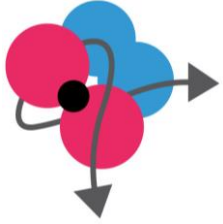


Hydrogen and CCS – one of the cornerstones of the European Green Deal

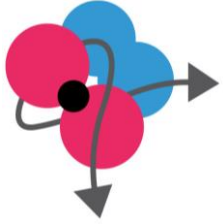
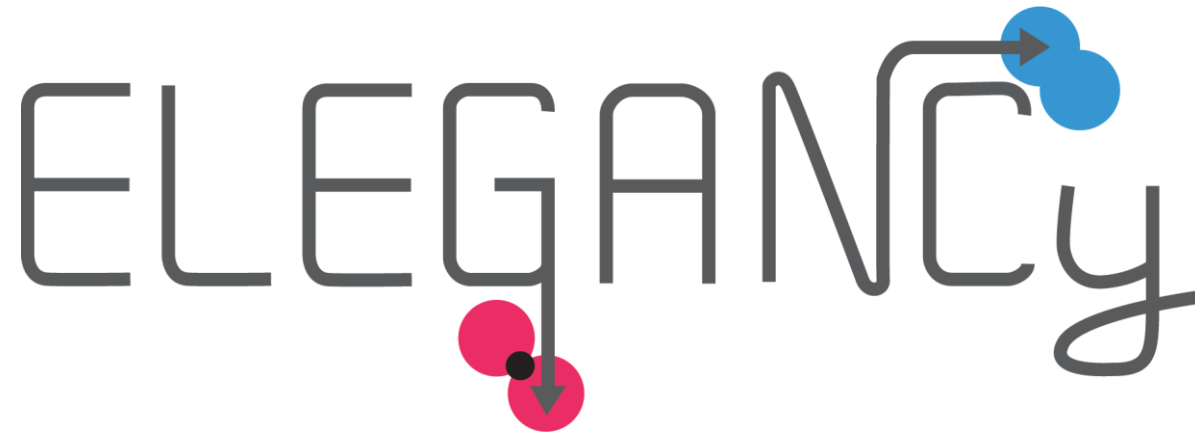
<http://www.elegancy.no/>

Webinar, 2020-06-18

Hydrogen and CCS – one of the cornerstones of the European Green Deal



10:00	<ul style="list-style-type: none">• <i>Welcome</i>• <i>ELEGANCY overview and introduction</i> Svend T. Munkejord (Chief Scientist, SINTEF)
10:20	<ul style="list-style-type: none">• <i>The role of hydrogen in accomplishing Europe's Green Deal</i> Diederik Samsom (Head of Cabinet of Frans Timmermans, European Commission)
10:40	<ul style="list-style-type: none">• <i>The role of hydrogen and CCS to achieve Europe's climate goals – case studies in Germany, Switzerland, United Kingdom, the Netherlands and Norway</i> Gunhild A. Reigstad (Research Manager, SINTEF)
11:00	<ul style="list-style-type: none">• <i>The German hydrogen strategy</i> Wolfgang Marquardt (Chairman of the Board of Directors, Forschungszentrum Jülich)
11:20	<ul style="list-style-type: none">• <i>Perspectives on the hydrogen economy as essential element of a low carbon world</i> Nilay Shah (Professor, Imperial College London)
11:40	<ul style="list-style-type: none">• <i>Q&A</i>• <i>Wrap-up and conclusions</i> Nils A. Røkke (EVP Sustainability, SINTEF)
12:00	<ul style="list-style-type: none">• <i>End of webinar</i>



Overview and key messages

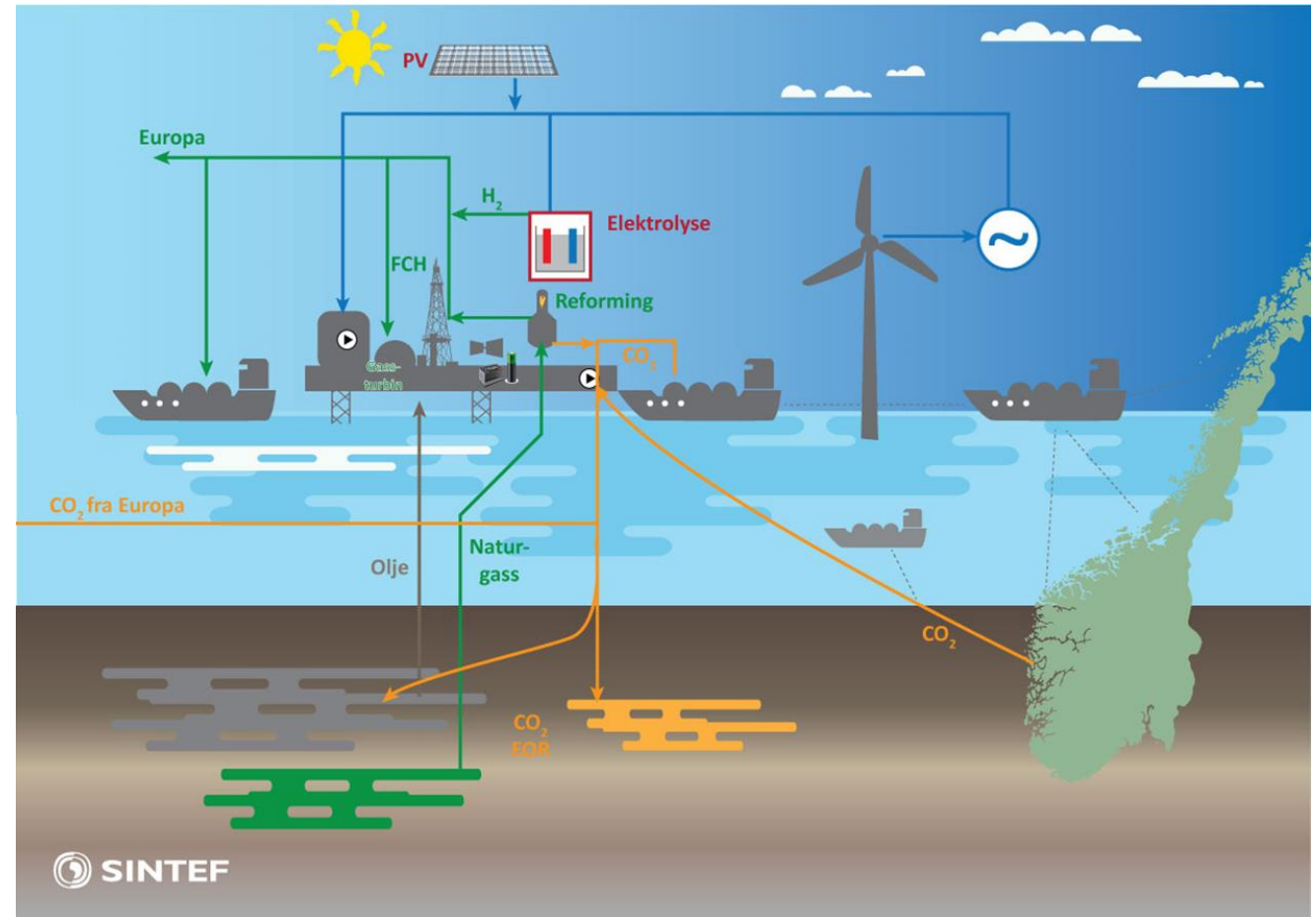
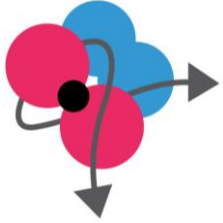
Svend Tollak Munkejord, SINTEF Energy Research, project coordinator

M Mazzotti, M van der Spek, C Banet, N Shah, GA Reigstad, G Guidati,
HL Skarsvåg

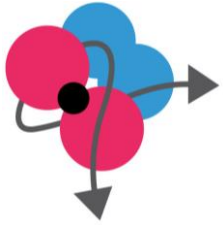
<http://www.elegancy.no/>

Webinar, 2020-06-18

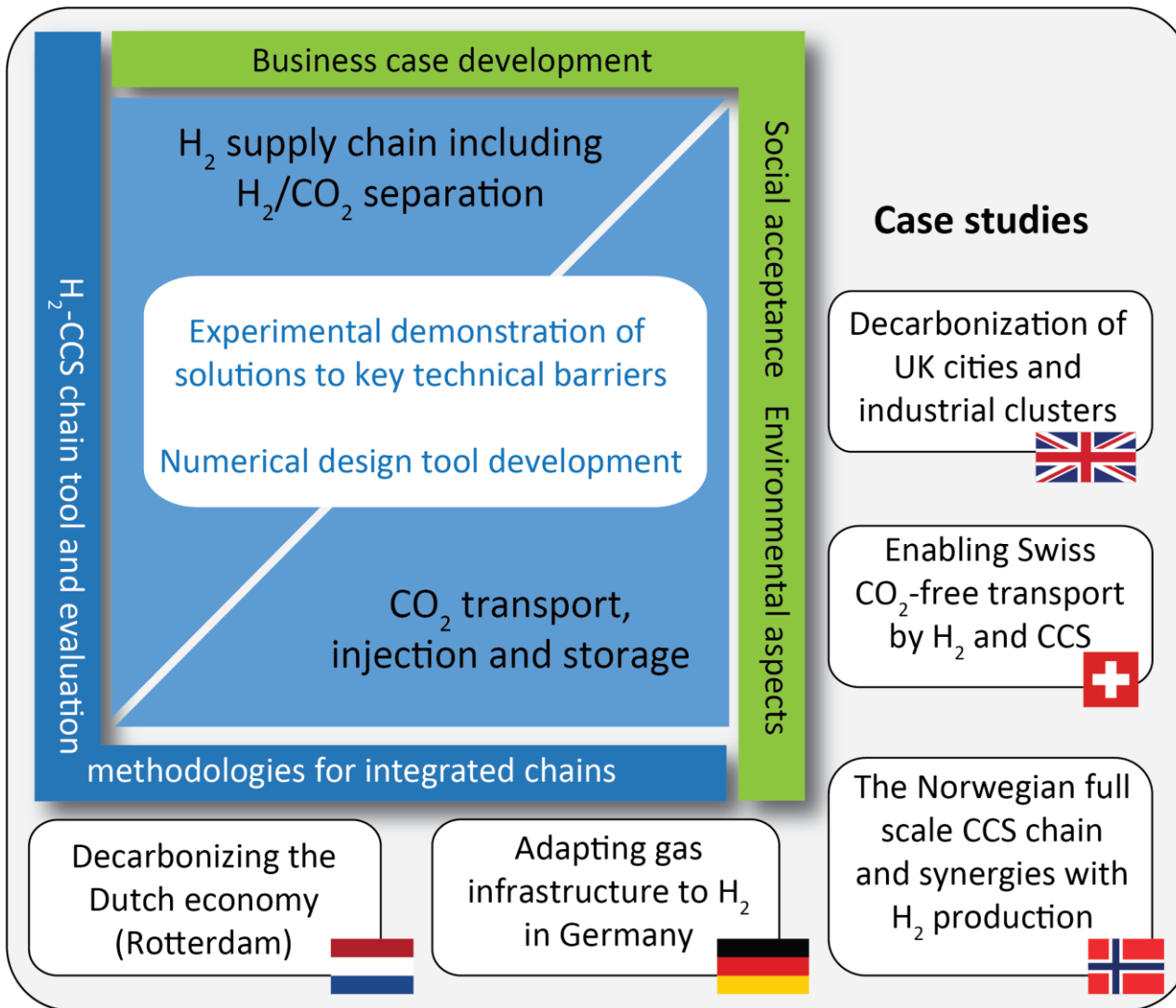
ELEGANCY – context



- The low-carbon economy needs H₂
- The low-carbon economy needs CCS
- Combining hydrogen with CCS offers an exciting opportunity for synergies and value creation
- ELEGANCY aims at contributing to fast-track the decarbonization of the European energy system



ELEGANCY – key information



Case studies

Decarbonization of UK cities and industrial clusters



Enabling Swiss CO₂-free transport by H₂ and CCS

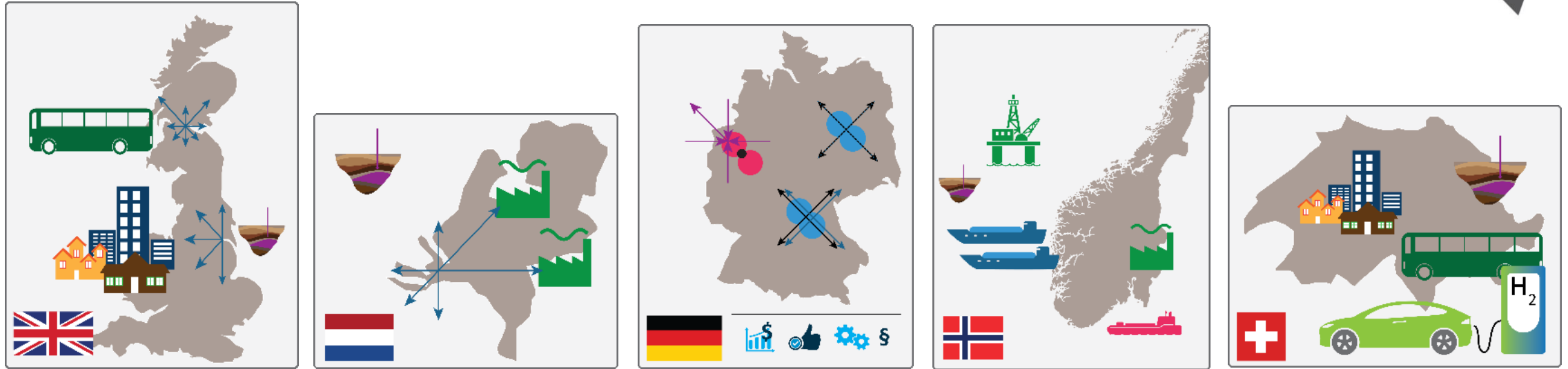
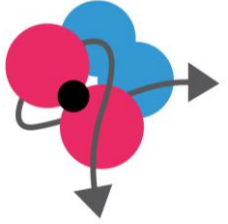


The Norwegian full scale CCS chain and synergies with H₂ production



- Duration: 2017-08-31 to 2020-08-31.
- Budget: 15 599 kEUR

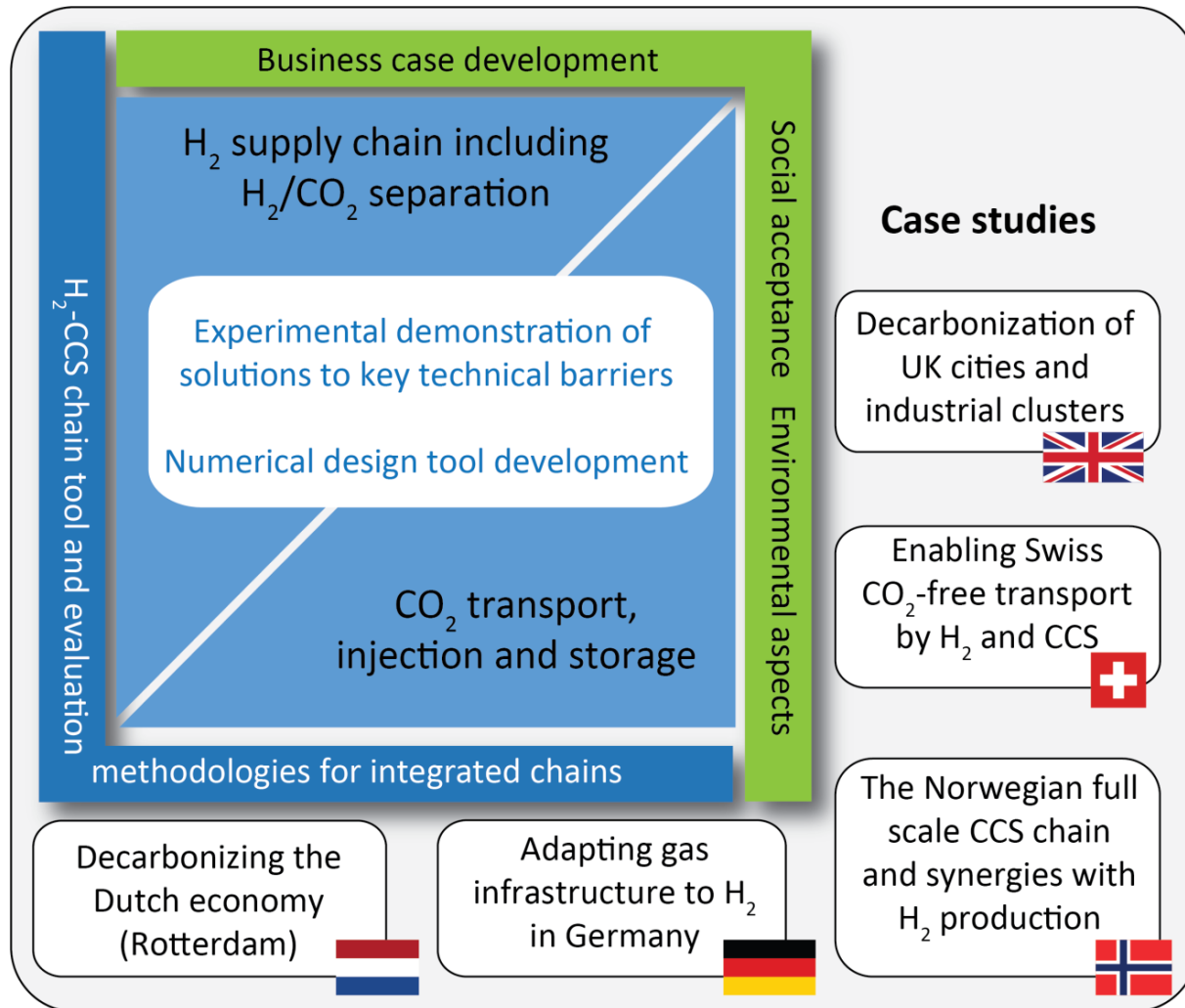
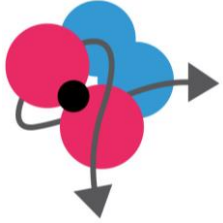
Yes, we can!



Conclusions:

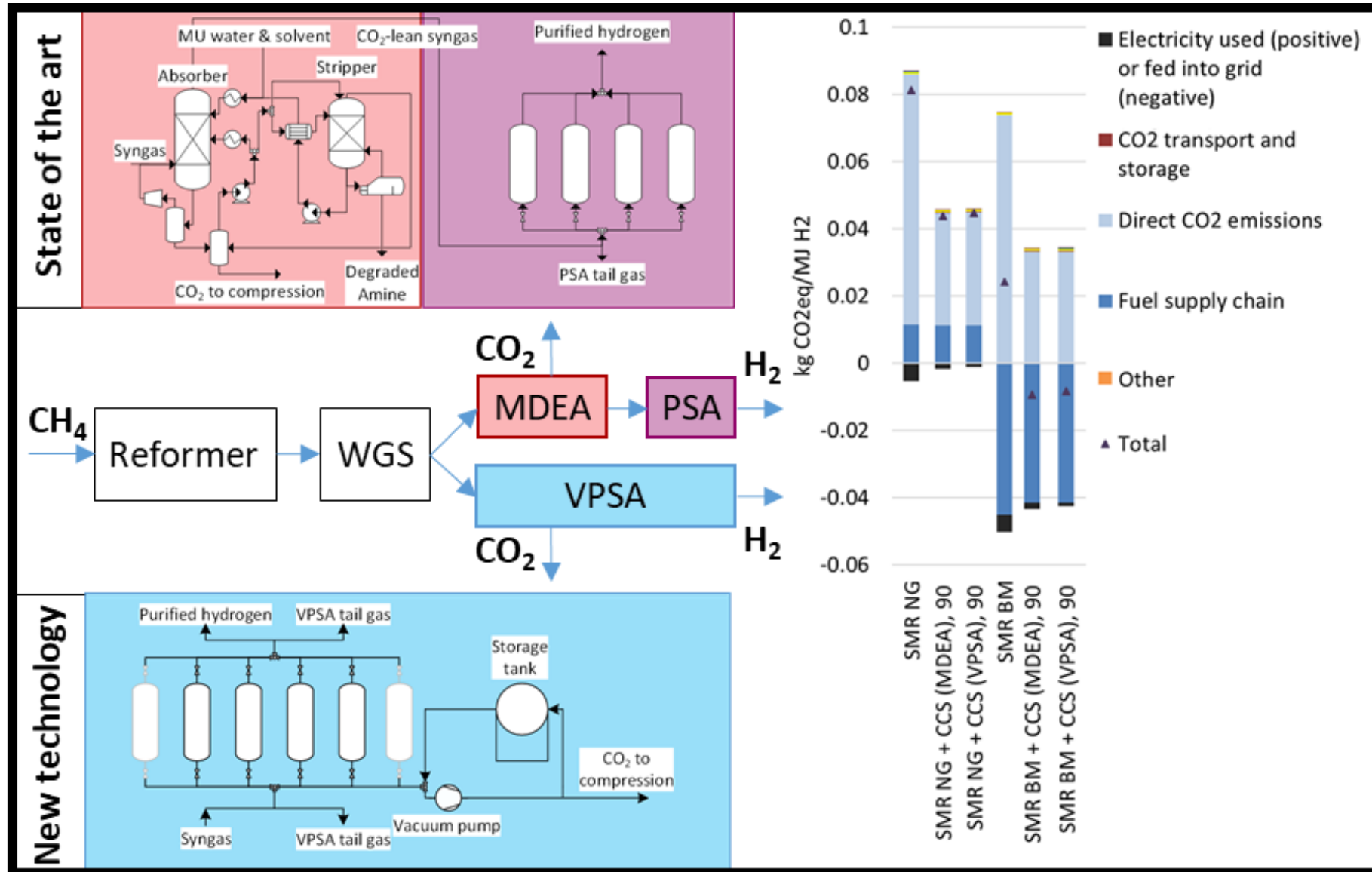
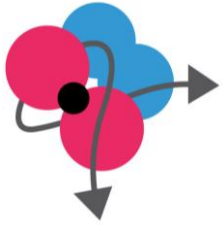
- Hydrogen can be delivered at scale – fast-tracking the 2050 net-zero emission goal.
- Hydrogen produced from renewable energy and natural gas with CCS will be needed.
- CCS is an efficient and safe way to eliminate CO₂ emissions.
- The Hydrogen Pathway needs financial, regulatory and political frameworks.

ELEGANCY – Enabling a low-carbon economy via H₂ and CCS by...



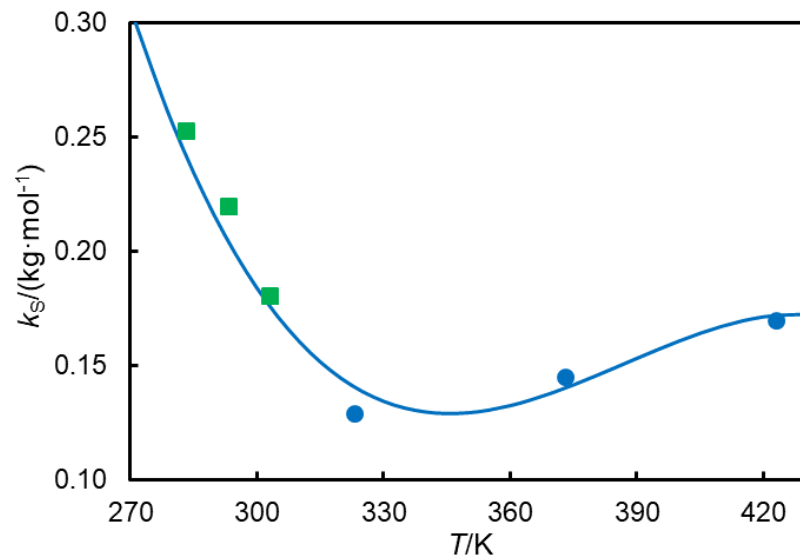
1. improving the Life Cycle Analysis performance of hydrogen production with CCS;
2. enhancing our understanding of CO₂ storage, particularly stemming from H₂ production;
3. enabling low carbon H₂ production with fossil-carbon or biomass via new market models;
4. designing cost-optimal and carbon footprint-optimal H₂ and CO₂ networks;
5. assessing country-specific challenges and opportunities, and identifying feasible country-specific pathways towards a H₂ economy coupled with CCS;
6. educating the next generation of European engineers and scientists on H₂ and CCS.

H₂ supply and H₂-CO₂ separation



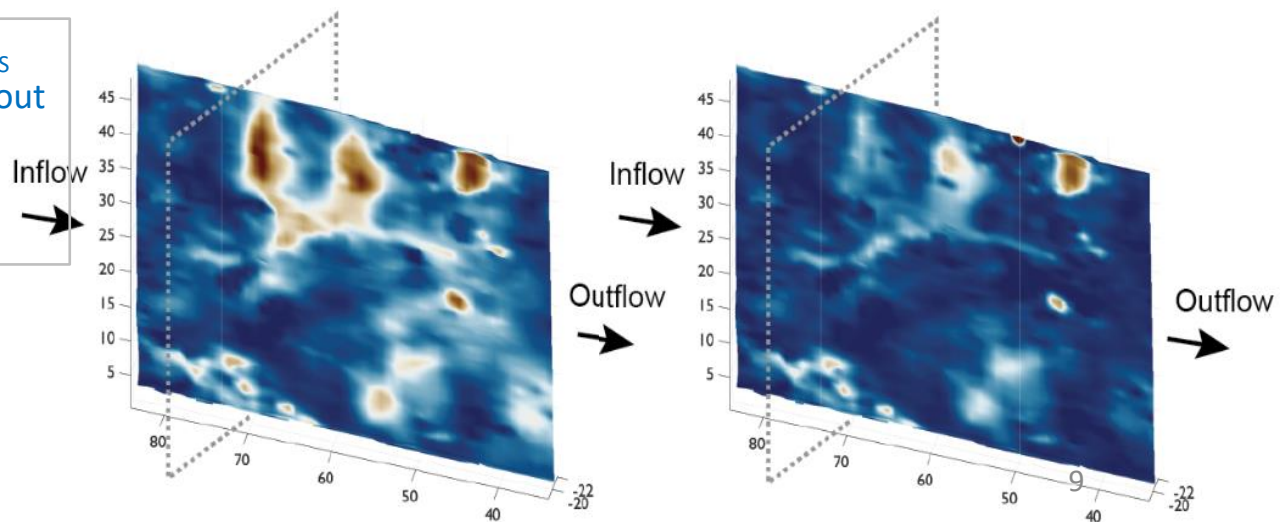
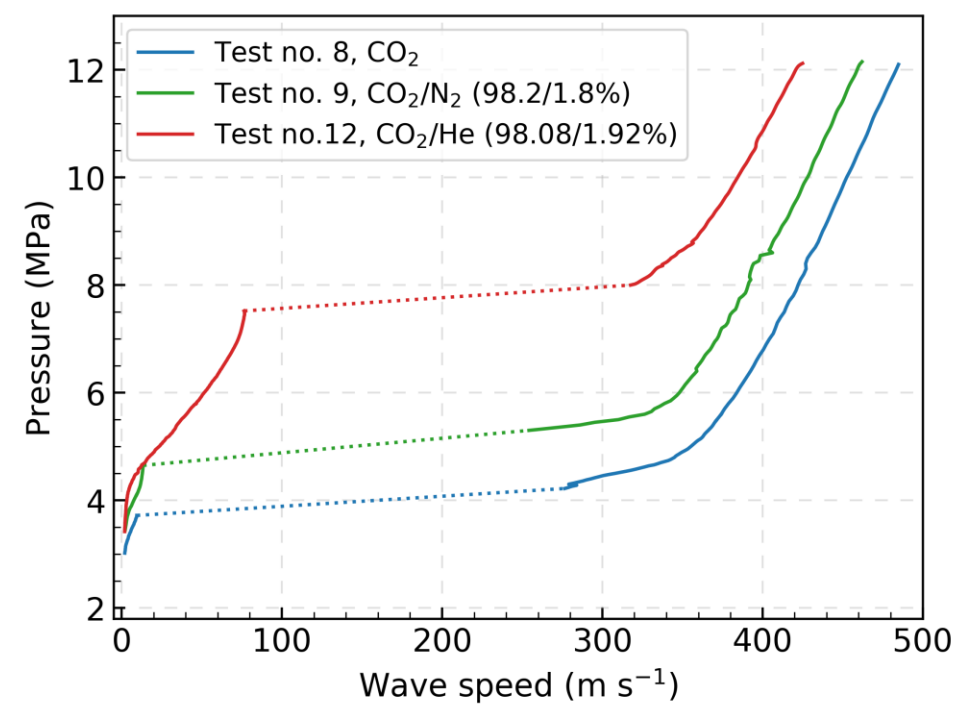
CO₂ transport, injection and storage

- Data and validated models helping engineers to design and operate safe and efficient systems
 - Thermophysical properties
 - Transient multiphase flow
 - Flow in rocks and in faults
 - Geomicrobiology

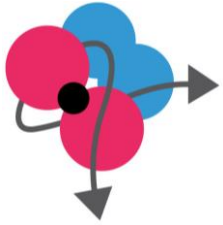


Sechenov coefficient k_s describing the salting-out of H₂ by NaCl:
●, this work;
■, literature

Decompression from 12 MPa, 25 °C. Effect of 2% N₂ and He.



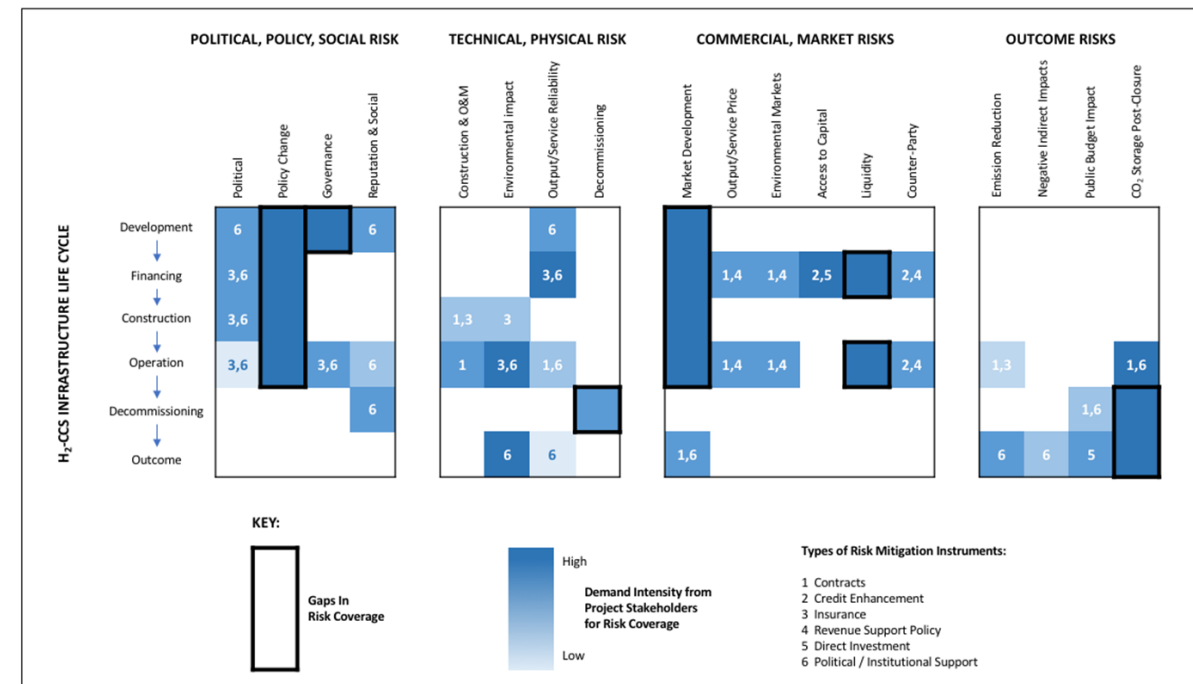
Business case development and legal aspects



- **Business Model Development Toolbox** available from www.elegancy.no.
- Suite of Excel tools and accompanying guidance applicable to CCS case studies and projects.

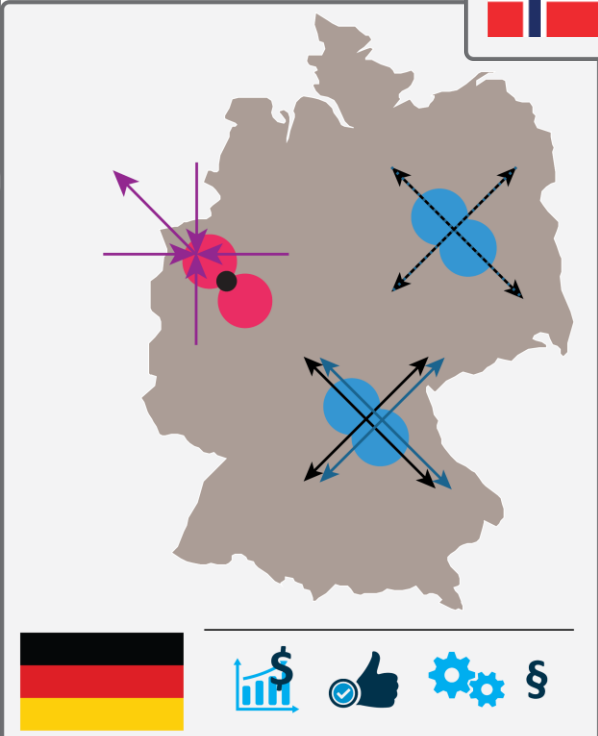
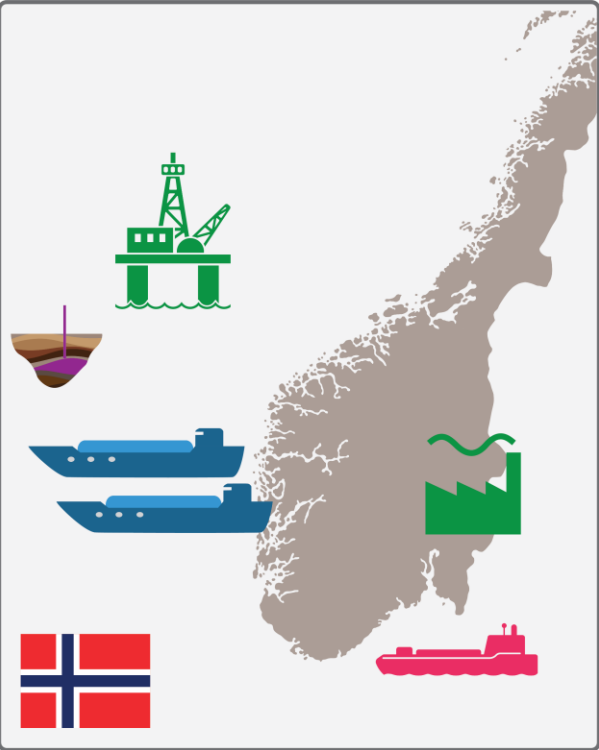
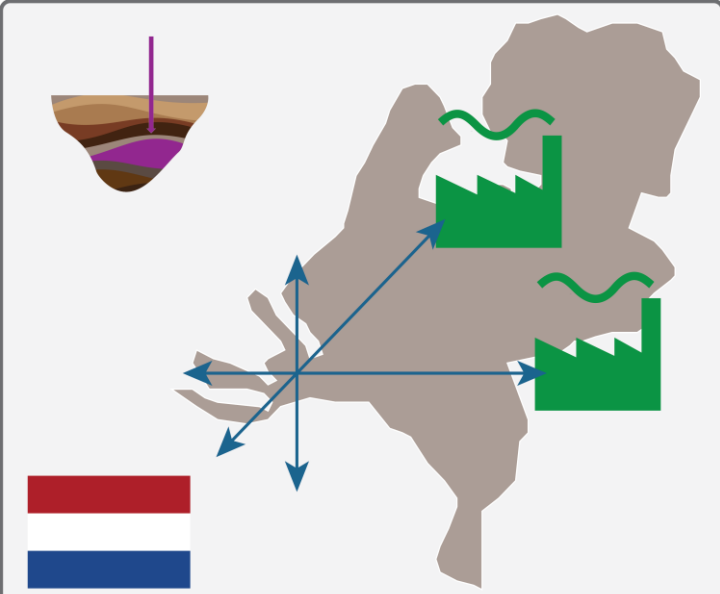


- Purpose of the Toolbox:
 - Assessment of business context, the identification and assessment of business risks, the selection of business models, and the assessment of business cases.
 - Identification and visualization of the key issues for the project early in the development process.
 - Facilitate collaboration and engagement among stakeholders.

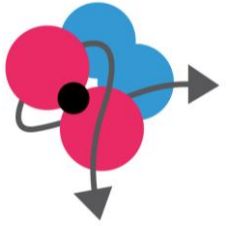


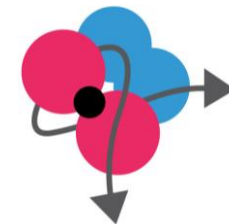
ELEGANCY case studies

- Including open-source H₂-CCS chain tool
- See separate presentation



Educating the next generation of European engineers and scientists on H₂ and CCS





Multi-level communication

I&EC
research
Industrial & Engineering Chemistry Research

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Article

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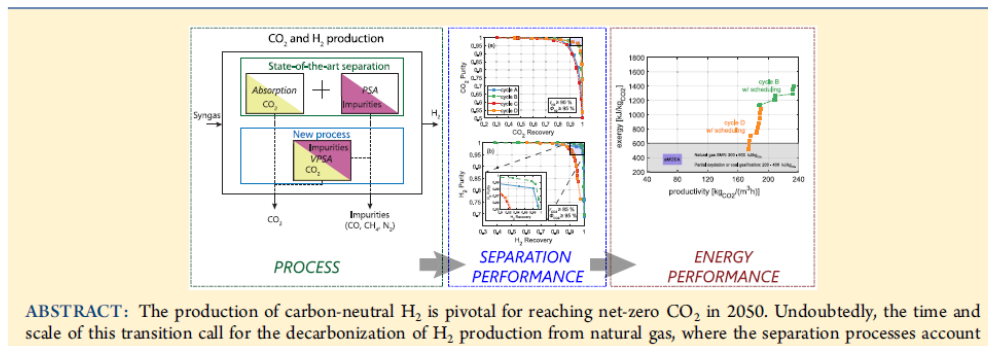
Novel Adsorption Process for Co-Production of Hydrogen and CO₂ from a Multicomponent Stream

Anne Streb,[†] Max Hefti,[†] Matteo Gazzani,^{*,†} and Marco Mazzotti^{*,†}

[†]ETH Zurich, Institute of Process Engineering, Zurich 8092, Switzerland

^{*}Utrecht University, Copernicus Institute of Sustainable Development, 3512 JE Utrecht, The Netherlands

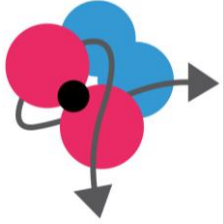
Supporting Information



From scientific papers...

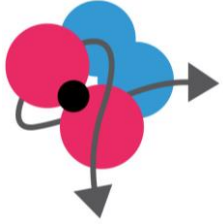
... to a meeting in the EU Parliament, Brussels

Conclusion



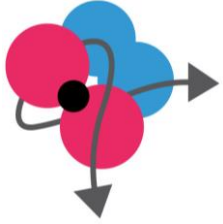
- ELEGANCY helps fast-tracking the decarbonization of Europe's energy system by combining CCS and H₂
 - by overcoming specific scientific, technological and economic/legal barriers,
 - by undertaking five national case studies adapted to the conditions in the partner countries.

ELEGANCY webinar series



- More information: www.elegancy.no

- Tomorrow, 19 June: ELEGANCY – Unlocking opportunities and addressing challenges for large-scale hydrogen provision in Germany, Switzerland, United Kingdom, the Netherlands and Norway
- Monday 22 June: Hydrogen supply and CO₂ injection and storage
- Tuesday 23 June: Business case development and hydrogen-CCS chain tool



Acknowledgement

ACT ELEGANCY, Project No 271498, has received funding from DETEC (CH), BMWi (DE), RVO (NL), Gassnova (NO), BEIS (UK), Gassco, Equinor and Total, and is cofunded by the European Commission under the Horizon 2020 programme, ACT Grant Agreement No 691712.



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