



Lenfest Center for Sustainable Energy
EARTH INSTITUTE | COLUMBIA UNIVERSITY

 COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

 AICHE ASME AIME IEEE ASCE
Carbon Management

NSF RCN-SEES: Multidisciplinary Approaches to Carbon Capture, Utilization and Storage (CCUS)

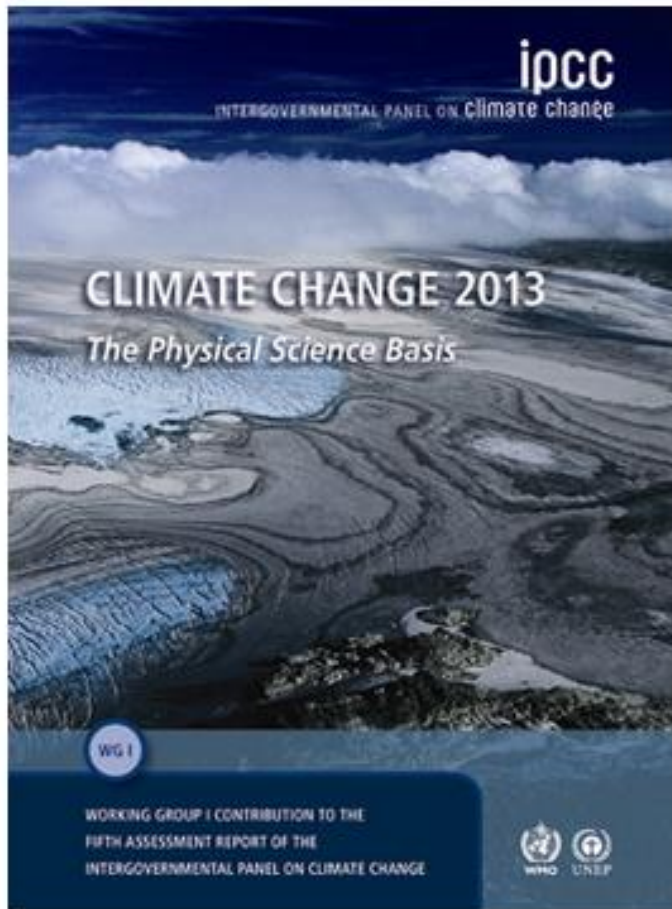
A.-H. Alissa Park
Lenfest Center for Sustainable Energy
Columbia University
New York

April 15th – 16th, 2014



Goal of NSF **R**esearch **C**oordination **N**etwork program

The goal of the RCN program is to advance a field or create new directions in research or education by supporting groups of investigators to **communicate** and **coordinate** their research, **training** and **educational activities across disciplinary, organizational, geographic and international boundaries**. RCN provides opportunities to foster new collaborations, including international partnerships, and address interdisciplinary topics. Innovative ideas for implementing novel networking strategies, collaborative technologies, and development of **community standards for data and meta-data** are especially encouraged.



[Summary for Policymakers](#)

[Full Report](#)

Quick Links

- [Fifth Assessment Report \(AR5\)](#)
- [More on Working Group I \(WGI\) report](#)
- [More on AR5](#)

▼ Report by Chapters

Technical Summary

- [Introduction](#)
- [Observations: Atmosphere and Surface](#)
- [Observations: Ocean](#)
- [Observations: Cryosphere](#)
- [Information from Paleoclimate Archives](#)
- [Carbon and Other Biogeochemical Cycles](#)
- [Clouds and Aerosols](#)
- [Anthropogenic and Natural Radiative Forcing](#)
- [Evaluation of Climate Models](#)
- [Detection and Attribution of Climate Change: from Global to Regional](#)
- [Near-term Climate Change: Projections and Predictability](#)
- [Long-term Climate Change: Projections, Commitments and Irreversibility](#)
- [Sea Level Change](#)
- [Climate Phenomena and their Relevance for Future Regional Climate Change](#)

[Annex I: Atlas of Global and Regional Climate Projections](#)

[Annex II: Glossary](#)

[Annex III: Acronyms and Regional Abbreviations](#)

[Changes to the Underlying Scientific/Technical Assessment \(IPCC-XXVI/Doc.4\)](#)

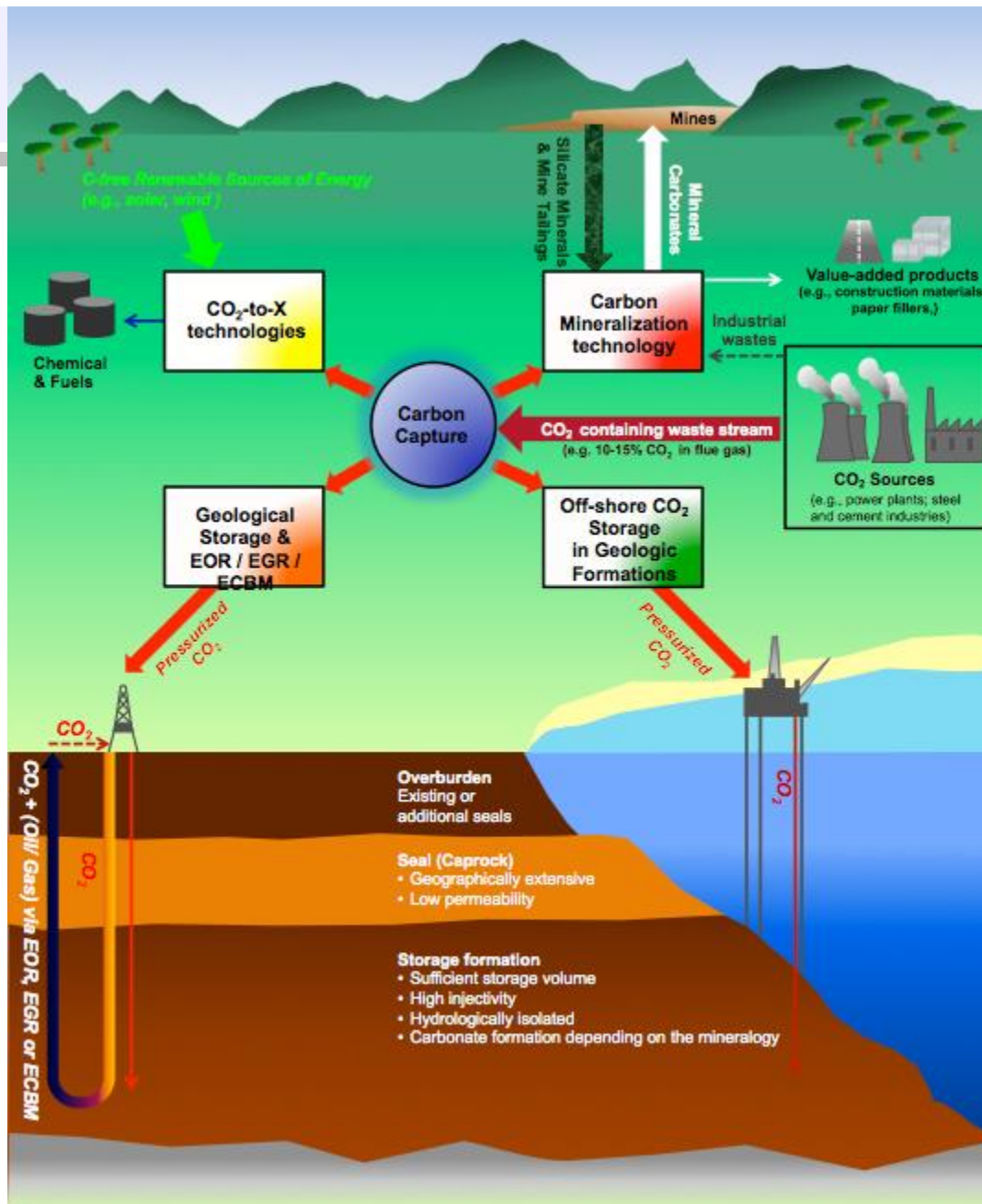
[Complete Underlying Scientific/Technical Assessment \(166MB\)](#)

E.8 Climate Stabilization, Climate Change Commitment and Irreversibility

Cumulative emissions of CO₂ largely determine global mean surface warming by the late 21st century and beyond (see Figure SPM.10). Most aspects of climate change will persist for many centuries even if emissions of CO₂ are stopped. This represents a substantial multi-century climate change commitment created by past, present and future emissions of CO₂. {12.5}

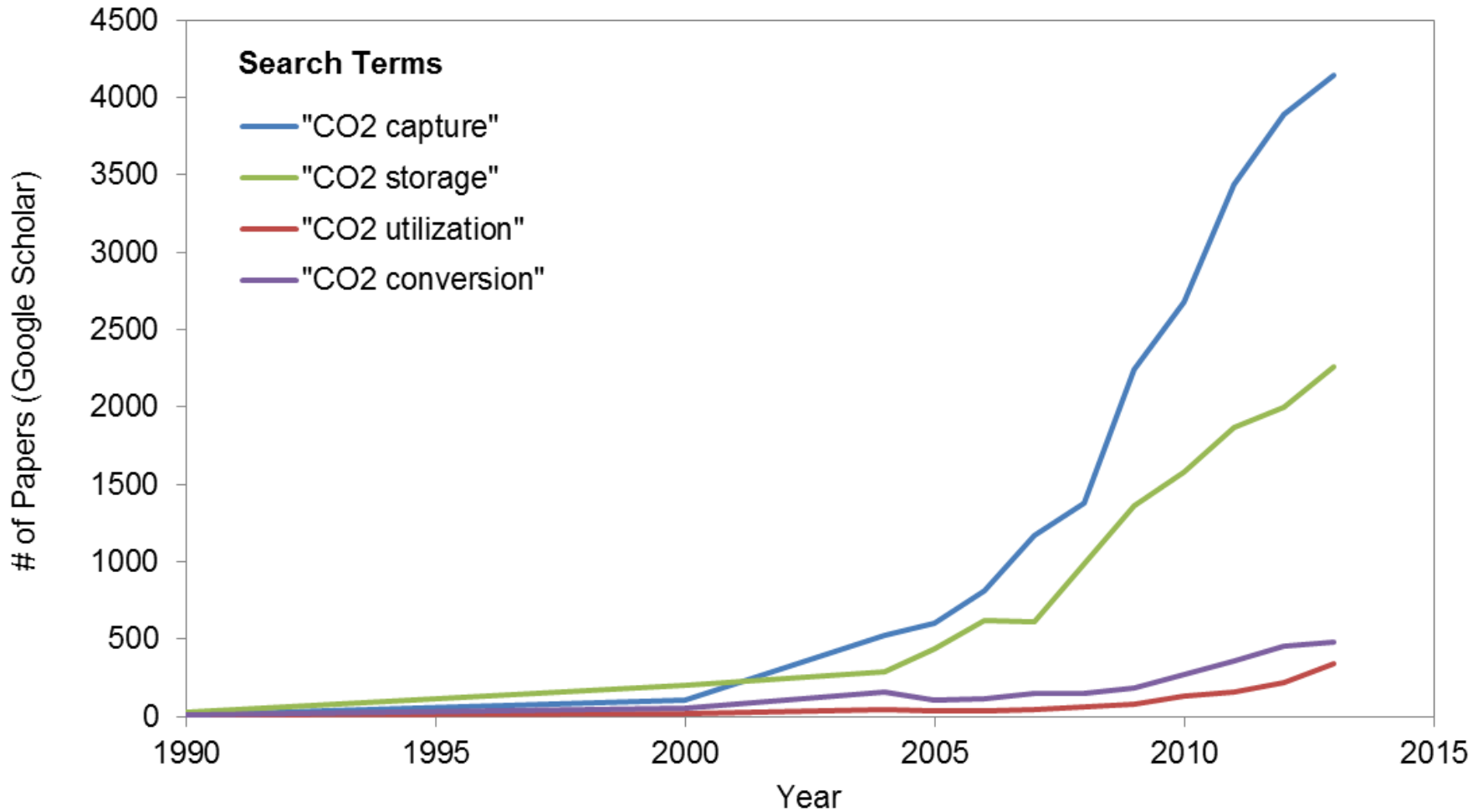
- Methods that aim to deliberately alter the climate system to counter climate change, termed geoengineering, have been proposed. Limited evidence precludes a comprehensive quantitative assessment of both Solar Radiation Management (SRM) and Carbon Dioxide Removal (CDR) and their impact on the climate system. CDR methods have biogeochemical and technological limitations to their potential on a global scale. There is insufficient knowledge to quantify how much CO₂ emissions could be partially offset by CDR on a century timescale. Modelling indicates that SRM methods, if realizable, have the potential to substantially offset a global temperature rise, but they would also modify the global water cycle, and would not reduce ocean acidification. If SRM were terminated for any reason, there is *high confidence* that global surface temperatures would rise very rapidly to values consistent with the greenhouse gas forcing. CDR and SRM methods carry side effects and long-term consequences on a global scale. {6.5, 7.7}

<http://www.scientificamerican.com/article.cfm?id=latest-ipcc-climate-report-puts-geoengineering-in-the-spotlight>



Carbon Capture, Utilization and Storage

Publications in CCUS



Why RCN-CCUS?

CCUS community needs one voice and a coherent vision.

Why would you want to join the RCN-CCUS?

- Networking with other players in CCUS
 - Collectively find out what are the right questions to work on.
 - Collaborative opportunities (science & social science, academic & industrial)
 - Visibility of your work to the broader CCUS communities via webinar, website, and meetings including annual symposium. We will maintain the RCN-CCUS website to provide the centralized information source for your papers, reports, patents etc.

Mission Statement of RCN-CCUS

Our mission is to build a **trans-disciplinary** Research Coordination Network (RCN) on **Carbon Capture, Utilization and Storage** (CCUS) that will facilitate research collaborations and training that cross the boundaries of the natural sciences, engineering, and the social and economic sciences to develop new understanding, theories, models and technologies as well as assessment tools for the developed technologies and their implementation plans for global communities.

NSF RCN-SEES: Multidisciplinary Approaches to Carbon Capture, Utilization and Storage (CCUS)

PI: Ah-Hyung Alissa Park

(09/2012 – 08/2016, NSF Program Director: Bruce Hamilton)

Project Management

LCSE - Columbia University

PI: A.-H. Alissa Park

CU PMs: Taylor and Gadikota & AIChE team: Schuster

Steering Committee

Thrust POC: Park

Members: Park, Lackner, Schlosser, Kelemen & Mutter (Columbia), Aines (LLNL), Fan (OSU), Fitts & Socolow (Princeton), Jones (Georgia Tech), Keairns (AIChE), Mazzotti (ETH-Zurich), Rubin (CMU), Sageman (Northwestern), Smit (Berkeley), Snurr (Northwestern) and Song (Penn State)

Educational Thrust

Thrust POC: Schuster & Pfirman

- K-12: K-12 teachers (Buck and Miller)
- Young Professional (TBA)
- MCM at Columbia (Lackner)
- Research Experience in C Science (Tomski)
- Women in Science and Engineering (Gadikota)
- Council of Environmental Deans and Directors (CEDD, TBA)

* Columbia participants unless noted

* International participants are in blue

PE Society Thrust

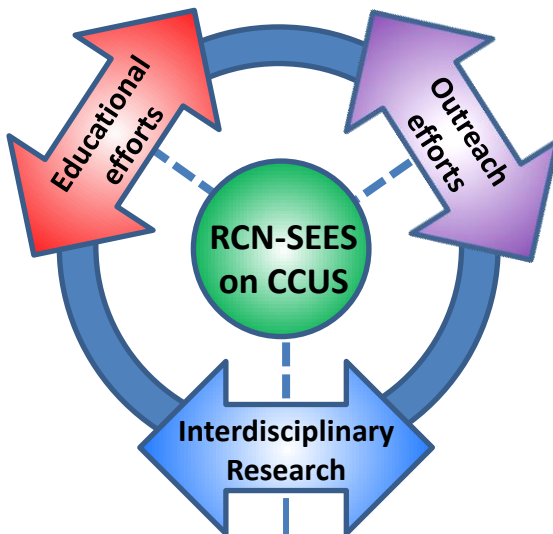
Thrust POC: Keairns & Schuster (AIChE)

AIChE (TBA), AIME (TBA), ASCE (TBA), ASME (TBA), IEEE (TBA), Fox (IMECHE)

Industrial Thrust

Thrust POC: Gupta (RTI) & Schuster (AIChE)

B&W (Vargas), GE (Perry), RTI (Gupta), SK Energy (Park), ARAMCO (Katikaneni), ORICA Ltd. (Brent), POSCO (Jung), etc



Academic

CO₂ Capture & Conversion Thrust

Thrust leader: Petit & West

Aines (LLNL), Panagiotopoulos & Bocarsly (Princeton), Chen, Coppens (UCL), Lee (SKU), Farrauto, Liu & Heldebrant (PNNL), Li (NCSSU), Wang (Zhejiang), Park, Reimer (Berkeley), Snurr (Northwestern), Song (PSU), Wilcox (Stanford), Yegulalp, Zhang & Zhang (CAS-IPE), etc

CO₂ Transportation, Storage & EOR Thrust

Thrust leader: Matter (USH) & Brady (SNL)

Baciocchi (UR-TV), Bonneville (PNNL), Blunt (Imperial), Bryant (UT Austin), Dipple (UBC), Dlugogorski (UNewcastle), Goldberg, Lee (KAIST), Park, Peters & Fritt (Princeton), Sageman & Husson (Northwestern), Wang (Yale), Zhu (Indiana), etc

CO₂ MVA & Risk Analysis Thrust

Thrust leader: Stute & Venkat

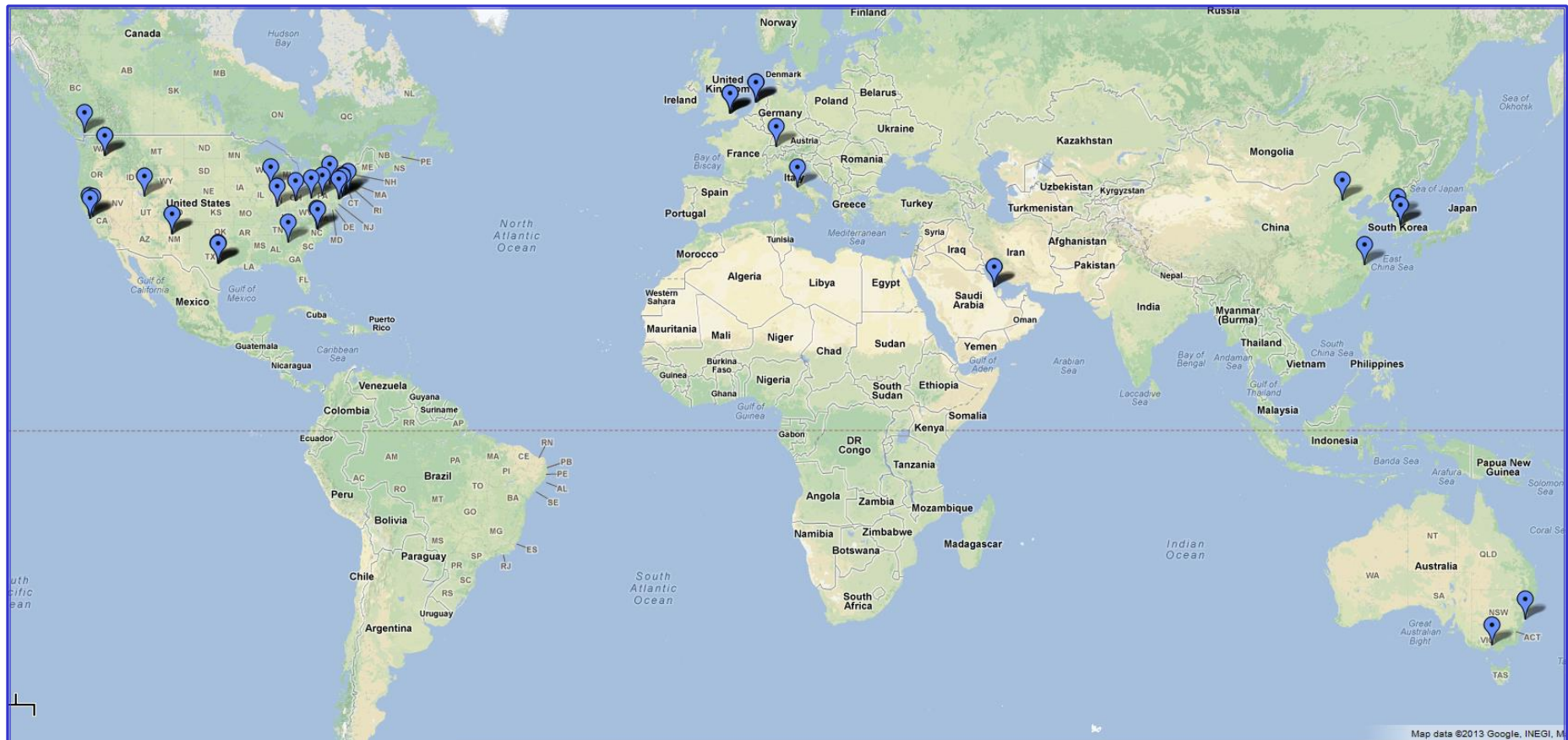
Bonneville (PNNL), Goldberg, Lackner, Meinrenken, Park, Peters (Princeton), Romanak (BEG Texas), Zhu (Indiana), etc

Policy, Business & Law Thrust

Thrust leader: Barrett & Gerrard

Coppens (UCL), Fox (IMECHE), Lackner, Marcotullio, Shindell, Urpelainen, van Ryzin, Weber, Welton, van der Zwaan (ECN), etc

RCN-CCUS participants (as of 02/12/2013)



- 10 countries
- ~60 Academic participants
- ~26 Non-academic participants
- Student participants are not counted yet.

RCN-CCUS Activities

I. Research Coordination

- Formulation of Project Management Team & Identification of RCN participants
- Annual meetings, workshops and symposium
- Seminars via Web-conferencing

II. Educational Development and Programming

- Curriculum Development (Masters in Carbon Management at Columbia U.)
- RECS program in summer

III. Outreach Activities

- International Outreach
- K-12 outreach
- RCN-CCUS Website
- Gordon Research Conference

Mission Statement

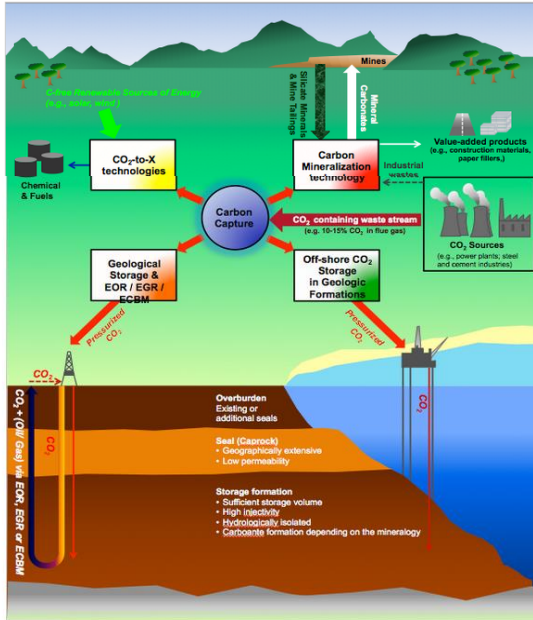
Overall Schemes of Carbon Capture, Utilization and Storage

Carbon Capture, Utilization and Storage (CCUS) is one of the greatest challenges faced by humanity that cannot be solved by simply employing traditional scientific or engineering approaches. The development of CCUS technologies as well as their implementation requires more than ever cross-cutting collaborations among natural science, engineering and social science disciplines.

Furthermore, the development of national and international policies and economic framework are also important for the significant reduction in the anthropogenic carbon emissions. The G8 recently stated the goal of achieving at least a 50% reduction in worldwide greenhouse gas emissions by 2050. To achieve this ambitious goal, we need to work together and encourage the effective rapid transfer of knowledge between participating members of the global communities.

In light of this, the RCN-SEES is formulated to provide transformative research collaborations in CCUS and facilitate research collaborations that effectively cross the boundaries of the natural sciences, engineering, and the social and economic sciences. If successful, this effort would lead to new understandings, theories, models and technologies as well as assessment tools for CCUS and their implementation plans for global communities.

The proposed activities of the RCN-SEES also include extensive educational and outreach activities, which will allow the creation of the workforce that has the holistic understanding of CCUS related issues with strong scientific and engineering skills.



Who We Are

Participating Institutions

Learn about the participation of Columbia University and AIChE teams as well as the CCUS Network teams.

[Go to Participating Institutions →](#)

Participating Members

Learn more about participating members from institutions throughout the world.

[Go to Participating Members →](#)

Participating Institutions



[Learn More →](#)

Participating Members.

See participating CCUS Network members from Columbia University and institutions worldwide.

[Learn More →](#)

- RCN-CCUS Website: The RCN-CCUS website was launched

(www.ccusnetwork.org)