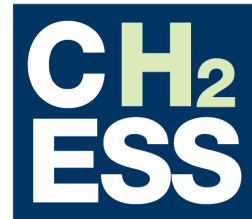


Welcome to us!

Dr. Cecilia Wallmark
Director of CH2ESS

Within the hydrogen area since 1999



**Centre for
Hydrogen
Energy Systems
Sweden**

AT LULEÅ UNIVERSITY OF TECHNOLOGY

LULEÅ
TEKNISKA
UNIVERSIT

LULEÅ
UNIVERSITY
OF TECHNOLOGY



National and European perspectives

- FCH JU, 2008
- The EU 2050 climate targets
Driving demand.
- The EU Hydrogen Strategy 2020
EU support to RnD, mass production and incentives.
Hydrogen Valleys.

- 1990's - Large R&D programs on fuel cells
- 2004 – Limiting national R&D funds for hydrogen and fuel cells
- 2016 – The industry project Hybrit
- The Swedish strategy proposal 2021
Including targets as international frontrunners and global use.



Green power, biomass, distr heating, green CO₂, H₂O, capital

Sweden as a frontrunner in hydrogen

[Vätgaskonferensen 2023, CH2ESS @ LTU]

Active stakeholders along the full value chain, geographical spread, applications and systems

Major component suppliers

- ABB
- Hitachi
- SKF
- Alfa Laval
- ...

Early network of HRS
 >60 stations accepted for public financial support

High quality heavy-duty FCV

- Volvo
- Scania



Front runners in fossil-free green iron and steel etc

- SSAB
- LKAB
- H2 Green Steel
- Ovako
- Power2Earth

Hydrogen based fuel production

- Liquid Wind
- St1
- Vattenfall
- Uniper
- ...

World class fuel cell material, components, stacks and systems

- PowerCell
- Alleima
- Cellimpact
- Permascand...

Energy system innovations and research with multiple stakeholders and sector coupling

Marine applications

- Gotland
- ...

Strong innovation, SME

E.g for flights with FC, GT, hydrogen storage

First movers

World class hydrogen research

- KTH
- Umeå
- Chalmers
- Lund
- Uppsala
- LTU
- RISE

World leading steel and metallurgy research

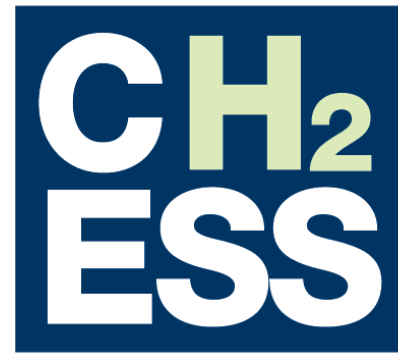
- LTU
- KTH
- Swerim

Stakeholders active in hydrogen and fuel cell research and development, all TRL



EU Hydrogen Week 2022-2024

Initiated 2021



**Centre for
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- 1) Education**
- 2) Excellent, demand driven research**
- 3) Accelerating hydrogen:
Regional, national & Nordic events**



LTU - excellence



Production

Distribution

Storage

Use

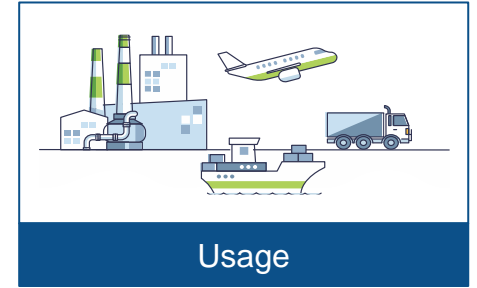
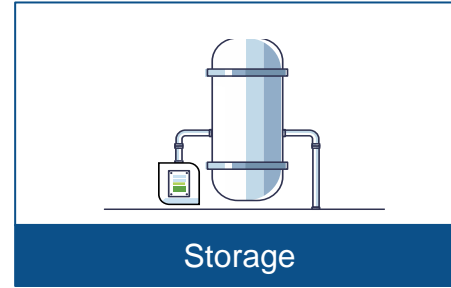
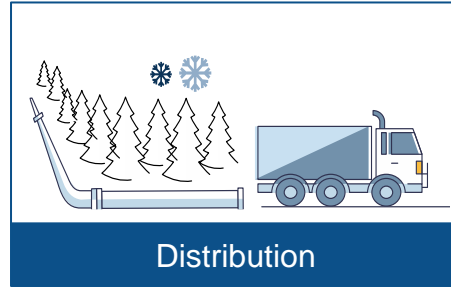
Safety,
health,
acceptance

- Electric power technology – grid issues and smart power grid;
- Energy system analysis – Scenario analysis; Climate; Energy efficiency
- Sustainable energy technology – Advanced biofuels, combustion, district heating, CCS, ...
- Building design and fire – Safety against fire and explosion
- Production development – Laser welding; Manufacturing
- Rock mechanics – Storage in lined rock caverns
- Geological and environmental science – CO₂ storage
- Applied physics – Control technology
- Machine design – Hydrogen distribution
- Cyber-physical systems – Hydrogen storage and distribution
- Fluid mechanics – Hydrogen distribution/safety
- Quality technology and logistics
- Rights of indigenous people
- Human work sciences – Safety
- National economy
- Environmental law
- History, city planning...

CH₂ESS Steering Group – Accelerating hydrogen

 <p>VATTENFALL</p>	 <p>Skellefteå Kraft</p>	 <p>Stegra</p>	
 <p>Luleå Energi</p>	 <p>REGION NORRBOTTEN</p>	 <p>region västerbotten</p>	 <p>BODENS KOMMUN</p>
 <p>Skellefteå kommun</p>	 <p>Piteå kommun</p>	 <p>LULEÅ KOMMUN</p>	 <p>LULEÅ TEKNISKA UNIVERSITET</p>
 <p>TITAN KONSTRUKTION</p>	 <p>GÄLLIVARE NÄRINGSLIV</p>		

**The CH₂ESS
growing
research
portfolio (2022-2023
funding)**



Energy & Fluid mechanics

Electrocatalytic production of liquid organic hydrogen carriers (LOHC) and chemicals from lignin

Methanol as a storage

Oxygen in iron oxide process

Carbon capture, storage and use

Green Fuels

Power grid connections

Formic acid as hydrogen carrier

Hydrogen from biomass

Pipeline flows x2

1 MW electrolyser (H2LABS)

Material & Safety

Condition monitoring - pipelines

Polymer for H₂ tanks

Lined rock caverns

Ammonia – storage materials

Laser welding for stationary storage

Industrial symbiosis, energy & storage in rock caverns (H2AMN)

Bearing performance

Fossil-free steel (FINAST)

Safety, permits & acceptance (H2SIPP)

Law & Economics

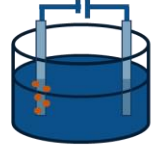
Heavy duty vehicles

Socio-technical challenges, stakeholders

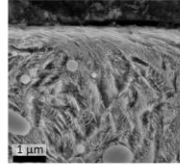
LTU initiative develops new lab test facilities for hydrogen – with 2022-2023 national & EU funding



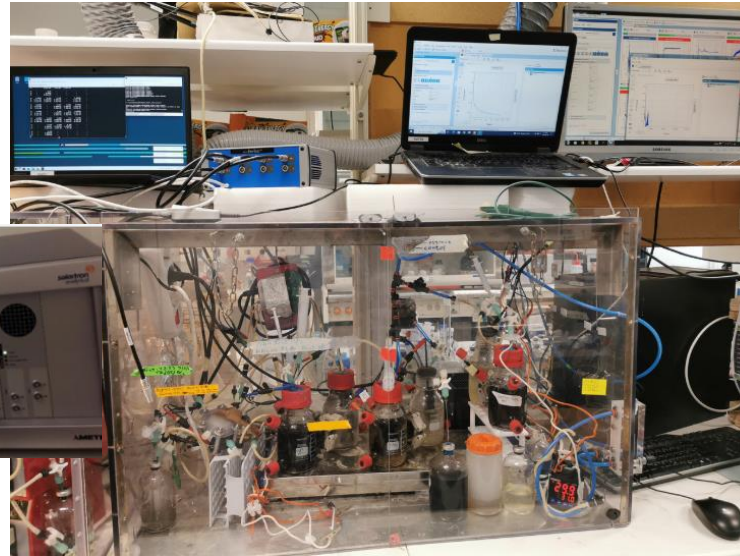
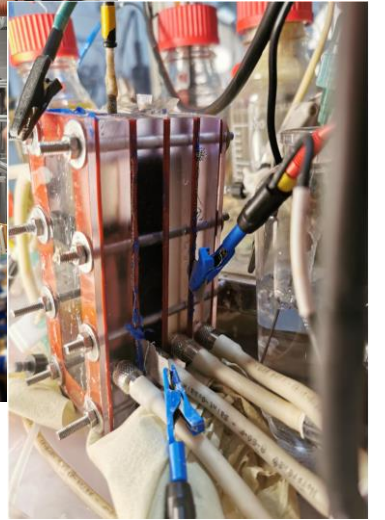
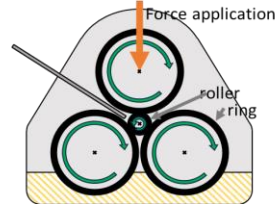
1: Electrochemical hydrogen charging

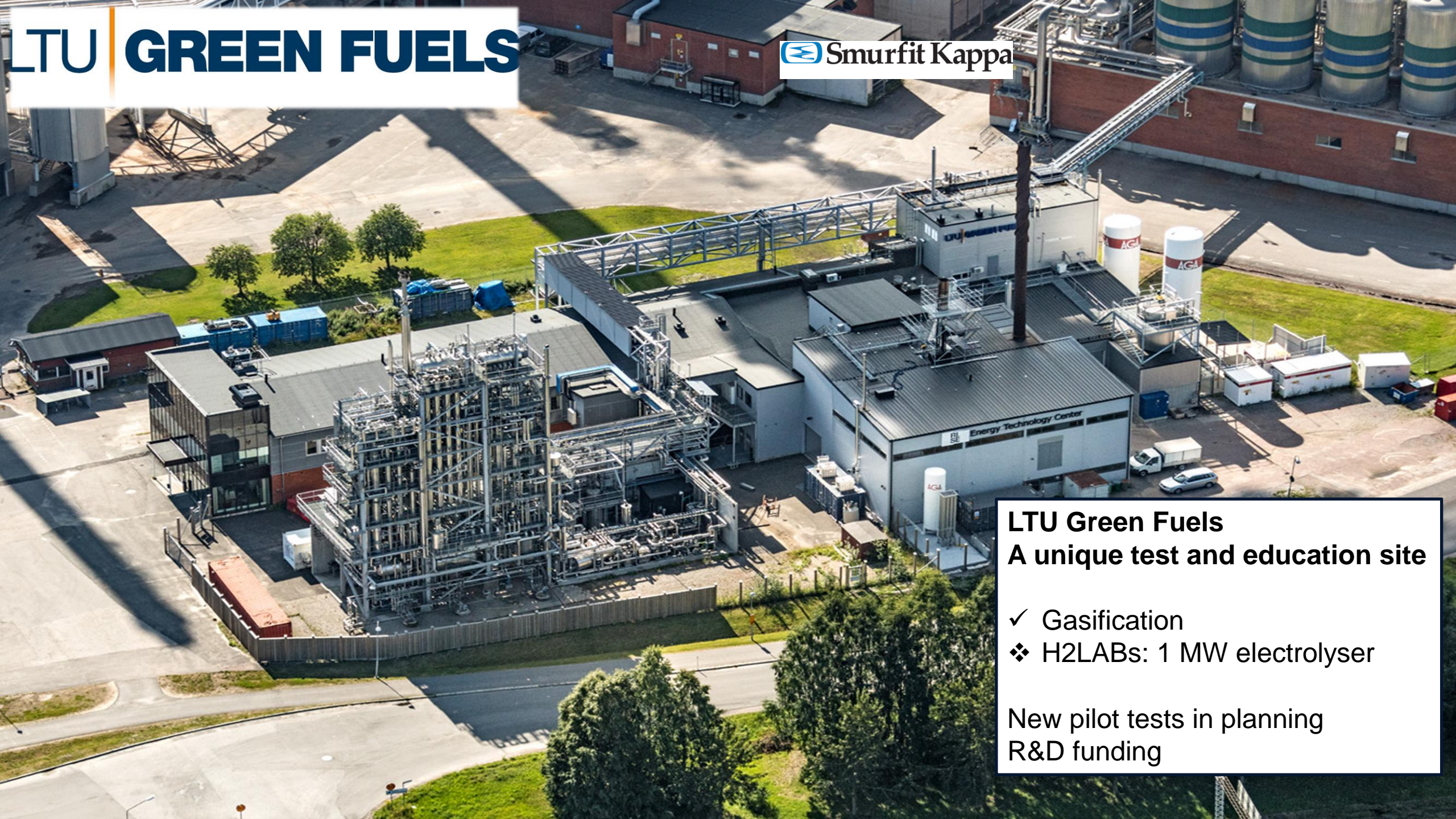


3: Material analysis



2: Tribotesting





LTU Green Fuels A unique test and education site

- ✓ Gasification
- ❖ H2LABs: 1 MW electrolyser

New pilot tests in planning
R&D funding

POLITICS

ORGANISATION

KNOWLEDGE



Hydrogen, Ammonia and Methanol in Hydrogen Hubs in the Nordic Region

NORDIC HYDROGEN VALLEYS



Hydrogen Safety and Improved Permit Processes

NORDIC HYDROGEN VALLEYS

ACCEPTANCE

ECONOMY

REGULATIONS

SAFETY

TECHNOLOGY

ENERGY

LINE ROCK CAVERNS

Addressing major barriers – with the 2022 understanding



Building the Nordic hydrogen economy, 24-25/1

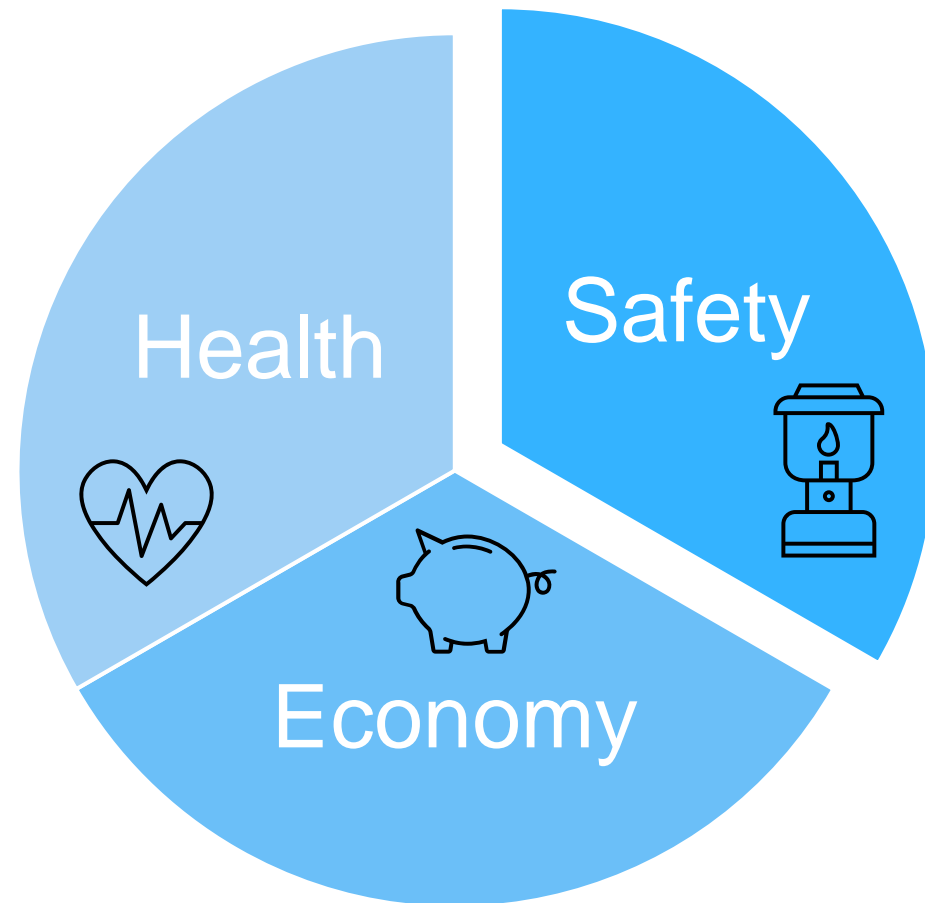
Both2nia goes Luleå 2023

150 visitors from 10 countries, agreed:

- To coordinate education possibilities further between academy and companies
- To extend the regional value chains for the global hydrogen area
- To improve co-operation and inclusion of SME and pave the way for common Nordic offers
- To share how fun and important work we do within hydrogen in the region, to attract further companies and people to continue the innovative business and technology development.
- To expand the dialogue and to arrange further events to continue the development together.



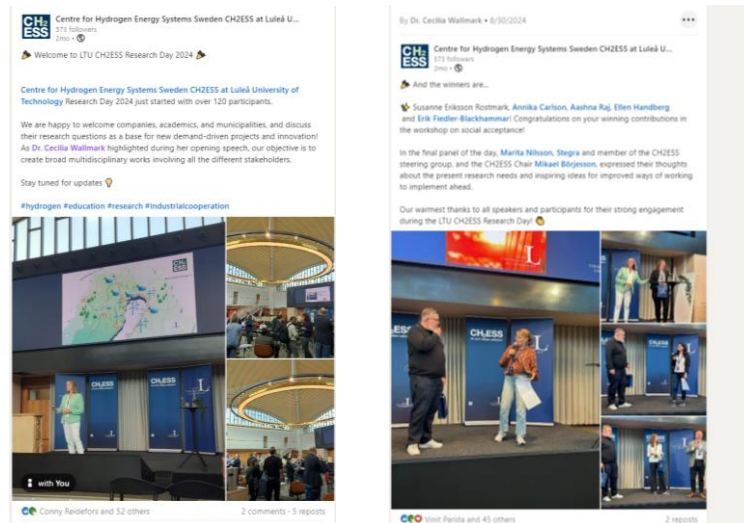
The 2025 status, the political trilemma – and the need for R&D support



About CH2ESS

- [Publications | Luleå tekniska universitet H2ESIN & around 60 peer review papers 2021-2024](#)
- [Research projects on Centre for Hydrogen Energy Systems Sweden | Luleå tekniska universitet \(ltu.se\)](#)
- [Education on Centre for Hydrogen Energy Systems Sweden | Luleå tekniska universitet \(ltu.se\)](#)

[CH2ESS on LinkedIn](#)



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Centre for Hydrogen Energy Systems Sweden

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.

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.

Research

→

Education

In collaboration with companies within CH2ESS, we further develop research and training so that they match the needs of hydrogen competence.

→

About CH2ESS

→

Showcases groundbreaking hydrogen research and innovation

Centre for Hydrogen Energy Systems Sweden (CH2ESS), recently brought together researchers, industry partners, and students to delve into the latest breakthroughs in hydrogen research.

→

Overlooked technology for fossil-free hydrogen

An important technology pathway that is rarely mentioned in the constant search for cost-efficient technologies to reduce carbon dioxide emissions, is biomass-based hydrogen production.

→

Assessing Hydrogen Gas Transport in pipelines

New research on hydrogen gas transport in pipelines was recently published in the International Journal of Hydrogen Energy.

→



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