD for eight late-stage projects.

### Chile releases its Green Hydrogen Action Plan 2023-2030

- Plan outlines 81 action items across 18 categories, incl. governance, economic and financial incentives, etc.
- Measures will be implemented in two phases. Phase 1 (2023 to 2026), focus on setting the necessary conditions for the growth of the Green H2 industry. Phase 2 (2026 to 2030), plan will focus on the development of the green H2 industry with an emphasis on regional and local development.

# Key updates

## Projects (I/II)

### **MOL inaugurates the green hydrogen plant in Hungary**

- 10 MW electrolysis unit of Plug Power installed to produce ~1,600 tonnes of clean, carbon-neutral green hydrogen per year.
- ~24 mUSD investment project will reduce the carbon footprint of the Danube Refinery by more than 25,000 tonnes of carbon dioxide per year.

### **Axpo and Rhienergie open largest green hydrogen production plant in Switzerland**

- 2.5 MW plant produces up to 350 tonnes of green hydrogen a year.
- Produced green hydrogen is delivered to refueling stations and industrial customers in the future.

### **5 MW hydrogen production plant in Bavaria ceremonially inaugurated**

- Go-ahead was given for the commissioning of the first grid-connected 5 MW hydrogen production plant in Bavaria, Germany.
- Kraftanlagen Energies & Services SE appointed as general contractor for construction & commissioning.
- Nel Hydrogen's alkaline electrolyser used in the plant.

### **SJVN launches India's first multi-purpose green hydrogen pilot project**

- Project at Nathpa Jhakri Hydro Power Station (NJHPS) will produce 14 kg green H<sub>2</sub>/ day using a 20 Nm<sup>3</sup>/hr capacity alkaline electrolyser.
- Green hydrogen from the project will fuel NJHPS's High Velocity Oxygen Fuel (HVOF) coating facility and will also generate electricity through a fuel cell of 25 kW capacity.

### **EverWind Fuels announces completion of FEED for its 1st phase 240,000 tonnes per annum green hydrogen to ammonia plant**

- EverWind completed Front-End Engineering Design (FEED) and Front-End Loading Engineering (FEL-3) with Black & Veatch for its project in Point Tupper, Nova Scotia.
- Project will use PEM electrolysers with commercial operation expected in 2026.

### **Splitwaters selected by Akna Energy for 20 MW green hydrogen plant**

- Splitwaters will supply a turnkey solution incl. electrolysers, and will be responsible for the engineering, procurement, construction, and commissioning of the plant.
- 20 MW Green hydrogen plant to be built & put into operation in late 2025 to produce 3 million kg of green hydrogen per year.

### **Salzgitter and Uniper sign pre-contract for supply and purchase of green hydrogen**

- Pre-contract covers technical and commercial framework conditions for the supply of green hydrogen to be produced in the 200 MW plant will be used for Salzgitter steel plant.
- Plant planned by Uniper in Wilhelmshaven in Germany, scheduled to be commissioned in 2028.

### **EXSOTHyC project started tackling green hydrogen production costs via material innovation**

- EXSOTHyC, 3-year research project, is funded by Clean Hydrogen Partnership focusing on electrolyser innovation.
- Coordinated by Stargate Hydrogen, project partners include the University of Saint Andrews, Agfa-Gevaert, Eindhoven University of Technology, and Fraunhofer Institute for Manufacturing Technology & Advanced Materials IFAM.



# Key updates

## Projects (II/II)

### Giga-scale green hydrogen project announced in Arctic Norway

- Norwegian developer H2Carrier applied for permission to build two offshore wind farms to produce green hydrogen and ammonia at True North Green Ammonia project.
- Project would produce 109,000 tonnes of green hydrogen per year — suggesting an electrolyser size of ~1 GW — and 610,000 tonnes of green ammonia.

### PNE announces plan to build 1 GW green hydrogen project in Spain

- PNE, German RE developer announced plans to build a 1 GW green hydrogen project in Albacete, central Spain with expected cost of ~3.2 bn USD.
- Project, managed by its Spanish subsidiary Kolya-PNE, secured land rights and water supply in the arid region.

### Helen to invest in Helsinki's first green hydrogen production plant

- Capacity of 3H2 – Helsinki Hydrogen Hub pilot plant project – will be ~ 3 MW.
- Produced hydrogen will primarily be used through a hydrogen filling station.
- Aim is to launch the hydrogen production in the new plant in 2026 and open the hydrogen filling station in 2027.

### Linde to increase green hydrogen production in Brazil

- Linde's subsidiary White Martins will build, own and operate a second 5MW pressurized alkaline electrolyser plant in Jacareí, São Paulo.
- Once operational, White Martins' new plant will supply green hydrogen to glass manufacturer Cebrace and other industrial customers.

# Key updates

## Asset owners and EPCs (I/II)

### Lhyfe announces the launch of the first green hydrogen marketplace on its online portal Lhyfe Heroes

- Digital platform allows buying and selling green hydrogen, anywhere, any time.
- Eventually, Marketplace will be available to all hydrogen buyers requiring delivery (fuel stations, logistics centers, etc.).
- Around ten partners already in the first deployment phase.

### Green Energy Park raises 30 mUSD in initial equity funding for green hydrogen project in Brazil

- Signed a definitive agreement for 30 mUSD Series-A funding and obtained the long-term rights for hydrogen port terminal facilities in Luis Correia, Brazil.
- Green Energy Park - Piaui is the company's first hydrogen production plant, targeting 10.8 GW of electrolyser capacity when fully built.

### Alpiq acquires a majority stake in the Finnish hydrogen pioneer P2X Solutions

- Alpiq now holds 54.9% shares in P2X Solutions with option to raise it to 100% by 2028 end.
- P2X Solutions will be managed on a partnership basis and continue to be run as an independent company.
- Participating interest primarily takes the form of a capital increase and the purchase of the minority stake of an institutional investor.

### TES announces the successful fundraising of ~152 mUSD to support the development of its key e-NG projects

- Investors include AtlasInvest, Reggeborgh, Zhero, Zodiac Maritime, Azimut Group.
- Proceeds from the raise will be used to develop TES' global portfolio of large-scale e-NG (natural gas) production projects and its import terminal project in Wilhelmshaven, Germany.

### JGC awarded FEED contract for green hydrogen/methylcyclohexane (MCH) production plant in Malaysia

- JGC Corporation awarded the Front-End-Engineering-Design contract for a green hydrogen and MCH production plant in Malaysia by ENEOS and Sumitomo Corporation.
- Plant expected to produce ~90,000 tonnes of hydrogen/year for conversion to MCH. Of the hydrogen produced, 2,000 tonnes /year will be supplied to local users.

### INA has signed two contracts – for construction of a green H2 plant in Croatia

- INA, part of MOL Group, setting up 2 green hydrogen projects of 107 mUSD value to be completed by 2026.
- First plant will be setup at Rijeka Refinery with 10 MW electrolyser to produce green hydrogen.
- Second project refers to the industrial location in Sisak where INA is planning to build a facility for production of biomethane.

### Lhyfe and Swiss Steel Group subsidiary Ugitech signed MoU to decarbonize the Steel Group's operations using green hydrogen

- Announced the signing of a MoU for the creation of a green hydrogen production unit at Ugitech's Ugine site, France.
- Lhyfe plans to install a 30 MW electrolyser with a capacity of 12 tonnes/day at the Ugitech plant.
- Green hydrogen produced will be used at steel plant, and for mobility purposes.

### J-POWER and Yamna sign a MoU for the joint development and investment in green hydrogen and ammonia projects globally

- Both parties agreed to jointly develop & invest into green hydrogen projects which are either based on Yamna's existing pipeline or additional projects to be jointly developed.
- Based on the agreed collaboration framework, the Parties will establish specific agreements for any project they jointly engage in future.



# Key updates

## Asset owners and EPCs (II/II)

### **RWE and Haltermann Carless sign MoU to develop green hydrogen project in Harwich, UK**

- RWE and Haltermann Carless to work together to develop green hydrogen plant on land that forms part of the Haltermann Carless industrial site.
- Feasibility studies are completed for a green electrolyser at the site and work is underway to assess both grid and water connections to enable the project to progress.

### **OCP and Fortescue to partner to develop green energy, hydrogen and ammonia in Morocco**

- Collaboration for large-scale integrated green ammonia and green fertilizer production capacity.
- Planning to setup manufacturing of green technology and equipment, R&D and Technology Hub.
- Collaboration of corporate venture capital funds to drive investment in key technology advancements.

### **JERA has concluded an agreement with ReNew Power to jointly develop a green ammonia production project**

- Jointly develop a project from basic design through detailed design in Paradip, India, to produce ~100,000 tons of green ammonia annually.
- Supply green ammonia produced from the Project to Japan approximately 100,000 tonnes annually with JERA.

# Key updates

## Electrolyser OEMs and supply chain (I/III)

### HyStor Energy places gigawatt capacity reservation with Nel Hydrogen

- 1 GW+ capacity reservation of alkaline electrolyzers for Mississippi Clean Hydrogen Hub.
- Nel will provide alkaline technology at scale and contribute with its hydrogen expertise and experience.
- Electrode production at Nel's plant at Herøya, Norway is expected to run through 2025-27.

### Accelera electrolyzers to power Chevron solar-to-hydrogen project

- Accelera by Cummins will supply to Chevron New Energies two 5 MW electrolyser system to produce electrolytic hydrogen in Lost Hills, US.
- PEM based electrolyser system will generate ~2 tons of hydrogen per day at fuel-cell-grade purity.

### Hygen Energy announces strategic partnership with ITM Power to drive industry growth

- Hygen Energy selected ITM Power as a key supplier for PEM electrolyzers.
- 2-phase collaboration will see 50 MW of Neptune Plug and Play electrolyzers across several projects participating in UK's government funding programs, followed by 150 MW of larger-scale modular electrolyzers.
- Each project will be subject to a Final Investment Decision.

### ANDRITZ acquires stake in Norwegian tech-company HydrogenPro

- ANDRITZ, leading EPC player, acquired a 13.8% stake in the HydrogenPro.
- Two companies already entered into a strategic partnership last year to provide integrated solutions for the supply of green hydrogen plants.

### TOPSOE announces plans for new US SOEC electrolyser factory for clean hydrogen

- Announced plans to build a factory in Chesterfield, Virginia for manufacturing SOEC electrolyser with a planned capacity more than 1 GW.
- Awarded 136 mUSD under Federal tax credits from the Department of Energy under the Qualifying Advanced Energy Project Credit (48C).

### Fortescue officially opens electrolyser facility in Gladstone, Australia

- Inaugurated 15,000 sqm advanced manufacturing facility with capacity to produce over 2 GW of PEM electrolyser stacks annually.
- Australian Government contributed ~30 mUSD from the Collaboration Stream of the Modern Manufacturing Initiative for the development of the facility.

### Stiesdal Hydrogen and Danfoss sign commercial agreement on hydrogen electrolyser production

- Stiesdal Hydrogen and Danfoss to introduce an advanced hydrogen electrolyser solution based on heat exchanger design.
- Both companies collaborated to develop a new and scalable solution for the electrolysis cell stack of Stiesdal's electrolyzers.

### Elcogen closes its funding round, raising overall ~142 mUSD

- Closed funding round with strategic investment from Baker Hughes and equity investment from Hydrogen One Capital Growth plc, HD Hyundai and Mirae, and project grants from the European Commission.
- Funds will be used to expand Elcogen's manufacturing capacity at new factory facility in Tallinn, Estonia, with a manufacturing capacity of up to 360 MW.

# Key updates

## Electrolyser OEMs and supply chain (II/III)

### Sunfire to conduct FEED study for 500 MW green hydrogen project

- Sunfire will be conducting the front-end engineering and design study (FEED) for a 500 MW hydrogen project in Europe scheduled for operation by 2028.
- Sunfire's comprehensive FEED study will define operational parameters, site requirements, and execution guidelines with integration partners (EPCs).

### Plug Power signs two BEDP contracts for 350 MW electrolysers across Europe and US

- Contracted to deliver Basic Engineering and Design Packages (BEDP) for projects in Europe and the U.S. with a combined capacity of up to 350 MW of electrolysers.
- These agreements enhance Plug's overall BEDP portfolio, bringing the company's total amount of global BEDP contracts to 4.5 GW.

### Doral announces strategic green hydrogen agreement with Verdagy

- Companies will collaborate on Doral's green hydrogen development pipeline of over 1 GW to deploy Verdagy's electrolysers in Doral's facilities.
- Verdagy will supply systems to Doral through 2030.
- Agreement is global with a focus in Europe, United States, Australia and the Middle East.

### Green Hydrogen Systems (GHS) and BWSC sign collaborative agreement on green hydrogen projects

- Aim of the collaboration is to offer full green hydrogen plants with pre-engineered & optimized site layout based on GHS' HyProvide X-Series module.
- Focus is on reducing time and risk during project maturation and execution.
- Targeting green hydrogen projects in 6-50 MW range in key European markets.

### Ohmium partners with Tata Projects to advance green hydrogen initiatives in India

- Ohmium will provide PEM electrolysers while Tata Projects will manage the entire EPC process, including engineering, design, integration, and optimization.
- Strategic partnership combining expertise of both entities to ensure seamless project execution and deliver a comprehensive and cost-effective solutions green hydrogen in India.

### H2 Green Mining and Ohmium sign agreement to boost green hydrogen in Chile

- Collaborating on developing a 20 MW green hydrogen pilot project, with a potential to rapidly scale to 200 MW.
- Green hydrogen output will be used in mines and fuel trucks.
- The project is based in Northern Chile, in the town of Calama in the Atacama Desert.

### Hoeller Electrolyzer GmbH seeks investors and strategic partners

- Hoeller will be utilizing the new funding to finalize the development of the Prometheus - PEM based stacks.
- Hoeller filed an application for preliminary insolvency proceedings at the end of March.

### MHI begins operation of SOEC test module at Takasago Hydrogen Park

- MHI SOEC test module comprises a module with multiple cartridges of 500 cell stacks bundled together.
- During test operations, the electrolytic efficiency of the module recorded was 3.5 kWh/Nm<sup>3</sup>.
- MHI plans to install a MW-class SOEC system demonstration facility in next few years.

# Key updates

## Electrolyser OEMs and supply chain (III/III)

### **SolydEra, Bosal, VDL to accelerate electrolyser industrialization**

- MoU signed to advance solid oxide electrolyser and fuel cell technologies.
- Alliance combines SolydEra's expertise in solid oxide fuel cells and electrolysis stacks, Bosal's capabilities in developing 'Hot Balance of Plants', and VDL's experience in manufacturing, industrialization, and system assembly.

### **German manufacturing giant Bosch begun sending prototypes of its new 1.2MW PEM electrolysers to pilot customers**

- Compact PEM electrolysers are expected to be launched commercially in 2025.
- Bosch Electrolysers can produce 1kg of hydrogen from ~52 kWh of electricity.

### **HydrogenPro granted a new R&D project "H2-ELECTRODE"**

- Project is a trans Nordic M-ERA.NET with focus on improving the efficiency of alkaline electrolysis.
- Project partners include Aarhus University and the company Seldeon Oy in Finland.
- Project has a total value of 1 mUSD and is supported by 0.7 mUSD with contribution from Innovation Fund Denmark, Business Finland, and The Research Council of Norway.

### **Electric Hydrogen marks the opening of its electrolyser gigafactory**

- Inaugurated factory at Devens, Massachusetts (US).
- Once fully ramped, facility will produce 1.2 GW capacity electrolysers.
- Electric Hydrogen headquarters, where core electrolyser technology developed, also located in Massachusetts.

### **Godrej & Boyce contributes to one of the world's largest commercial-scale green hydrogen plant**

- Godrej Process Equipment provided 8 heat exchangers to a green hydrogen project in the Middle East.
- Godrej Process Equipment invested around 36 mUSD for the enhancement of manufacturing facility for delivery of specialized and large equipment especially in the hydrogen, clean energy and power sectors.

### **Green Power IGBT PWM hydrogen production rectifier was successfully put into operation**

- IGBT PWM rectifier was successfully put into production for PetroChina's Yumen Oilfield Hydrogen Demonstration project.
- Green Power's IGBT PWM hydrogen production rectifier adapted for Qianfang alkaline electrolyser.

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