NORWEGIAN CCS RESEARCH CENTRE

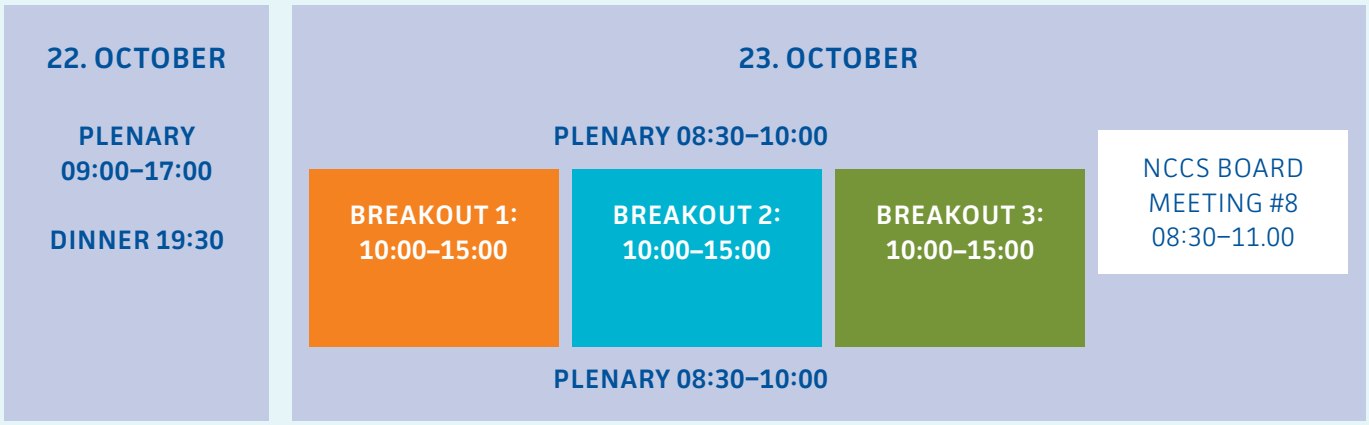
NCCS Consortium Days 2019

22nd-23rd October 2019

FRIMURERLOGEN, TRONDHEIM

Overview of Consortium days

*additional webinars available on the **eRoom**



22ND OCTOBER	
09:00	**Welcome and Safety Issues** Mona J. Mølnvik, Centre Director
09:10	**NCCS: Where are we now?** Amy Brunsvold, Centre Manager
09:25	**Education in NCCS, mobility, visions for student engagement** James Dawson (NTNU) and Ingrid Anell (UiO)
09:40	**Communication and the path forward**

CO_2 capture in NCCS

Highlights and latest results

10:00	**Pitch: Solvent-technology – environmental aspects (Task 2)** Hanna Knuutila (NTNU)
	Pitch: Low emission H_2 production (Task 3) Protonic Membrane Reformer: Simulations, measurements and up-scaling Jonathan Polfus, SINTEF Industry
	Pitch: CO_2 capture and transport through liquefaction (Task 4) CCCP – Cold Carbon Capture Pilot. CO_2 Liquefaction and Syngas decarbonization Stian Trædal, SINTEF Energy Research
	Pitch: CO_2 capture integration (Task 6) Benchmarking MEA performance – concentration, scale and practicalities Rahul Anantharaman, SINTEF Energy Research
	Pitch: Gas turbines (Task 5) Characterization of hydrogen flames through numerical modelling and experimental studies Andrea Gruber, SINTEF Energy Research
10:40	COFFEE BREAK
11:00	**Carbon-free power generation from hydrogen-fired gas turbines** Dr. Mirko Bothien, Ansaldo Energia
11:20	**Spin-off project - Reheat2H2** Towards clean and stable hydrogen reheat combustion in gas turbines Jonas Moeck, NTNU
	Spin-off project – MACH2 Membrane-Assisted CO_2 capture through liquefaction for clean H_2 production Thijs Peters, SINTEF Industry
11:30	**Extended talk: Public support to CCS under EU state aid rules** Catherine Banet, University of Oslo
12:00	LUNCH

CO_2 Storage in NCCS

Highlights and latest results

13:00	**A short profile of the Scientific Committee with scientific challenges for NCCS** Philip Ringrose, NTNU (Equinor)
13:10	**Pitch: Cost-efficient CO_2 monitoring technology (Task 12)** Optimal acquisition and use of data for quantitative CO_2 monitoring Peder Eliasson, SINTEF Industry
	Pitch: Reservoir management and EOR (Task 11) CO_2 mobility control with foam – modelling of laboratory flooding tests. Alv-Arne Grimstad, SINTEF Industry
13:30	**Spin-off project POREPAC - Preventing loss of near-well permeability in CO_2 injection wells** Project presentation and first results from laboratory tests Andreas Berntsen / Ingebret Fjelde, NORCE
13:50	**Perspectives on value creation for industry - benefits realization Northern Lights team** Torbjørg Fossum, CCS R&D Manager, Equinor
14:10	**Spin-off project FRISK** Quantification of fault-related leakage risk Elin Skurtveit, NGI
	Spin-off project TOPHOLE Tophole monitoring of permanently plugged wells Bastien Dupuy, SINTEF Industry
	Spin-off project EMCO2 Accelerating CSEM technology for efficient and quantitative CO_2 monitoring Anouar Romdhane, SINTEF Industry
14:40	COFFEE BREAK

CO_2 chain integration, thermodynamics and transport

Highlights and latest results

15:10	**Pitch: Design of CCS chain under uncertainties and fluctuations** Simon Roussanaly, SINTEF Energy Research
	Pitch: New advanced facility to provide key data for safer and better transition to CCS and hydrogen systems. Caroline Einen, SINTEF Energy Research
	Reducing uncertainties by modelling and experiments Svend Tollak Munkejord (SINTEF Energy Research)
15:30	**Extended presentation IMPRECCS** Sigurd W. Løvseth, SINTEF Energy Research
	Plenary Discussions
15:50	**European R&I collaboration on CCUS (SET plan) and Mission Innovation** European and national funding opportunities Main take-aways from Mission Innovation Workshop in June Marie Bysveen, SINTEF Energy Research
16:30	**Discussions for the day – what have we learned?**
17:00	**Goals for next day, closing of Day 1**
19:00	DINNER - FRIMURERLOGEN

23RD OCTOBER

Location: Innovation and potentials for value creation

08:15	**Wake-up coffee**
08:30	**Welcome and Recap Day 1, goals for the day** Sigmund Ø. Størset, SINTEF Energy Research
08:40	**Recap of the effect study** Sigmund Ø. Størset
08:50	**Industrial perspective on value creation and R&D impact** Zabia Elamin, Aker Solutions
09:10	**Introduction to breakout sessions, value creation and scenario development in NCCS** Grethe Tangen and Inna Kim
	COFFEE BREAK

In-depth technical program (see next pages for details)

10:00 – 15:00

BREAKOUT 1:	BREAKOUT 2:	BREAKOUT 3:
Capture	**Chain, liquefaction, transport, thermodynamics**	**Storage**
Location: «Peisestuen»	**Location: «Hjørnestuen»**	**Location: «Storsal»**

Breakout 1: Capture

Selected results, innovations, and potential for value creation

Location: «Peisestuen»

10:00	**Task 5 - Hydrogen-fired gas turbines** Thermo-acoustic characteristics of hydrogen/methane flames in single-sector combustors (Eirik Æsøy) Thermo-acoustic characteristics of hydrogen/methane flames in annular combustors (Jose G. Aguilar) Ignition, propagation and stabilization of hydrogen flames at reheat conditions (Andrea Gruber)
11:00	**Task 3 - Low-emission hydrogen production** Development of PMR membranes (Jonathan Polfus) Simulations of PMR membranes (Luca Riboldi) Development of simulation framework for PMR modules (Geir Skaugen)
12:00	LUNCH
13:00	**Task 6 - CO_2 capture process integration** Energy & cost performance baseline for post-combustion capture using MEA (Chao Fu) CO_2 capture from WtE plants using CaL process (Rahul Anantharaman) Exploring the potential of PSA-Liquefaction process for post-combustion CO_2 capture (Luca Riboldi)
14:00	**Task 2 - Solvent technology – environmental aspects** MEA degradation (Solrun Johanne Vevelstad/Andreas Grimstvedt) DORA- Dissolved Oxygen Removal Apparatus (Roberta V. Figueiredo)
15:00	**Plenary discussion** Summary from breakouts
16:00	**Closing Consortium Days 2019 – plenum**

Breakout 2: Chain, liquefaction, transport, thermodynamic

Selected results, innovations, and potential for value creation

Location: «Hjørnestuen»

10:00	**Task 4 - CO_2 capture and conditioning through liquefaction** Low-pressure LCO_2 production and experimental investigation of CO_2 freeze-out (Stian Trædal)
10:30	**Task 1 - CO_2 value chain and legal aspects** Impact of uncertainties on the design and cost of CCS from a waste-to-energy plant (Simon Roussanaly) Design of a shipping supply chain under operational uncertainties (Vegard Skonseng Bjerketvedt) Toward optimal conditions for transport of CO_2 by ship (Simon Roussanaly) The legal framework of CO_2 shipping for CCS in Norwegian waters (Viktor Weber) CCS under the EU ETS: legal consequences of the CO_2 shipping option (Heidi Sydnes Egeland)
12:00	LUNCH
13:00	**Task 7 - CO_2 transport** A new numerical method for multiphase flow of CO_2 in pipes (Barbara Re, UZH) Roadmap for development of prediction tools for running-ductile fracture in CO_2 pipelines (Svend Tollak Munkejord) New depressurization experiments (Han Deng)
14:00	**Task 8 - Fiscal metering and thermodynamics for efficient and reliable CO_2 capture, transport, and injection** Ternary VLE measurements (CO_2 + N_2 + CH_4) and verification of EOS-CG (Sigurd W. Løvseth, SINTEF Energy Research, Tobias Neumann, NTNU/RUB) Status and plans for measurements on binary CO_2 + SO_2 mixtures (Martin Khamphasith) Testing of flow meters for fiscal metering? (Sigurd W. Løvseth)
15:00	**Plenary discussion** Summary from breakouts
16:00	**Closing Consortium Days 2019 – plenum**

Breakout 3: Storage

Selected results, innovations, and potential for value creation

Location: «Storsal»

10:00	**Task 9 – Structural derisking** Horda Platform new learnings (Mark Mulrooney) Addressing across-fault and top seal potential for CCS in Viking Group sandstones of the Horda Platform (Johnathon Osmond) Fault integrity workflow – learnings and potential using geomechanical models (Jung Chan Choi)
11:00	**Task 10 – CO_2 storage site containment** Well Integrity Atlas – first results from worldwide survey (Speaker) Are we modelling caprock mechanical risk correctly? (Marcin Duda) Aquifers beat depleted reservoirs (Pierre Cerasi)
12:00	LUNCH
13:00	**Task 11 – Reservoir management and EOR** CO_2 foam mobility control. Simulation of core flooding experiments using foam properties measured in laboratory. (Alv-Arne Grimstad) Field-scale simulation of CO_2 foam mobility control. Sensitivity analysis on foam/surfactant properties. (Alv-Arne Grimstad)
14:00	**Task 12 - Cost-efficient CO_2 monitoring technology** Data-driven AVO inversion for CO_2 monitoring (Amir Ghaderi, SINTEF Industry) Combined reservoir simulation and rock physics inversion for improved CO_2 storage security – a Sleipner case study (Francesca Watson, SINTEF Digital) Integrated Monitoring Approach for Offshore Geological CO_2 Storage (Joonsang Park, NGI)
15:00	**Plenary discussion** Summary from breakouts
16:00	**Closing Consortium Days 2019 – plenum**

TASK	LEADER
1: CO_2 chain integration and legal aspects	Simon Roussanaly
2: Solvent technology – environmental issues	Solrun Vevelstad
3: Low emission H_2 production	Jonathan Polfus
4: CO_2 capture and conditioning - liquefaction	David Berstad
5: H_2 gas turbines	Andrea Gruber
6: CO_2 capture integration	Rahul Anantharaman
7: CO_2 transport	Svend Tollak Munkejord
8: Fiscal metering and thermodynamics	Sigurd W. Løvseth
9: Structural derisking	Elin Skurtveit
10: CO_2 storage site containment	Pierre Cerasi
11: Reservoir management and EOR	Alv-Arne Grimstad
12: Cost-efficient CO_2 monitoring technology	Peder Eliasson

SPIN-OFF PROJECTS	PROJECT LEADER
Impact of CO_2 impurities and additives in CCS - IMPRECCS	Sigurd W. Løvseth
Towards clean and stable hydrogen reheat combustion in gas turbines - Reheat2H2	Jonas Moeck
Preventing loss of near-well permeability in CO_2 injection wells - POREPAC	Andreas Berntsen
Quantification of fault-related leakage risk - FRISK	Elin Skurtveit
Membrane-Assisted CO_2 capture through liquefaction for clean H2 production – MACH2	Thijs Peters
Accelerating CSEM technology for efficient and quantitative CO_2 monitoring – EM4CO2	Anouar Romdhane
Tophole monitoring of permanently plugged wells - Tophole	Bastien Dupuy

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https://www.sintef.no/projectweb/nccs/