

## **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. 15<sup>th</sup> - Friday Oct.19<sup>th</sup>, 2018**

***Provided by:* Petroleum Research School of Norway (NFIP), International Energy Cluster (IEC), The ColNor Clean Energy Research and Educational Collaboration (NorCol), 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> Capture
- Day 2:** CO<sub>2</sub> Capture and CO<sub>2</sub> Transport
- Day 3:** CO<sub>2</sub> Storage
- Day 4:** CO<sub>2</sub> Utilization in Hydrates and in Enhanced Oil Recovery (EOR)  
- Tour of CSM CCUS and EOR Laboratories
- Day 5:** CO<sub>2</sub> 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. 15<sup>th</sup>****Climate Perspectives and CO<sub>2</sub> 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***CO<sub>2</sub> Capture****13:00** *The New IPCC agreement Issued in Seoul, South Korea, October 8th, 2018: Actions to Remove CO<sub>2</sub>*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** *CO<sub>2</sub> 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



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16:00 *CO<sub>2</sub> 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. 16<sup>th</sup>

### CO<sub>2</sub> Capture and CO<sub>2</sub> Transport

#### CO<sub>2</sub> 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 *Large Scale Projects Worldwide*  
Christopher Romans, Mitsubishi Heavy Industries

12:00 *Lunch*

#### CO<sub>2</sub> Transport

13:00 *Pipelines – The Safest Way for CO<sub>2</sub> 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 CO<sub>2</sub> 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. 17<sup>th</sup>

#### **CO<sub>2</sub> Storage**

09:00 *Overview of CO<sub>2</sub> Storage Options*  
Manika Prasad, Colorado School of Mines

09:30 *Regulatory Challenges in CO<sub>2</sub> Storage*  
Michael Moore, East-West Strategic Advisors

10:00 *Coffee*

10:30 *Geomechanics in CO<sub>2</sub> Storage*  
Manika Prasad, Colorado School of Mines

11:30 *Computational Modeling of Fault Poromechanics for Storage-Induced Seismicity and CO<sub>2</sub> 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 CO<sub>2</sub> Emissions*  
Erik Lindeberg, SINTEF

14:20 *Tertiary CO<sub>2</sub> EOR in 23 North Sea Oil Fields - Combined CO<sub>2</sub> Storage Based in Industrial CO<sub>2</sub> Sources*  
Erik Lindeberg, SINTEF

15:00 *Coffee*

15:30 *Numerical Simulation of CO<sub>2</sub> Storage in Saline Aquifers*  
Yu-Shu Wu, Colorado School of Mines

16:15 *CO<sub>2</sub> Storage, Monitoring, Verification and Accounting*  
Erik Lindeberg, SINTEF

17:00 End of Day

**Day 4: Thursday Oct. 18<sup>th</sup>****CO<sub>2</sub> 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 *CO<sub>2</sub> Storage in Hydrates with Associated Methane Production*  
Arne Graue, University of Bergen

10:00 *Coffee*

10:30 *Field Experiences from CO<sub>2</sub> Injections in Hydrates: North Slope CO<sub>2</sub>-CH<sub>4</sub> Exchange Project*  
Arne Graue, University of Bergen

11:00 *CO<sub>2</sub> EOR Assessment*  
Wayne Rowe, Schlumberger Carbon Services

12:00 *Lunch*

**CO<sub>2</sub> Utilization in EOR as CCUS**

13:00 *CO<sub>2</sub> 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 CO<sub>2</sub> in Beer Manufacturing, Tour of Coors Brewery for Group 1/CSM Lab Tour for Group 2*

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

16:00 *CO<sub>2</sub> EOR, CCUS, and the Horizontal Revolution in the Permian Basin*  
Steve Melzer, Melzer Consulting

16:30 *Current CO<sub>2</sub> EOR Perspectives*  
Hossein Kazemi, Colorado School of Mines

17:30 *End of Day*

19:00 *Conference Dinner at the Golden Hotel*

**Day 5: Friday Oct. 19<sup>th</sup>****CO<sub>2</sub> EOR and Whole Value Chain CCUS Future Development**

- 09:00 ***Surfactant Selection for Foam EOR***  
**George Hirasaki, Rice University**
- 10:00 ***CO<sub>2</sub> Foam EOR for Mobility Control***  
**Arne Graue, University of Bergen**
- 10:30 ***Coffee***
- 11:00 ***Historical Overview of CO<sub>2</sub> EOR Field Applications***  
**David Schechter, Texas A&M University**
- 12:00 ***Lunch***
- 13:00 ***CO<sub>2</sub> 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**