



CCUS STUDENT WEEK 2018

“Whole Value Chain Carbon Capture, Utilization, and Storage (CCUS)”

Venue: Golden Hotel, 800 11th St, Golden, CO 80401, USA

Time: Monday Oct. 15th - Friday Oct.19th, 2018

***Provided by:* Petroleum Research School of Norway (NFIP), International Energy Cluster (IEC), The ColNor Clean Energy Research and Educational Collaboration, NorTex Petroleum Cluster and co-hosted by Colorado School of Mines and Royal Norwegian Consulate General in Houston.**

Sponsored by: Norwegian Research Council Research School Funding Program and NRC/Climit.

Conference Objectives:

1. Accelerate CO₂ research collaboration between Norway, China, Brazil, and USA
2. Provide opportunity for experts in industry and academia to collectively discuss CCUS research
3. Provide PhD students with current CCUS research status and the way forward
4. Provide oil industry an opportunity to communicate needs to the next generation engineers
5. Emphasize CO₂ as mean to mitigate negative climate effects in oil production utilizing CCUS
6. Provide a Whole Value Chain Approach Overview for students within CCUS

Scientific Program:

- Day 1:** Climate Perspectives and CO₂ Capture
- Day 2:** CO₂ Capture and CO₂ Transport
- Day 3:** CO₂ Storage
- Day 4:** CO₂ Utilization in Hydrates and in Enhanced Oil Recovery (EOR)
- Tour of CSM CCUS and EOR Laboratories
- Day 5:** CO₂ EOR and Whole Value Chain CCUS Future Development

Social Program:

- Day 1:** - Reception at Table Mountain Inn
- Day 4:** - Tour of the Coors Brewery
- Day 4:** - Conference Dinner at The Golden Hotel

**Day 1: Monday Oct. 15th****Climate Perspectives and CO₂ Capture**

08:30 Registration and Coffee

09:00 *Welcome and Symposium Objectives*

Arne Graue, Prof. of Physics, University of Bergen, Norway;

Chair of the Boards: Petroleum Research School of Norway and NorTex Petroleum Cluster

Dag Nummedal, Former Director of CERI, Colorado School of Mines

Climate Perspectives

09:30 *CCUS Assessment: CCUS in the US - Global Importance of CCUS*

Arne Graue, Prof. of Physics, University of Bergen, Norway;

Chair of the Boards: Petroleum Research School of Norway and NorTex Petroleum Cluster

10:00 *Reflections on IPCC Perspectives*

Klaus Lackner, Arizona State University

10:30 *Coffee*

11:00 *Global Climate Concerns – The Air We Breathe: It Is Not What it Used To Be*

Russ Schnell, National Oceanic and Atmospheric Administration (NOAA)

11:30 *Economic Determinants of Success in CCS Installation*

Ian Lange, Colorado School of Mines

12:00 *Lunch*

CO₂ Capture

13:00 *The New IPCC agreement Issued in Seoul, South Korea, October 8th, 2018: Actions to Remove CO₂*

Dag Nummedal, Colorado School of Mines

13:30 *The Business Case for Carbon Capture, Utilization, and Storage*

Matt Lucas, Carbontech and David Smaldone, CDG Engineers

14:30 *CO₂ Capture Technologies – An Overview*

Robert Braun, Colorado School of Mines

15:00 *Coffee*

15:30 *Findings of a Colorado Multi-Institutional Research Project to Reduce Methane Emissions from Natural Gas Operations*

Dag Nummedal, CSM

Norwegian Consulate General
Houston

- 16:00 *CO₂ Capture from the Air*
Klaus Lackner, Arizona State University
- 17:00 *Aerosols and Radiation Balance: From Uncertainty in Future Climates to Albedo Modification*
James Wilson, University of Denver
- 17:30 End of Day
- 19:00 - 21:00 *Reception at Table Mountain Inn*

Day 2: Tuesday Oct. 16th

CO₂ Capture and CO₂ Transport

CO₂ Capture

- 09:00 *Post Combustion Capture*
Christopher Romans, Mitsubishi Heavy Industries
- 09:30 *Oxyfuel Capture Technologies*
Greg Jackson, Colorado School of Mines
- 10:00 Coffee
- 10:30 *Pre-Combustion*
Raghubir Gupta, Susteon Inc.
- 11:00 *North American Projects and Policy Landscape*
Christopher Romans, Mitsubishi Heavy Industries
- 12:00 *Lunch*

CO₂ Transport

- 13:00 *Pipelines – The Safest Way for CO₂ to Travel*
Ken Havens, Kinder Morgan
- 13:45 *The Intersection of Environment and EOR, How Carbon Capture is Changing Tertiary Recovery*
Bob Balch, PRRC, New Mexico Tech
- 14:30 *Natural CO₂ Sources in the USA and Possible Anthropogenic Opportunities*
NN
- 15:00 *Coffee*



15:30 *Offshore Challenges - Ships or Pipeline*
NN

16:00 *Panel Debate: USA and the World on CCUS – Economy or Climate as Drivers?*
Moderator: Arne Graue, Univ. of Bergen, Norway

17:00 End of Day

Day 3: Wednesday Oct. 17th

CO₂ Storage

09:00 *Overview of CO₂ Storage Options*
Manika Prasad, Colorado School of Mines

09:30 *Regulatory Challenges in CO₂ Storage*
Michael Moore, East-West Strategic Advisors

10:00 *Coffee*

10:30 *Geomechanics in CO₂ Storage*
Manika Prasad, Colorado School of Mines

11:30 *Computational Modeling of Fault Poromechanics for Storage-Induced Seismicity and CO₂ Leakage*
Birendra Jha, University of Southern California

12:00 *Lunch*

13:00 *Integration of Geophysical and Geomechanical Modeling to Monitor Integrity of Carbon Storage*
Birendra Jha, University of Southern California

13:40 *Large Scale CCUS in the North Sea Can Handle All EU Coal Power CO₂ Emissions*
Erik Lindeberg, SINTEF

14:20 *Tertiary CO₂ EOR in 23 North Sea Oil Fields - Combined CO₂ Storage Based in Industrial CO₂ Sources*
Erik Lindeberg, SINTEF

15:00 *Coffee*

15:30 *Numerical Simulation of CO₂ Storage in Saline Aquifers*
Yu-Shu Wu, Colorado School of Mines

16:15 *CO₂ Storage, Monitoring, Verification and Accounting*
Erik Lindeberg, SINTEF

17:00 End of Day

**Day 4: Thursday Oct. 18th****CO₂ Utilization in Hydrates and in Enhanced Oil Recovery (EOR)**

- Tour of CSM CCUS and EOR Laboratories
- Tour of Coors Brewery

09:00 *Fundamentals of Hydrates, Climate Perspectives, and Energy Potentials*
Luis Zerpa, Colorado School of Mines

09:30 *CO₂ Storage in Hydrates with Associated Methane Production*
Arne Graue, University of Bergen

10:00 *Coffee*

10:30 *Field Experiences from CO₂ Injections in Hydrates: North Slope CO₂-CH₄ Exchange Project*
Arne Graue, University of Bergen

11:00 *CO₂ EOR Assessment*
Wayne Rowe, Schlumberger Carbon Services

12:00 *Lunch*

CO₂ Utilization in EOR as CCUS

13:00 *CO₂ for EOR – Historical Perspectives, Current State of the Art Technology Status, and Technological Challenges*
Ganesh C. Thakur, Univ. of Houston, Director of Energy Industrial Partnerships & Distinguished Professor of Petroleum Engineering U. of Houston, 2012 SPE President & Former VP Chevron and Ramanan Krishnamoorti, University of Houston.

14:00 *Utilizing CO₂ in Beer Manufacturing, Tour of Coors Brewery for Group 1/CSM Lab Tour for Group 2*

15:00 *Utilizing CO₂ in Beer Manufacturing, Tour of Coors Brewery for Group 2/CSM Lab Tour for Group 1*

16:00 *CO₂ EOR, CCUS, and the Horizontal Revolution in the Permian Basin*
Steve Melzer, Melzer Consulting

16:30 *Current CO₂ EOR Perspectives*
Hossein Kazemi, Colorado School of Mines

17:30 *End of Day*

19:00 to 22:00 *Conference Dinner at the Golden Hotel*

Norwegian Consulate General
Houston**Day 5: Friday Oct. 19th****CO₂ EOR and Whole Value Chain CCUS Future Development**

- 09:00 *Surfactant Selection for Foam EOR*
George Hirasaki, Rice University
- 10:00 *CO₂ Foam EOR for Mobility Control*
Arne Graue, University of Bergen
- 10:30 *Coffee*
- 11:00 *Historical Overview of CO₂ EOR Field Applications*
David Schechter, Texas A&M University
- 12:00 *Lunch*
- 13:00 *CO₂ Foam EOR Field Pilots in Texas*
Zachary Alcorn, University of Bergen
- 13:30 *CCUS Policy*
Morgan Bazilian, Payne Institute, Colorado School of Mines
- 14:00 *Coffee*
- 14:30 *Future Solutions for Whole Value Chain CCUS*
- 10 min summaries: Manika Prasad, Arne Graue and Dag Nummedal
- Discussion
- 15:30 *Synthesize Student Learning and Discussion*
Manika Prasad, Colorado School of Mines
- 16:00 End of Conference