



# Resolving the Legal and Regulatory Challenges to Geologic Sequestration of CO<sub>2</sub>—A CCSReg Project Workshop

Hall of the States, Washington, DC

October 25-26, 2010

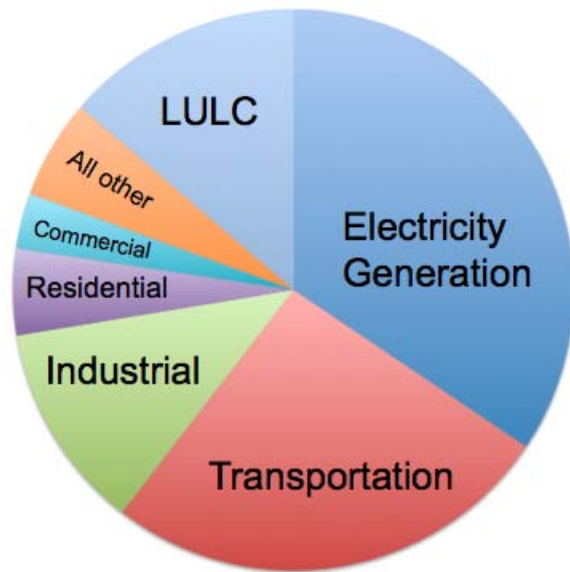
Washington, D.C.

[http://www.ccsreg.org/workshop\\_information.html](http://www.ccsreg.org/workshop_information.html)

Thank you for joining us today!

# Why CCS?

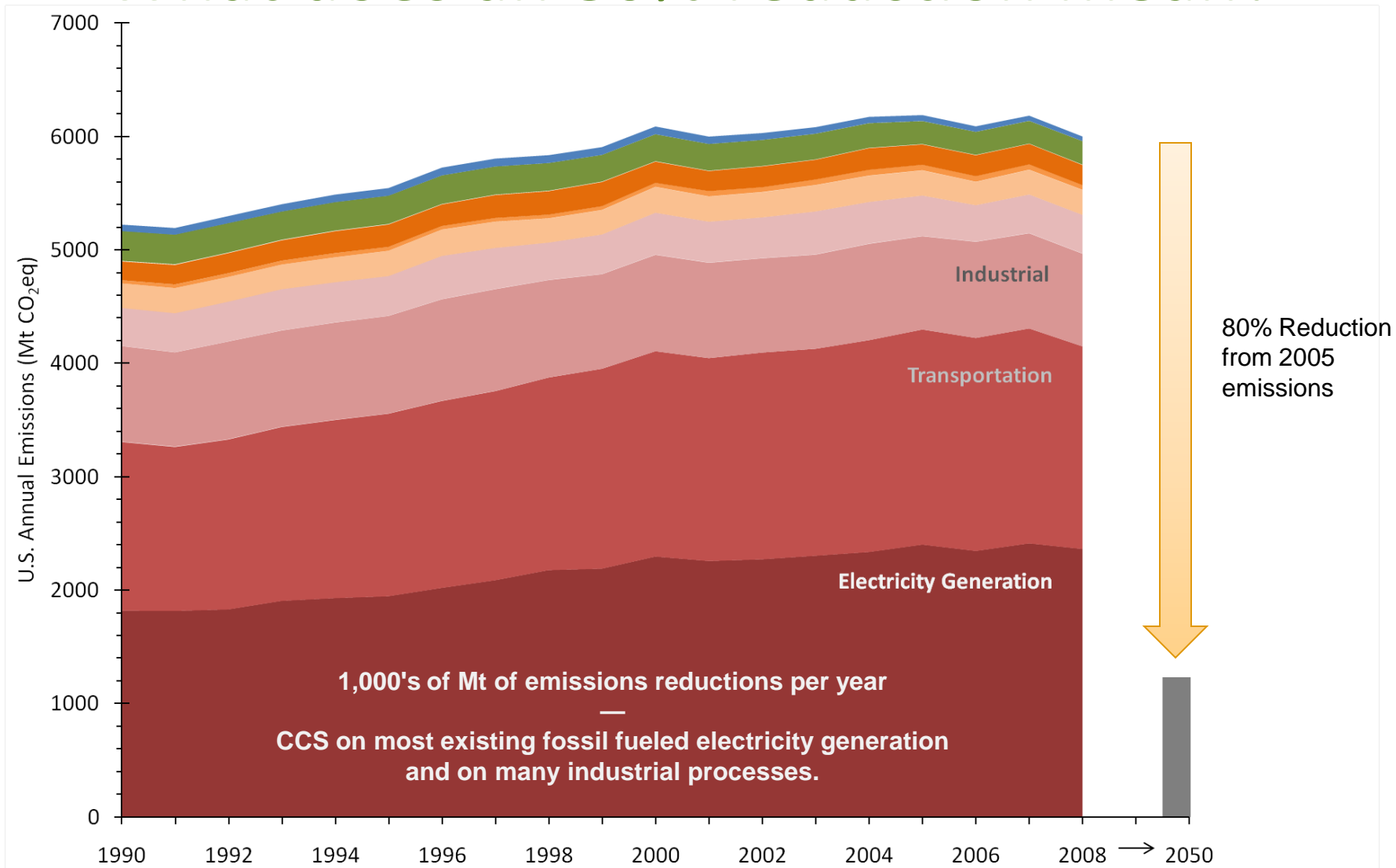
Once they enter the atmosphere, the concentrations of CO<sub>2</sub> and most other greenhouse gases remain elevated for over 100 years. Thus, to avoid serious climate change the world needs to reduce its emissions of GHGs by roughly 80% from what they are today.



In all the analyses we have done, and all serious ones we have looked at, we find no cost-effective way to de-carbonize the U.S. energy system unless CCS is part of the portfolio of options along with efficiency, renewables, nuclear, etc.

Data from U.S. EPA for 2008  
[www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010\\_Report.pdf](http://www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_Report.pdf)

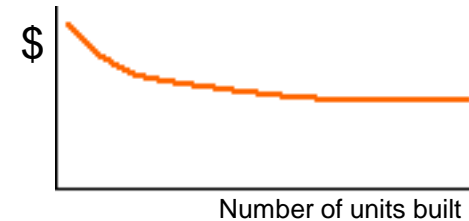
# What does an 80% reduction mean?



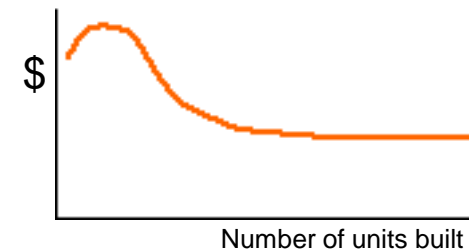
# Two things must happen if CCS is to be part of the solution

1. The technology must be developed and deployed at sufficient scale to become cost effective. Since today there is no restriction on CO<sub>2</sub> emissions, this will take financial support from government.

The learning curve will probably not look like this:



But rather like this:



For details see Rubin et al., IJGGC, 2007.

2. A regulatory regime must be developed that makes CCS safe, environmentally sound, affordable, and socially equitable.  
**This is the objective of the CCSReg Project.**

# What we hope to get from this workshop

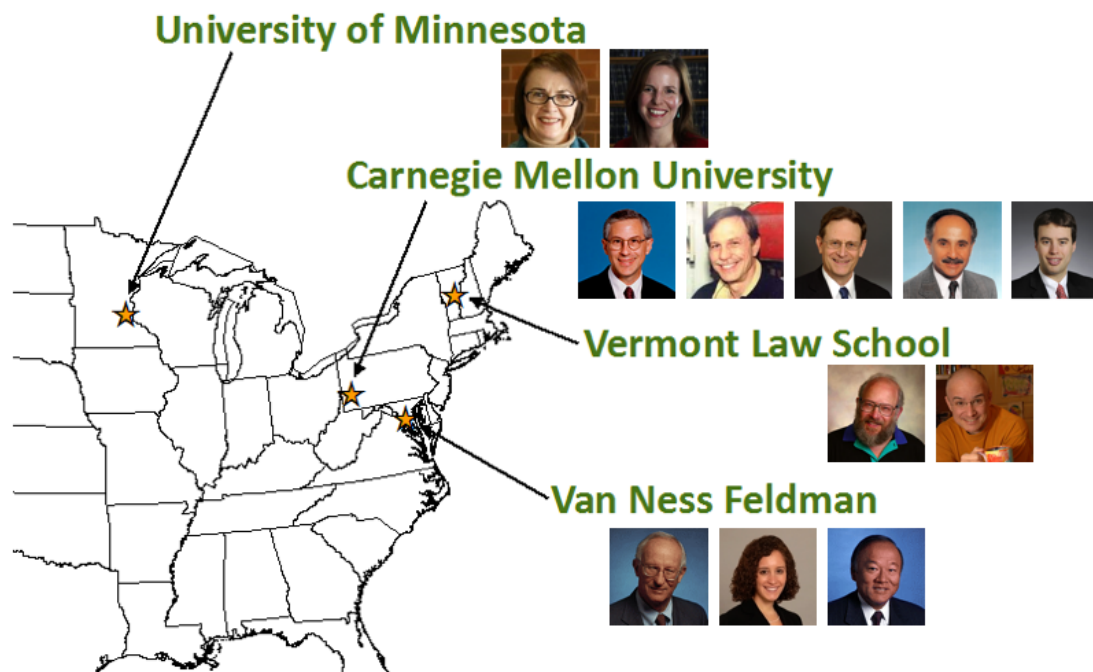
- A vigorous assessment and critique of the draft of our model legislation.
- Suggestions for things that might be done differently to improve the draft.
- A general discussion of the importance of making progress on the regulatory front to promote CCS development.

## What we are *not* looking for from this workshop:

- Consensus about, or endorsement of, the approach we have adopted in the draft model legislation.

# Development of a regulatory regime requires both technical and legal expertise

In 2008, we assembled such a team with support of \$2-million from the Doris Duke Charitable Foundation and additional support for technical work of about \$200k from NSF via the Climate Decision Making Center (CDMC).



# Project time line

Start of DDCF support



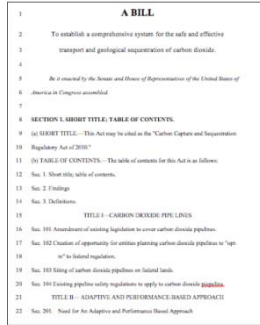
Workshops in DC and in Zurich

Development of basic framing

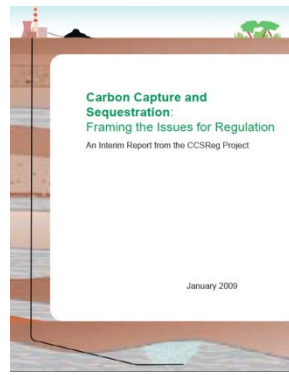


Briefings and conference presentations

Development of draft legislative language



Development of a series of policy briefs



January 2009 Publication of Interim Report



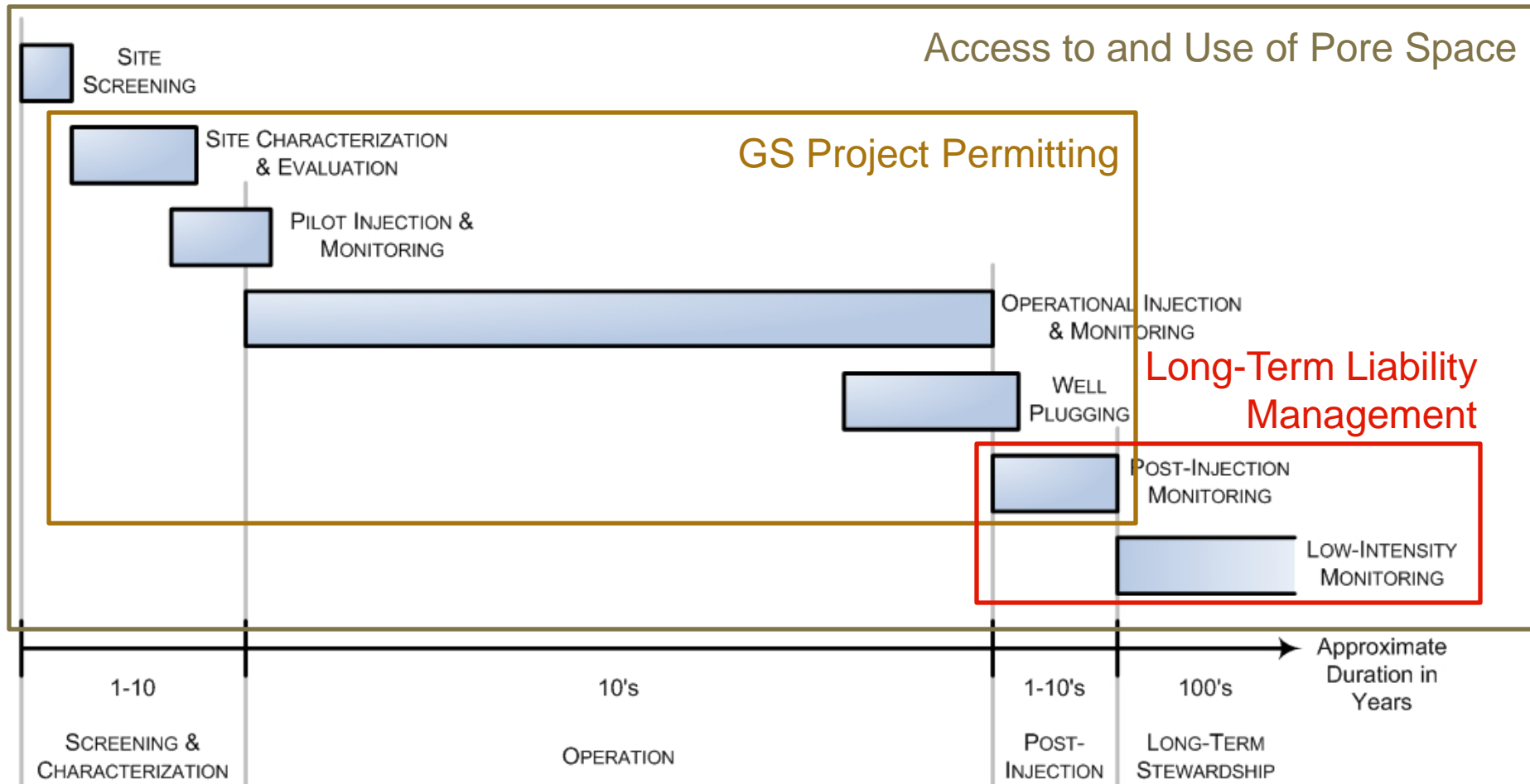
Today's workshop



# There are barriers in at least five areas that could limit large-scale CCS deployment

Access to and use of pore space	A lack of clarity on ownership of pore space in deep geological formation and the means by which this space can be accessed for CO <sub>2</sub> sequestration
Permitting of geologic sequestration projects	Limited authorization for the U.S. Environmental Protection Agency (EPA) to consider impacts beyond those to underground sources of drinking water (USDW) in their Underground Injection Control (UIC) program rule making process A tendency for the EPA to create procedural rules under the UIC program Gaps in knowledge necessary to create detailed regulations for GS today
Management of long-term liability	No system by which the liabilities (tort or otherwise) associated with CO <sub>2</sub> sequestration can be managed in the long-term (i.e., post-closure)
Development of pipeline infrastructure	Lack of an adequate regulatory framework for the construction of CO <sub>2</sub> pipeline infrastructure, particularly for pipeline siting and access to eminent domain
Difficult to manage commercial risks	Uncertainty over the structure of a future CO <sub>2</sub> emissions control program—cap and trade, or otherwise—and the way in which CCS will fit into this program Uncertainty surrounding the economics of capture and geological sequestration, the structure of a future carbon sequestration industry, and the relationships between organizations in this industry.

# Barriers impact geologic sequestration projects at different places across the project lifecycle



# Agenda for the rest of the day

11:00	Opening Session: CCS Technology and the CCSReg project	
	Opening remarks	Granger Morgan, Carnegie Mellon University
	Review of the CCSReg project goals, participants, products, and outcomes from the meeting	Granger Morgan, Carnegie Mellon University
	Technical overview of geologic sequestration	Michael Celia, Princeton University
12:00	Lunch	
13:00	Session 1: Adaptive regulation	Melisa Pollak, University of Minnesota
	CCSReg Presentation	Sean McCoy, Carnegie Mellon University
	Response 1	Micah Ziegler, World Resources Institute
	Open discussion	
14:15	Session 2: Pore space access and use	
	CCSReg Presentation	Lee Gresham, CCSReg
	Response 1	Owen Anderson, University of Oklahoma
	Response 2	Barclay Rogers, C12 Energy
	Open discussion	
16:00	Refreshment Break	
16:15	Session 3: Long-term stewardship & liability	
	CCSReg Presentation	Michael Dworkin, Vermont Law School
	Response 1	Marty McBroom, AEP
	Response 2	Scott Anderson, EDF
	Response 3	Chiara Trabucchi, Industrial Economics
	Open discussion	
18:00	Adjourn	

# Each session will be shaped by your contributions to the discussion

- Each session will begin with a brief **summary** of the solutions we have proposed, and will highlight how we have gone about implementing the recommendation in the draft legislative language.
- One to three participants, who we contacted prior to the meeting, will then **comment** on our recommendations and their implementation.
- The remainder of the time (at least 30 minutes) is for **open discussion** of the issues.

## A BILL

To establish a comprehensive system for the safe and effective transport and geologic sequestration of carbon dioxide.

1 *Be it enacted by the Senate and House of Representatives of the*  
2 *United States of America in Congress assembled,*

### 3 SECTION 1. SHORT TITLE.

4 This Act may be cited as the "Carbon Capture and Sequestra-  
5 tion Regulatory Act of 2010".

### 6 SEC. 2. TABLE OF CONTENTS.

7 The table of contents for this Act is as follows:

SECTION 1. SHORT TITLE.

SEC. 2. TABLE OF CONTENTS.

SEC. 3. FINDINGS

SEC. 4. DEFINITIONS

SEC. 5. SEVERABILITY OF PROVISIONS.

#### TITLE I—CARBON DIOXIDE PIPELINES

SEC. 101. SITING AND CONSTRUCTION OF CO<sub>2</sub> PIPELINES.

SEC. 102. SAVINGS PROVISIONS

#### TITLE II—ADAPTIVE AND PERFORMANCE-BASED

##### APPROACH

SEC. 201. NEED FOR AN ADAPTIVE APPROACH TO THE  
GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE

SEC. 202. CREATION OF A CCS TECHNICAL ADVISORY  
COMMITTEE OF THE NATIONAL RESEARCH COUNCIL.

SEC. 203. REQUIREMENTS FOR PERIODIC REVIEW AND  
REVISIONS

# Candid discussion is critical to helping us refine our draft

As such, we are conducting this session under the Chatam House Rule:

"...participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed."

We plan to produce a very brief summary of the workshop discussions. In it we will not identify individual speakers, nor affiliations. As participants, you have all received an attendees list and, in keeping with Chatam House Rules, *we ask that you not share this list with others who are not present today.*

# Funding for this workshop and the CCSReg Project

This workshop and the work of the CCSReg project is made possible by support from:

- The Doris Duke Charitable Foundation (Grant 2007117) to Carnegie Mellon University, Department of Engineering and Public Policy for the project, "Regulation of Capture and Deep Geological Sequestration of Carbon Dioxide".
- The National Science Foundation through the Climate Decision Making Center at Carnegie Mellon University (SES-0345798).

# Technical overview of geologic sequestration: Prof. Michael Celia

Professor Michael Celia is chair of the Department of Civil and Environmental Engineering at Princeton University. He received a B.S. in Civil Engineering from Lafayette College in 1978, an M.S. in Civil Engineering from Princeton University in 1979, and a PhD from Princeton in 1983. In 1985 he joined the faculty of M.I.T., and returned to Princeton to join the Civil Engineering faculty in 1989. Professor Celia's areas of research include groundwater hydrology, ecohydrology, numerical modeling, contaminant transport simulation, and multiphase flow in porous media, with applications focused on ecohydrology in water-limited ecosystems and on large-scale geological sequestration of carbon dioxide. The carbon work is part of a large multi-disciplinary effort at Princeton known as the Carbon Mitigation Initiative. Professor Celia served for 10 years as editor of the journal *Advances in Water Resources*. He is a Fellow of the American Geophysical Union, recipient of the 2005 AGU Hydrologic Sciences Award (citation: For fundamental research contributions to subsurface hydrology and numerical methods in water resources, and for providing a model of Academia at its best), and has been named the 2008 Darcy Lecturer by the National Ground Water Association. As a contributing author for the IPCC Working Group III Special Report on Carbon Dioxide Capture and Storage, Professor Celia shares, with many colleagues, the 2007 Nobel Peace Prize.

