Hydrogenious LOHC

Safe. Flexible. Independent.
LOHC for resilient energy systems.

Made in Europe.
Built for scale.

Hydrogenious LOHC

Hydrogenious LOHC enables safe, efficient and flexible hydrogen storage and transport to consumers in industry and mobility across the globe, made in Europe. Our proven Liquid Organic Hydrogen Carrier technology is based on benzyltoluene as carrier medium (short: LOHC-BT) and can utilize conventional liquid-fuel infrastructure.

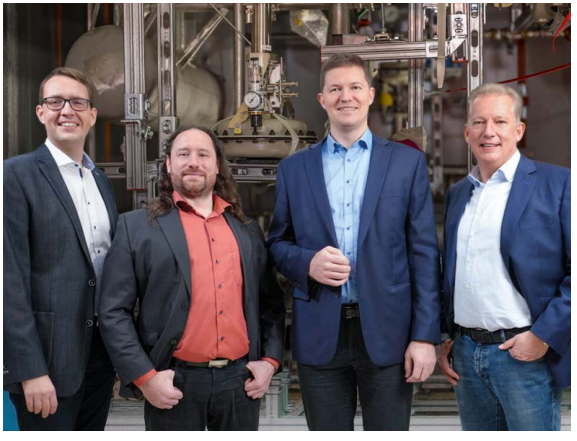
Founded in 2013 as a pioneer in LOHCs, Hydrogenious LOHC has since become Europe's market leader in LOHC technology, built on innovation and technological excellence. Our company focuses on the development of LOHC-BT technology for small and large-scale hydrogen transport and storage solutions. Our portfolio includes small-scale units for local energy solutions, R&D systems, large-scale plants for industrial applications as well as consultancy, licensing and services along the value chain.

With our unique technology expertise and experience in realizing LOHC applications in various settings, we empower hydrogen producers and offtakers to build cost-efficient, clean and safe hydrogen trade routes.

Headquartered in Erlangen/Germany with around 50 employees and investors AP Ventures, Royal Vopak, Winkelmann Group, Mitsubishi Corporation, Covestro, JERA Americas, Temasek, Hyundai Motor Company, Chevron Technology Ventures, Paviliion Capital and Valterra Platinum, we are a major enabler and accelerator for the energy transition.

Hydrogenious LOHC Maritime

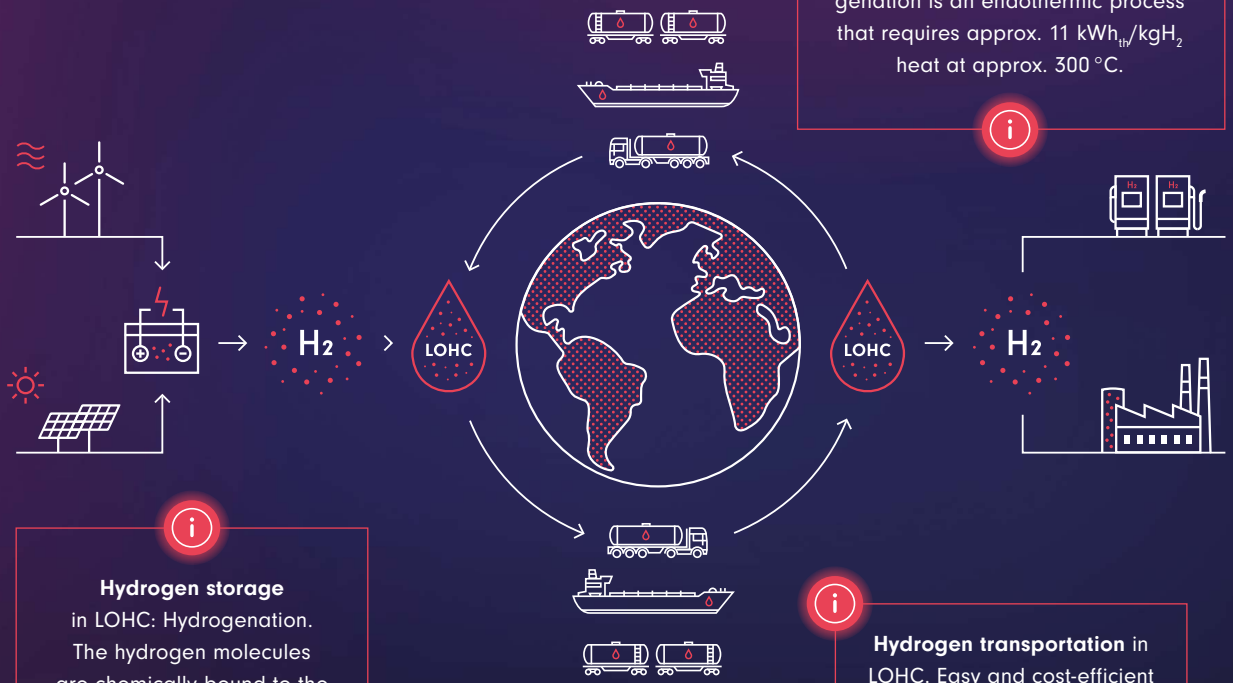
Hydrogenious LOHC Maritime, established as Joint Venture with Østensjø Group in 2021 and located in Norway, develops an emission-free on-board propulsion system with a promising LOHC/fuel cell solution for the global shipping industry.



The Hydrogenious LOHC management team (from left): Dr Andreas Lehmann (Chief Executive Officer), Dr Caspar Paetz (Chief Technology Officer), Dr Daniel Teichmann (Executive Chairman of the Board of Directors) and Dr Stefan Buerkle (Chief Operating Officer)

We store hydrogen in a liquid organic carrier. The missing link to clean hydrogen supply chains.

Hydrogen release from LOHC: Dehydrogenation. The hydrogen molecules are chemically released from the LOHC via a catalytic reaction in a continuous process. The dehydrogenation is an endothermic process that requires approx. 11 kWh_{th}/kgH_2 heat at approx. 300 °C.



Hydrogen storage in LOHC: Hydrogenation. The hydrogen molecules are chemically bound to the LOHC via a catalytic reaction in a continuous process. The hydrogenation is an exothermic process generating approx. 9 kWh_{th}/kgH_2 heat at approx. 250 °C.

Hydrogen transportation in LOHC. Easy and cost-efficient logistics utilizing the existing infrastructure for fossil fuels via ship, barge, train or truck. The same applies to LOHC storage.

LOHC-BT technology enables safe, flexible and efficient hydrogen infrastructure.

Superior safety

- No handling of molecular hydrogen
- Hardly flammable with flash point 112.5 °C, non-explosive, even when loaded with hydrogen
- Hazard potential comparable to Diesel and thus clearly superior to ammonia

Enhanced flexibility

- Conventional liquid fuel infrastructure usable
- Handling at ambient temperatures and pressure during storage and transport
- No self-discharge over time – multi-month storage without losses

High efficiency

- Competitive volumetric storage density 54 kg hydrogen per m^3 LOHC
- More than 99.9 % hydrogen purity from the process without purification step
- Carrier material commercially available and reusable hundreds of times

We provide technology for stationary LOHC applications, optimized for scalability.

Large-scale Plants

Storage

- Flexible industrial hydrogenation unit to match with renewables
- Direct coupling with large-scale electrolysis and steam methane reforming
- Can be combined with underground storage

Hydrogenation process	Exothermic reaction using a solid catalyst
Heat release	Approx. 9 $kWh_{th}/kg\,H_2$ at 200 – 250 °C for Storage Plant
Reaction pressure	Approx. 15 – 30 barg

Release

- Industrial dehydrogenation unit designed for continuous and flexible operation
- Designed for coupling with hydrogen hubs and pipeline networks
- Can be combined with underground storage

Dehydrogenation process	Endothermic reaction using a solid catalyst
Heat demand	Approx. 11 $kWh_{th}/kg\,H_2$ at 250 – 330 °C for Release Plant
Released hydrogen purity	More than 99.9 %; fuel cell hydrogen quality (ISO-14687) with additional purification step
Reaction pressure	Approx. 1.5 – 3 barg

Small-scale Units

Mini Plants

- Lab-scale R&D systems
- 5 pre-defined system setups available

Use Cases	› Reactor test/Catalyst test › Process data measurement
System Design	› 12 – 65 g H_2 release per hour › 15 – 600 g H_2 storage per hour › Housing depending on plant capacity (1x1x1 m up to 4x4x4 m)

Container Systems

- Turnkey container-based systems
- Available for hydrogenation and dehydrogenation

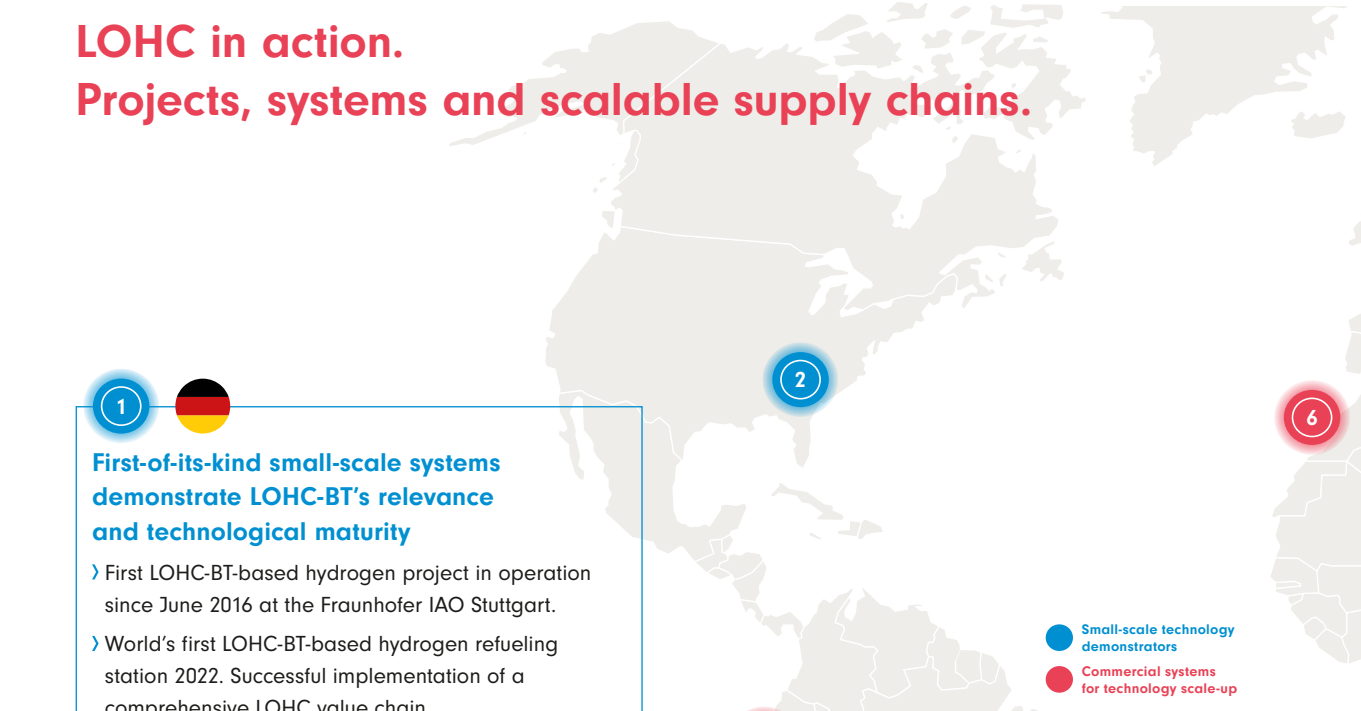
Use Cases	› Process demonstration › H_2 supply chain integration › LOHC job training
System Design	› 1 kg H_2 storage/release per hour › 20 to 30 foot container

Custom Solutions

- Individual process and system design
- Pilot projects for hydrogenation, de-hydrogenation or combined processes

Use Cases	› Smaller industrial systems › Large LOHC demonstrator
System Design	› Up to 15 kg H_2 storage/release per hour › Up to 4x20 foot container

LOHC in action.
Projects, systems and scalable supply chains.



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First-of-its-kind small-scale systems demonstrate LOHC-BT's relevance and technological maturity

› First LOHC-BT-based hydrogen project in operation since June 2016 at the Fraunhofer IAO Stuttgart.

› World's first LOHC-BT-based hydrogen refueling station 2022. Successful implementation of a comprehensive LOHC value chain.

2

Go West 2016

› Two box systems for United Hydrogen to expand the local hydrogen supply radius.

3

HySTOC 2018

› Demonstration of cost-effective storage and transport of hydrogen stored in LOHC to a hydrogen refueling station.

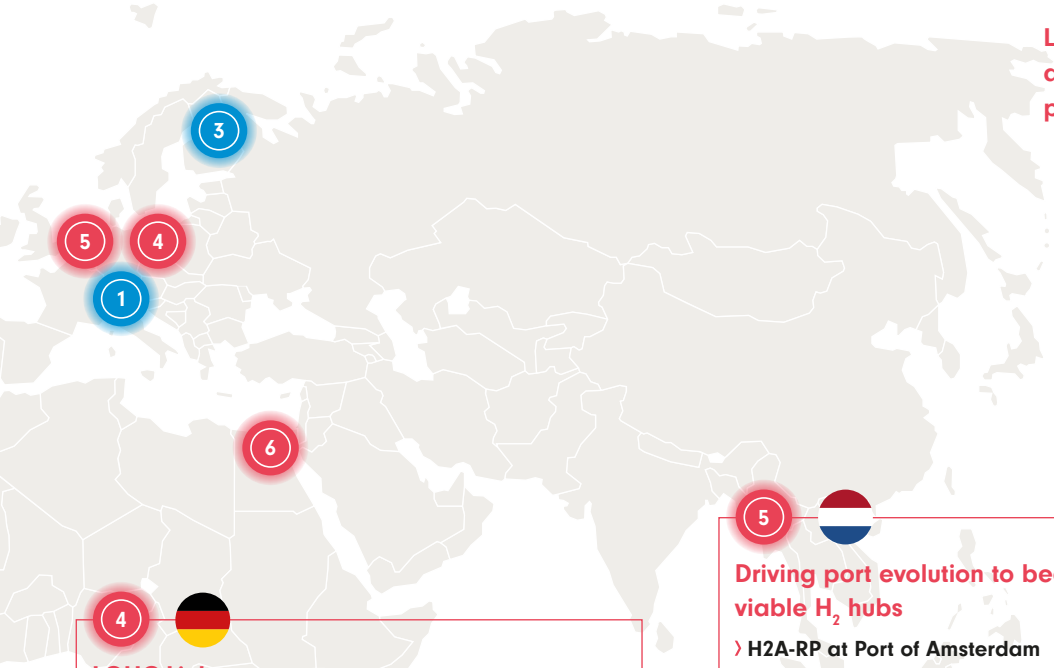
4

LOHC technology scale-up within Europe

› **One Reactor**
Unique reactor concept at Forschungszentrum Jülich to leverage the potential of LOHC-BT as energy storage medium: Storage and release of up to 100 tonnes of hydrogen per year from and in LOHC using one single reactor. Ready for operation in 2026.

› **Multi-SOFC demo project**
First-of-its-kind combination of hydrogen technologies for Hermann Josef Hospital Erkelenz: SOFC system, supplied with hydrogen released from LOHC, to be operational by the end of 2026.

Learn more about our projects:



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LOHC Link: An industrial end-to-end LOHC value chain

› **Project Hector**
Industrial plant for storing up to 1,800 tonnes of RFNBO hydrogen per year in LOHC at CHEMPARK Dormagen (Cologne, Germany). Hector will supply the Green Hydrogen @ Blue Danube Release Plant to establish a comprehensive LOHC link at industrial scale.

› **Green Hydrogen @ Blue Danube**
First LOHC hub in Central Europe, with the Release Plant located at the Bayernoil refinery in Vohburg a.d. Donau (Bavaria, Germany), providing a hydrogen release capacity of up to 1,800 tonnes per year. The plant is primarily supplied with loaded LOHC by Project Hector. Additionally, a storage system coupled with electrolysis in Bavaria will deliver up to 160 tonnes of green hydrogen per year.

5

Driving port evolution to become viable H_2 hubs

› **H2A-RP at Port of Amsterdam**
Joint cross-border lighthouse project with Evos & Port of Amsterdam with the goal to install an industrial large-scale LOHC Release Plant, aiming to import 36,000 tonnes of green hydrogen per year.

6

Enabling long-distance H_2 supply chains worldwide

› **LOHC Bridge**
A joint feasibility project under GIZ's H2Uppp program, in partnership with IRESEN and the Suez Canal Economic Zone, to assess the feasibility and role of LOHCs in the export of green hydrogen from Morocco and Egypt to Europe. It delivers a concise, evidence-based blueprint for large-scale LOHC import corridors.

Let's build the new energy world together: Your key contacts.

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