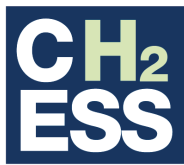


An aerial photograph of a small, perfectly circular island covered in dense, vibrant green forest. The island is situated in the center of a deep blue lake. The water's surface is textured with ripples and reflects the sky, which is filled with soft, white clouds. The overall scene is serene and natural, suggesting a focus on environmental or ecological research.

LTU CH2ESS

ResearchDays
27-28 Aug. 2025



**Centre for
Hydrogen
Energy Systems
Sweden**

AT LULEÅ UNIVERSITY OF TECHNOLOGY



Hydrogen is the key to a fossil-free energy systems and Luleå University of Technology is involved and secures that development in Sweden through groundbreaking research and skills supply. Luleå University of Technology is a strong research and education partner to the Swedish hydrogen industry with the aim of replacing fossils fuels and cope with the global climate change.

CH2ESS is a research and knowledge initiative at Luleå University of Technology with a focus on hydrogen use in industrial processes and energy systems, in close collaboration with Swedish industry, and international partners.





Meet

Transform Connect

These two days offered a unique opportunity for researchers from academia and professionals from industry to network and exchange knowledge and experiences on hydrogen technologies and their role in shaping a sustainable energy future.

”

” Together for a sustainable Tomorrow



By bringing diverse perspectives from research and industry, LTU CH2ESS Research Days highlighted the latest developments in hydrogen and opened new paths for collaboration, innovation, and real-world impact.



Opening Speech:

The annual LTU CH2ESS Research Days at Luleå University of Technology gathered over 120 participants, equally divided between LTU researchers and external guests from Sweden, Poland, Norway, Finland, and beyond. Discussions focused on innovation and future R&D goals in the hydrogen field, complemented by company pitches from Vattenfall and Nordion Energi.

In her opening, Dr. Cecilia Wallmark, Director of CH2ESS, emphasized three key themes:

- understanding our current position in research*
- identifying development needs in both research and education, and*
- sparking innovation together.*

Associate Prof. Cecilia Wallmark
Director of CH2ESS





Reflections from H2AMN



Prof. Joakim Lundgren
Deputy Director of CH2ESS

Prof. Joakim Lundgren, Deputy Director of CH2ESS, shared insights from the H2AMN project on the future of hydrogen supply and its challenges. He highlighted the strong potential for hydrogen and methanol production in northern Sweden, while noting that biomass-based hydrogen remains an underused opportunity.

He also emphasized that, with growing hydrogen demand, large-scale energy exports from the region are unlikely. Finally, Prof. Lundgren underlined the importance of avoiding energy colonialism by ensuring a just and sustainable transition amid accelerating investments in green energy.



Linda Wårell

Associate Prof. in Economics at LTU

Linda Wårell, Associate Professor in Economics at Luleå University of Technology, presented findings on drivers and barriers for hydrogen carriers in northern Sweden's ports.

Key drivers include future cost reductions, access to low-cost green electricity, and strong policy targets. Main barriers are high costs, limited support, long implementation timelines, and safety concerns.

She highlighted three priorities:

- stronger carbon taxation and funding,*
- broader collaboration, and*
- clearer political leadership for long-term investments.*



Panel Discussion

The Regional Perspective



The session featured representatives from industry and the energy sector, including Joakim Lundgren, Linda Wårell, and Patrik Isaksson. The panel emphasized the importance of finding synergies between industry and maritime shipping, suggesting that tailored energy carriers could create a more efficient and resilient system.

The discussion also underscored the need for stronger political leadership and consistent policies to reduce uncertainty. As fossil fuels must become less competitive, a holistic approach involving all stakeholders is essential. High hydrogen costs remain a major challenge, highlighting the need for closer cross-sector collaboration.



Max Meju

Professor in Applied Geophysics at LTU



Natural Hydrogen: Challenges & Opportunities

Prof. Max Meju, delivered the keynote “Natural Hydrogen Exploration from Source to Sink: Challenges and the Way Forward.” He highlighted the accidental discovery of hydrogen during a 2023 methane exploration in France, showing the potential of natural hydrogen reservoirs to meet future demand.

While electrolysis remains costly, “white hydrogen” could complement green hydrogen. Yet, challenges such as scalability, extraction, and transport persist. Prof. Meju stressed the need for integrated geochemical and geological approaches, and concluded that multidisciplinary collaboration and innovation are crucial to unlock natural hydrogen’s role in the energy transition.

Sustainable Catalysts for H₂ Production



Alberto Vomiero

Professor in Experimental Physics at LTU

Prof. Alberto Vomiero, UNESCO Chair Aid4GEA at Luleå University of Technology, presented his work on using non-critical raw materials for hydrogen production.

Currently, about 96% of industrial hydrogen is produced from fossil sources. Transitioning to water electrolysis is essential but limited by the use of scarce catalysts such as platinum and iridium.

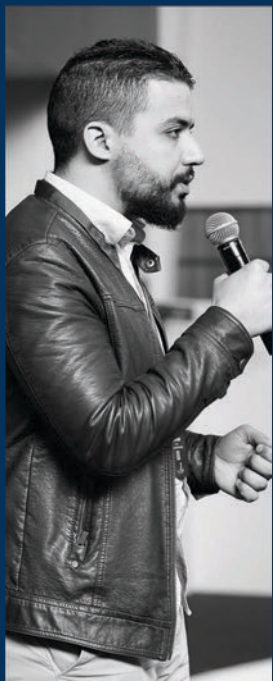
Prof. Vomiero's research explores non-critical oxides and sulphides as environmentally friendly, low-cost, and stable alternatives, paving the way for sustainable, scalable, and noble-metal-free hydrogen production.



Frontiers of Innovation

Researchers presented posters spanning hydrogen and sustainable energy, from materials and storage to electrolysis, industry applications, and biocatalysis.

The session highlighted innovative solutions, interdisciplinary collaboration, and the many pathways driving the hydrogen transition.



Turning Risky Ammonia into Safe Hydrogen Storage

Janna Attari

PhD Student in Material Design and Engineering



Janna Attari, presented her research on safe and efficient hydrogen storage using porous ammonia carriers.

Her work focuses on structuring alkaline earth metal halides, such as strontium chloride (SrCl_2), into advanced composites capable of reversibly storing ammonia.

Through methods like electrospinning, freeze-casting, and slip casting, she addresses key challenges including volume expansion, mechanical instability, slow desorption kinetics, and upscaling.

The goal is to develop solid-state systems for safer ammonia storage and transport—supporting a cleaner energy future where materials science drives the hydrogen transition.



Hydrogen Safety

Prof. Michael Försth, Professor in Fire Engineering, opened the session with a presentation on hydrogen safety from a fire and explosion perspective. Hydrogen poses unique risks and advantages, demanding new safety strategies beyond traditional industrial settings. He described three outcomes of a hydrogen leak: direct ignition with a jet flame, delayed ignition leading to explosion, or no ignition at all. Since hydrogen flames are invisible, material behavior is crucial—tests showed a blue cable absorbed 93% of infrared radiation, while an aluminum cap absorbed only 13%. Prof. Försth also highlighted pipeline failures caused by excavation or underground rupture, underscoring the need for precise safety distance calculations and scientific understanding as hydrogen use expands.

Michael Försth

Professor in Fire Engineering at LTU

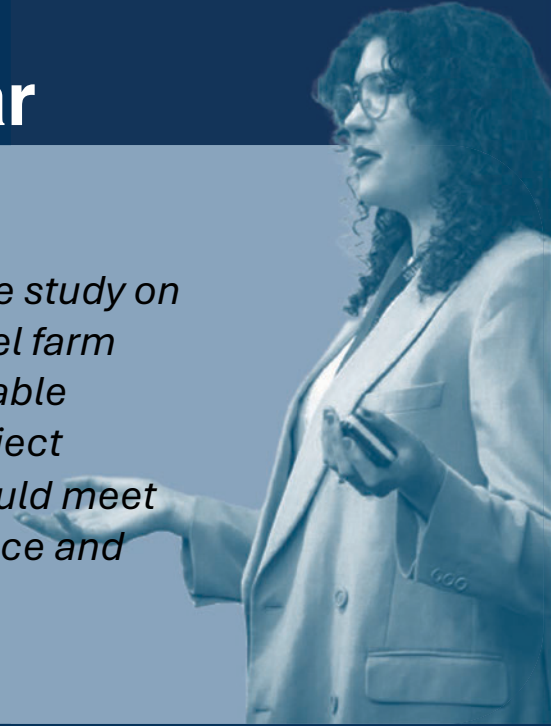




Alma Fahlén Hammar

PhD Student in Water Engineering at LTU

Alma Fahlén Hammar, presented a case study on using excess agricultural biomass to fuel farm vehicles. Developed within the Sustainable Hydrogen Value Chains course, the project showed that hydrogen and methane could meet fuel demand, enhancing energy resilience and reducing fossil dependence.



Andrea Correa

PhD Student in Fire Engineering at LTU

Andrea Correa, presented her research on radiative heat transfer from hydrogen jet flames. She showed that air humidity greatly reduces thermal radiation, directly influencing heat exposure and safety design.

Her work supports the development of safer hydrogen systems, with future integration into CFD simulations expected to improve large-scale safety assessments and infrastructure design.





Panel Discussion

Readiness for Hydrogen Infrastructure



A panel featuring Andrea Correa, Prof. Michael Försth, and representatives from Gällivare Näringsliv AB, Bodens Utveckling AB, and Nordion Energi discussed hydrogen infrastructure readiness.

They highlighted the need for large-scale safety data, noting that humidity can improve safety during hydrogen incidents. The panel also emphasized clearer permitting processes and closer collaboration between industry, researchers, and municipalities to ensure a safe and effective hydrogen transition.



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Prof. Jakub Kupecki

Institute of Power Engineering – National Research Institute (Poland)

The session “Hydrogen in Transport and Industry” showcased international collaboration, featuring the Polish team from the Institute of Power Engineering – National Research Institute. Prof. Jakub Kupecki presented on Power-to-X technologies using solid oxide electrochemical cells (SOECs).

He highlighted SOECs’ high efficiency at operating temperatures above 680 °C and their independence from scarce noble metals. His team’s metal-glass-ceramic SOECs offer a sustainable alternative to iridium-based PEM systems. With projects like HYDROGIN, VETNI, and MEGA-SOE, Poland demonstrates strong progress in hydrogen innovation. The session emphasized that international collaboration and technology diversity are key to a resilient hydrogen future.

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FINAST project: LTU, SSAB & Swerim
collaboration for climate-neutral steel



Jens Hardell

Professor in Machine Elements at LTU

Prof. Jens Hardell, presented ongoing efforts to enable fossil-free steel production through hydrogen integration.

He introduced the FINAST project focused on climate-neutral steelmaking through industrial research and cross-sector collaboration.

Prof. Hardell also highlighted the new CO₂-NICE project, which studies how alloy variations in scrap-based steelmaking affect the value chain and how to reduce their impact. Both initiatives reflect Sweden's strong drive toward a low-carbon, fossil-free steel industry.

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Hydrogen 2025: Special Edition – Education



Guided by Cecilia Wallmark and Erik Elfgren from Luleå University of Technology, participants explored how hydrogen-related expertise can reach the sectors that need it most.

Discussions covered two perspectives:

Universities: *How to integrate hydrogen more effectively into courses and programs, identify gaps, and promote collaboration. Industry:* *What knowledge and training are needed within organizations and among partners to support hydrogen adoption.*

The session emphasized that education and collaboration are essential to building a skilled, hydrogen-ready workforce.





Bonus Session



Power Grid & Green Transition

Led by:

Math Bollen

Professor in Electrical Engineering at LTU

The afternoon bonus session, led by Prof. Math Bollen, Professor in Electrical Engineering at Luleå University of Technology, focused on the TransNorr42 project cluster addressing transmission grid challenges arising from changing production and consumption patterns linked to the green transition. Initiated in northern Sweden, the project has relevance far beyond the region.

Researchers presented new insights on key topics:

- *Rashmika Kudahetti: stochastic market methods*
- *Peter Haigh: hosting capacity for H₂ production*
- *Mahsa Azarnia: hosting capacity for smart grids*
- *Marjan Katal : hosting capacity and flexible hydropower*





Closing Reflections:

The two-day event concluded with a warm summary by **Dr. Cecilia Wallmark**, who highlighted that accelerating hydrogen research, innovation, and education also requires better communication.

Mikael Börjesson and **Markus Odevall** offered closing reflections on collaboration and the path ahead. Markus emphasized the importance of working together across sectors and maintaining a systems view with stronger material regulation to drive industrial transformation. Mikael reflected on the global context of hydrogen development, noting security and large-scale experimentation as emerging priorities.

The event closed on an inspiring note:

momentum is building, collaboration is deepening, and together, the CH2ESS community is ready to lead the change.





With Gratitude

“The annual LTU CH2ESS Research Days are truly one of the highlights of the year for me. It is inspiring to hear our researchers share their progress and exciting results, while engaging in open discussions on future development needs together with industry partners, the public sector, and visiting colleagues from universities in several other countries. You are warmly welcome to join us next year—please reserve August 26–27, 2026.”



Cecilia Wallmark
Director of CH2ESS



*Sincere thanks to the CH2ESS Steering Group
for their support and guidance in making the
CH2ESS Research Days 2025 a success.*





CH₂ESS

Research Collaboration, Project Partners, and Financiers

Research Collaboration, e.g.	Additional Project Partners, e.g.	Public Research Project Financiers
Aalto University	ABB	Energimyndigheten
Aston University	AFRY	European Commission
Bioenergy and Sustainable Technologies (BEST)	Energiföretagen Sverige	European Innovation Council
Chalmers University of Technology	Energigas Sverige	Industrarbetarnas Stiftelse vid Baltiska Trävaru AB
DBFZ – Deutsches Biomasseforschungszentrum	Gällivare kommun	Interreg / European Union
Energiforsk	GEN-H Hydrogen Energy Solutions	Interreg Aurora
Gas Technology Institute (GTI)	Glocal Green	Kempestiftelserna
IEA Bioenergy	Göteborgs Hamn AB	Nordic Energy Research
Institute of Hydrogen Research (UQTR)	Hydri	Stiftelsen Energitekniskt Centrum i Piteå
IVL Swedish Environmental Research Institute	LKAB	Swedish Mining Innovation
Karlsruhe Institute of Technology (KIT)	LTU Green Fuels	Tillväxtverket
KTH Royal Institute of Technology Lindholmen Science Park	Lumire Luleå Miljöresurs MAX IV	Trafikverket Vetenskapsrådet
Lund University	Nordion Energi	Vinnova
Norwegian University of Science and Technology (NTNU)	Pite Energi	
NREL – National Renewable Energy Laboratory	Piteå Hamn AB	
NTNU Energy – Team Hydrogen	PRISMAS	
RISE Research Institutes of Sweden	SEKAB	
Swerim	SKB	
Technical University of Denmark (DTU)	SKF	
Technische Universität München (TUM)	Skoogs Bränsle AB	
The World Bank	Smurfit Kappa	
TNO – Innovation for Life	SSAB	
Umeå University	Statkraft	
Università degli Studi di Cagliari	SunPine	
University of Oulu / H2Future	Svenska Kraftnät	
VTT Technical Research Centre of Finland	Zelk	



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