CH$_2$ESS

Centre for Hydrogen Energy Systems Sweden

Accelerating hydrogen

by research, education
and support to the society

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OF TECHNOLOGY


Narvik
Kiruna
Gällivare
Mo i Rana
Arjeplog
Boden
Tornio
Luleå
H_2
Arvidsjaur
Piteå
Oulu
Storuman
Raahe
Skellefteå
Pyhäjoki
H_2
Umeå
Vaasa
H_2
LULEÅ TEKNISKA UNIVERSITET

INNOVATION FOR HYDROGEN

1) Development of the society & communication
2) Education – to reach many QUICKLY
3) Research – to be immediately RELEVANT

CH2ESS - Accelerating hydrogen!

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CH2ESS

Progress for education and research in hydrogen

- Unique collaboration between authorities, industry, energy, academia and public partners
- Working for the world's most sustainable solutions

CH2ESS leads, develops and collaborates locally, regionally, nationally, on Nordic and EU-level, and globally

CH2ESS is a doer

- Develop networks and projects
- Includes the ENTIRE hydrogen value chain and diverse research disciplines, e.g. Energy & Fluid Mechanics, Material & Safety, Law & Economics, Policy, Environment, Health & Society, IT & Digitalisation.

CH_2ESS consortium, Dec 2022

LKAB

SSAB

H2 green steel

VATTENFALL

Skellefteå Kraft

Luleå Energi

LULEÅ KOMMUN

REGION NORRBOTTEN

Skellefteå kommun

GÄLLIVARE

Piteå kommun

BODENS KOMMUN

LULEÅ UNIVERSITY OF TECHNOLOGY

Luleå University of Technology STRENGTHS

- Excellent demand-driven research – the highest proportion of corporate funded research among Swedish universities.
- Technical excellence combined with multidisciplinary research.
- Unique experimental environments for research.

Selected LTU - excellence

Electric Power Engineering – Power grid issues and smart solutions; acceptance limit calculations; electricity quality;
Energy Engineering – Biofuels, combustion, district heating, CCS, **Energy system analysis: Energy transition, Climate, Scenario analysis**
Structural and Fire Engineering – Fire and explosion safety, risk analysis
Manufacturing Systems Engineering – Laser-based joining and manufacturing
Mining and Rock Engineering – Rock room storage
Geosciences and Environmental Engineering – CO2 storage
Applied Physics – Control technology
Machine Design – Hydrogen distribution
Cyber-Physical Systems – Hydrogen storage/distribution
Fluid Mechanics – Hydrogen distribution/safety
Quality Technology and Logistics – Production/Storage/Usage
Human Work Science - Safety
Economics – Policy analysis, Acceptance etc
Law – Environmental law, Indigenous law

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The growing CH2ESS research portfolio

Dec 2022

Power system | H2 Production | Storage | Distribution | Use

- Power grid
- Polymer for H2 tanks
- Oxygen in iron oxide process
- Emerging techn., LCOH
- Bearing performance
- Heavy vehicles
- Biobased H2
- LRC – rock design
- Pipeline flows
- CCUS
- Emerging technologies
- Condition monitoring - pipelines
- Green Fuels
- Formic acid as hydrogen carrier
- Laser welding for stationary storage
- Ammonia – storage materials
- Methanol as a storage

Energy
Economy
Environment
Safety, Health
Social acceptance
Policy & law
IT…

Horizontal projects

- Socio-technical challenges
- Hydrogen pipeline: stakeholders, regulations, system

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LTU Green Fuels, Piteå

- **World-unique experimental infrastructure**

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Center for Hydrogen Energy System Sweden - CH_2ESS

Pilotanläggningen LTU Green Fuels

International, European, Nordic, national and regional co-operation

The Global Clean Energy Action Forum @ CEM13/MI7 23/9-22

”Hydrogen: Perspectives and Experiences from the northern and southern hemispheres”

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The significance of hydrogen for northern Sweden and the significance of our activities for hydrogen

- Hydrogen is considered a key to reach green-house targets
- Northern Sweden is an epicenter for the fossil free steel development based
- Hydrogen enables new business opportunites and security of supply
- CH2ESS supports the implementation by research and education, in co-operation from local to national and global level
- Researchers supports the development from material, to component to system level, all disciplines

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CH_2ESS

Contact: Director
Dr. Cecilia Wallmark
Within hydrogen since 1999

cecilia.wallmark@ltu.se
+46-70 549 20 76

www.ltu.se/centres/CH2ESS

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Accelerating hydrogen!

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Lab visits

Renewable hydrogen production and storage via biotechnology

- *Io Antonopoulou, Associate Senior Lecturer of Biochemical Process Engineering*

Fluid mechanics in hydrogen pipelines

- *Staffan Lundström, Professor in Fluid Mechanics*

Influence of hydrogen environments on the tribological behaviour of rolling element bearings

- *Jens Hardell, Professor in Machine Elements*

Bio-based hydrogen production using methanol as storage and transport controller

- *Kentaro Umeki, Professor of Energy Engineering*

Durability of Polymers and Composites for hydrogen delivery and storage

- *Roberts Joffe, Professor in Polymeric Composite Materials*

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