



Alliance for Sequestration Training, Outreach, Research & Education

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Abstract

The Sequestration Training, Outreach, Research and Education (STORE) Alliance at The University of Texas at Austin completed its activity under Department of Energy Funding (DE-FE0002254) on September 1, 2013. The program began as a partnership between the Institute for Geophysics, the Bureau of Economic Geology and the Petroleum and Geosystems Engineering Department at UT. The initial vision of the program was to promote better understanding of CO₂ utilization and storage science and engineering technology through programs and opportunities centered on training, outreach, research and technology transfer, and education.

With over 8,000 hrs of formal training and education (and almost 4,500 of those hours awarded as continuing education credits) to almost 1,100 people, STORE programs and activities have provided benefits to the Carbon Storage Program of the Department of Energy by helping to build a skilled workforce for the future CCS and larger energy industry, and fostering scientific public literacy needed to continue the U.S. leadership position in climate change mitigation and energy technologies and application.

Now in sustaining mode, the program is housed at the Center for Petroleum and Geosystems Engineering, and benefits from partnerships with the Gulf Coast Carbon Center, TOPCORP and other programs at the university receiving industry funding.

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Executive Summary

The Sequestration Training, Outreach, Research and Education (STORE) Alliance at The University of Texas at Austin completed its activity under Department of Energy Funding (DE-FE0002254) on September 1, 2013. The program began as a partnership between the Institute for Geophysics, the Bureau of Economic Geology and the Petroleum and Geosystems Engineering Department at UT. The initial vision of the program was to promote better understanding of CO₂ utilization and storage science and engineering technology through programs and opportunities centered on training, outreach, research and technology transfer, and education.

In 2010, STORE started as an effort in the Gulf Coast Region, and we chose to focus our efforts in three of the top ten CO₂ emitters in the country: Texas, Florida and Louisiana. By 2013, we have developed an internationally recognized program to impart knowledge on CO₂ Utilization and Storage to stakeholders in countries around the world. For example, STORE has sent delegates to the United Nations Framework Convention on Climate Change to present information on carbon storage technology and workforce training, and the program will be hosting 90 people for the IEA Greenhouse Gas R&D Programme's International CCS Summer School at The University of Texas at Austin in July of 2014.

The program has been successful by focusing on two important program threads: (1) creating alliances with various local partners who will see a mutual benefit to our partnership, handle logistics of programming, advertise and assist in recruiting our target audience and sponsor our training at no or low cost to our target audience, and (2) creating materials to support our four programming areas: (a) training materials targeting professionals, (b) web-based resources for research and technology dissemination, (c) educational materials for K-12 teachers and (c) outreach materials and videos.

During the DOE funding period, STORE planned, hosted and participated in 68 events related to our mission, and STORE programs delivered 8,005 hours of formal training and education to 1075 people during DOE funding. The program awarded continuing education credits for 4,463 contact hours to 431 people.

Our STORE audiences range from professional engineers and geologists to state regulators and government officials to K-12 teachers and students. Partnerships were the key to bringing our training to a variety of audiences. For example, we were able to coordinate with several professional societies (e.g., Society for Petroleum Engineers, Gulf Coast Association of Geological Societies) to plan full-day workshops for engineers and geologists looking for training in carbon storage. In addition, we provided a half-day training/half-day field module when the Midwest Governors Association brought a group of regulators and state officials to Texas for a carbon storage and utilization tour. The field portion was a result of our alliance with Denbury Resources. Lastly, K-12 teachers are extremely interested in carbon storage technology and how it relates to the societal issues of energy, climate and water. By partnering with the Florida Association of Science Teachers, STORE was able to position itself with several keynote talks and teacher workshops in front of over 500 state science teachers.

STORE programs and activities have provided benefits to the Carbon Storage Program of the Department of Energy by helping to build a skilled workforce for the future CCS and larger energy industry, and fostering scientific public literacy needed to continue the U.S. leadership position in climate change mitigation and energy technologies and application.

Now in sustaining mode, the program is housed at the Center for Petroleum and Geosystems Engineering where it has been integrated into the center's website (<http://www.cpge.utexas.edu/store>). STORE now benefits from partnerships with the Gulf Coast Carbon Center, TOPCORP and other programs at the university receiving industry funding.

Final Project Summary

The Sequestration Training, Outreach, Research and Education (STORE) Alliance at The University of Texas at Austin completed its activity under Department of Energy Funding (DE-FE0002254) on September 1, 2013. The program began as a partnership between the Institute for Geophysics, the Bureau of Economic Geology and the Petroleum and Geosystems Engineering Department at UT. Now in sustaining mode, the program is housed at the Center for Petroleum and Geosystems Engineering where it has been integrated into the center's website (<http://www.cpge.utexas.edu/store>).

The **vision** of STORE is to promote better understanding of CO₂ utilization and storage science and engineering technology.

The **mission** is to create programs and opportunities in CO₂ utilization and sequestration

1. training,
2. outreach,
3. research and technology transfer, and
4. education.

STORE programs and activities have provided **benefits** to the Carbon Storage Program of the Department of Energy by:

1. helping to build a skilled workforce for the future CCS and larger energy industry, and
2. fostering scientific public literacy needed to continue the U.S. leadership position in climate change mitigation and energy technologies and application.

The program measures its successes through accomplishment of specific **objectives**:

1. plan, host and participate in events related to our mission, and
2. award continuing education credits to participants in our programs.

STORE programming follows a core set of **values**:

1. Collaboration: leverage collective technical expertise,
2. Alliances: leverage opportunities and shared objectives,
3. Quality: set and follow high standards, both technically and pedagogically, about imparting knowledge, and
4. Diversity: reach a diverse audience and show a diversity scientists and engineers (mentors).

In 2010, STORE started as an effort in the Gulf Coast Region, and we chose to focus our efforts in three of the top ten CO₂ emitters in the country:

1. Texas
2. Florida
3. Louisiana

Now, in 2013, we have developed an internationally recognized program to impart knowledge on CO₂ Utilization and Storage to stakeholders in countries around the world.

STORE has been successful by focusing on two important **program threads**:

1. Creating alliances with various local partners who will:
 - see a mutual benefit to our partnership
 - handle logistics of programming
 - advertise and assist in recruiting our target audience
 - sponsor our training at no or low cost to our target audience

2. Creating materials to support our 4 programming areas:
 - Training materials targeting professionals
 - Research and Technology Dissemination through web-based resources
 - Educational materials for K-12 teachers
 - Outreach materials and videos

The **topics** covered by STORE programming have been matched to our researcher/technologist/ professor specialties and experiences, including:

- Groundwater Protection
- Climate Change
- Site Characterization
- Subsurface Geology
- Permitting
- Reservoir Engineering
- EOR- CO₂
- CO₂ Injection
- CO₂ Monitoring
- Petrophysics
- Geophysics
- Geochemical Impacts
- Geomechanical Impacts
- Well Drilling and Completion for CO₂

Programming in training, outreach, research and technology transfer and education was achieved through **two approaches**: in-person interaction (e.g., instructors, mentors at workshops) and virtual interaction (e.g., web-based content, video content). Examples of work in the four programming areas will give a high-level overview of the types of activities that were conducted using DOE funding of STORE. The summary below emphasizes the importance of alliances and original materials created by the program as threads throughout the program.

Training

In-person Training

PROFESSIONAL/INDUSTRY AUDIENCE example:

Carbon Sequestration: Storage of CO₂ in Geologic Formations

One-day short course on CO₂ Sequestration

Alliance: SPE International Conference on CO₂ Capture Storage and Utilization

Date/Location: Nov 10-12, 2010, New Orleans, LA

Audience: Professional Engineers

CEUs: 23.2 CEUs awarded total (29 participants @ .8 CEU/participant)

STORE instructors: Steve Bryant, J.P. Nicot, Rebecca Smyth, Dan Collins, Tip Meckel, Hilary Olson

Other instructors: Traci Rodosta (DOE)

FEDERAL/STATE REGULATORS/POLICYMAKERS AUDIENCE example:

Commercial Enhanced Oil Recovery Using Carbon Dioxide
Workshop and Field Trip

Alliance: Midwestern Governors Association, Great Plains Institute, Denbury Resources, Southern Co. and the Southern States Energy Board

Date/Location: Sept 28, 2011, Houston, TX

Audience: Regulators and Policymakers

CEUs: 10.8 CEUs total awarded (27 participants @ .4 CEU/participant)

STORE instructors: Larry Lake, Sue Hovorka, Hilary Olson

Other instructors: Darrick Eugene (General Counsel, Texas Carbon Capture and Storage Association), Laura Miller (Director of Projects, Summit Power) and Gregory Kunkel (VP, Environmental Affairs for Tenaska)

Virtual Training

WEBINAR example:

Methodologies and guidelines for selection of storage sites in saline aquifers
One-hour Webinar

Alliance: Global CCS Institute (host)

Date/Location: August 29, 2013, online

Audience: Professional Earth Scientists and Engineers, Policymakers, NGOs

CEUs: ~3 CEUs total awarded by Global CCS Institute (30 participants @ .1 CEU/participant)

STORE instructors: Vanessa Nuñez-Lopez

Website: <http://www.globalccsinstitute.com/get-involved/webinars/2013/08/28/methodologies-and-guidelines-selection-storage-sites-saline>

Outreach

In-person Outreach

COMMUNITY OUTREACH example:

Energy and You in the 21st Century

Four-day workshop (8am-12pm daily)

Alliance: Rio Grande Valley Science Association, Catholic Diocese of Brownsville

Date/Location: June 6-9, 2011, Pharr, Texas

Audience: Middle School Girls

CEUs: no CEUs awarded for outreach events; 24 girls participated

STORE instructors: Jon Olson and Hilary Olson

Virtual Outreach

VIDEO example:

Can Potatoes Power the Planet

4:34-minute Outreach Video

Alliance: Striker Communications

Date/Location: March 7, 2012, filmed in Austin, Texas

Audience: General Public

CEUs: has been utilized as part of a number of teacher workshops to accompany in-class materials

STORE instructors: Jon Olson and Hilary Olson

Website: http://www.cpge.utexas.edu/STORE_videos

Research and Tech Transfer

In-person Research and Tech Transfer

STATE AND FEDERAL AGENCY GEOLOGISTS/ENGINEERS AUDIENCE example:

Making Capacity Estimates for Geologic Storage of CO₂ for Carbon Capture and Storage (CCS) Projects

Half-day seminar

Alliance: Florida Geological Survey and the U.S. Geological Survey in Tallahassee, FL

Date/Location: Feb 1, 2011, Tallahassee, FL

Audience: Professional Geologists and Engineers

CEUs: 3.6 CEUs awarded total (18 participants @ .2 CEU/participant)

STORE instructors: Sue Hovorka

Virtual Research and Tech Transfer

VIDEO example:

Kerr Investigation: Breaking the Mold on Near-Surface Monitoring

30-minute Technology Video

Alliance: IPAC-CO₂ (permissions and some video content)

Date/Location: August 2011 field work

Audience: Professional Earth Scientists and Engineers, Policymakers, NGOs

CEUs: has been utilized as part of a number of workshops, e.g., a teacher workshop in July, 2013, where CEUs have been given

STORE instructors: Katherine Romanak

Website: http://www.cpge.utexas.edu/STORE_KerrInvestigation

WEBSITE example:

CO2 Facts Website

Public outreach website maintained by STORE to answer frequently asked questions about CCS/CCUS; answers are facts checked by professional scientists/engineers and stamped with their approval, as well as links for further information

Alliance: Gulf Coast Carbon Center

Date/Location: launched in 2011, continues to grow with more FAQs

Audience: Public

Metrics: lately receives in excess of 9,000 hits per month and growing

STORE developers: members of STORE team and invited experts

Website: www.co2facts.org

Education

In-person Education

TEACHER CONFERENCE example:

Florida Association of Science Teachers 2011 Meeting

Two Key-Note Talks and Four Teacher Workshops

Alliance: *Florida Association of Science Teachers, Texas Earth and Space Science Revolution*

Date/Location: October 19-22, 2011, Orlando, Florida

Audience: Science Teachers

CEUs: 6 CEUs awarded (60 workshop participants @ .1 CEU/participant); 800 conference attendees; teachers do not receive CEUs for attending key-note talks

STORE instructors: Hilary Olson, Jon Olson, Katherine Romanak

Other instructor: Kathy Ellins (Texas Earth and Space Science Revolution)

Virtual Education

ONLINE example:

Carbon Capture and Geologic Storage

50-minute educational lecture

Alliance: UT Faculty Innovation Center

Date/Location: April 8, 2013, filmed in Austin, Texas

Audience: UT Graduate Students in Engineering

CEUs: educational content contributes to coursework for students, and is therefore not recorded as CEUs

STORE instructors: Tip Meckel

Website:

<http://mediasite.engr.utexas.edu/UTMediasite/Play/2c8b6be599f045c486b0f64090733cd81d>

A full chronological summary of activities is available in Appendix 1.

As previously mentioned, the program measures its successes through accomplishment of specific **objectives**. The metrics for these objectives are:

1. STORE planned, hosted and participated in 68 events related to our mission, and
2. STORE programs delivered 8,005 hours of formal training and education to 1075 people during DOE funding. The program awarded continuing education credits for 4,463 contact hours to 431 people. More details on these metrics are given in the table below.

Formal Educational Contact Hours through end of project (August 31, 2013)

TOTAL IMPACT (training, research and technology transfer and education):

Total formal training and education contact hours: 8,005 hrs to 1075 people

Technical Professionals make up **16% of those receiving** contact hrs, and **receive 15% of total formal contact hours** provided.

Professional STEM educators make up **24% of those receiving** contact hrs, and **receive 41% of total formal contact hours** provided.

University undergraduate and graduate students make up **60% of those receiving** contact hrs, and **receive 44% of total formal contact hours** provided.

DETAILS:

CEU contact hours: **4,463 hrs** (446 CEUs awarded, total of **431 people**)

27% CEUs awarded are training technical professionals (geologists, engineers, regulatory) on carbon capture and storage; **39% of people** receiving CEUs are **technical professionals**

73% CEUs awarded are training 5th- to 12th-grade educators on carbon capture and storage within an energy, climate and water framework; **61% of people** receiving CEUs are **professional educators of the upcoming STEM workforce**

University coursework contact hours: **3,542 classroom hrs** (total of **644 undergraduate and graduate university students**)

Sustainability of STORE has been made possible through two important avenues: (1) continued support from the Gulf Coast Carbon Center (an industrial affiliate program with annual industry sponsorship of \$50,000/sponsor); and (2) the creation of an Education, Training and Outreach Program at the Center for Petroleum and Geosystems Engineering (CPGE).

The Gulf Coast Carbon Center continues to have a mandate from its sponsors for knowledge sharing, and these activities occur through partnering and sharing funds with STORE based on specific interests of the sponsors. Funds (\$660,000) to create the new Education, Training and Outreach Program were received from ExxonMobil and General Electric at CPGE in June-July, 2012. Starting in the 4th quarter of 2012, STORE was moved to the newly created Education,

Training and Outreach Program at the Center for Petroleum and Geosystems Engineering (CPGE) at The University of Texas at Austin. Funding allowed creation of an infrastructure, website, management and administrative support to support the continuation of STORE. In addition, regulatory training related to CCUS developed under STORE was moved under the new TOPCORP program (a nation-wide training program for oil and gas regulators at CPGE's Education, Training and Outreach Program).

Early in its development, STORE published its own newsletter and maintained its own website through subcontracts to STRIKER Communications. With the move to house STORE in CPGE, STORE news is now disseminated as part of the CPGE newsletter and Gulf Coast Carbon Center newsletter (beginning January 2014). The STORE website was migrated from its own stand-alone website to now being part of the CPGE website, maintained by The University of Texas at Austin. The STORE website (www.storeco2now.com) regularly receives in excess of 50,000 hits monthly and is growing.

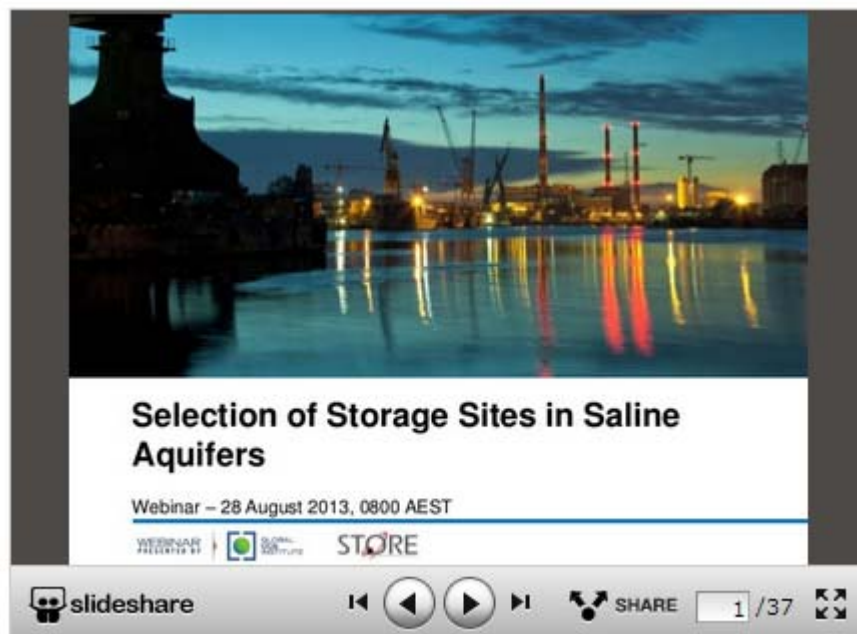
The program has now become fully integrated into The University of Texas through financial and logistical support of two units: The Bureau of Economic Geology (parent unit of the Gulf Coast Carbon Center) and CPGE. The Department of Energy's investment has resulted in a self-sustaining, education, training and outreach program related to CCS and CCUS. The program started with the concept of targeting 3 U.S. states with large emissions of CO₂ (Texas, Louisiana and Florida). STORE has now broadened its exposure and enhanced its reputation such that it regularly participates in international CCS/CCUS events (e.g., hosting a well-attended side event at the United Nations Climate Change Convention in 2012; hosting the IEAGHG International CCS Summer School in 2014). The Department of Energy has received a return on its investment in the form of completed projects (large numbers of programs and CEUs completed); buy-in from research units at a major university to support STORE both financially and logistically; financial sustainability from outside investors (sponsors of the GCCC such as Aramco Services, BG, BP, Chevron, China Petroleum Company, ExxonMobil, NRG, Schlumberger; sponsors of CPGE Education, Training and Outreach such as ExxonMobil and General Electric); and continued international programming to showcase U.S. successes and challenges in CCS and CCUS technology.

Appendix 1. Cumulative Activity Log of STORE Events (January 1, 2010 – August 31, 2013)

August 28, 2013

STORE Training: Webinar Series on CO2 Storage in Spanish

Vanessa Nuñez-Lopez of STORE and the Gulf Coast Carbon Center is partnering with the Global CCS Institute to present a 3-part webinar series on CO2 Storage in Spanish. The webinars are part of a capacity development program with the Mexican Academic Council of Earth Science Schools on the education of carbon capture and storage. The first webinar focused on 'Methodologies and guidelines for selection of storage sites in saline aquifers'.



July 21-26, 2013

STORE Training: 7th IEAGHG International CCS Summer School

Members of STORE participated in the 7th IEAGHG International CCS Summer School at the University of Nottingham, UK, serving as presenter and mentors.

STORE Participants:

Katherine Romanak – presenter, mentor

Hilary Olson – panel moderator, mentor



July 9, 2013

STORE Education: Role of Computation in Protecting the Environment

Members of STORE partnered with the Center for Subsurface Modeling to host high school teachers and students for a one-day workshop entitled "The Role of Computation in Protecting the Environment", hosted at the Bureau of Economic Geology in Austin, Texas.

STORE participants:

Hilary Olson, Katherine Romanak, Ramon Trevino

Attendees: 24 teachers

CEUs: 7 hours of contact, .7 CEUs awarded per person, total of 16.8 CEUs awarded during the workshop



June 27-28, 2013

STORE Education: CO2 Injection for Geological Carbon Storage

Members of STORE will run a two-day workshop at UT Austin focused on integrating geology, petrophysics, reservoir engineering and geomechanics in the design of a carbon storage facility for the Summer Undergraduate Research Internship (SURI) program at The University of Texas at Austin Petroleum and Geosystems Engineering (UT PGE) Department. The program enables undergraduates to research hot energy topics with world-class faculty members.



June 22, 2013

STORE Education: Introductory Central Texas Geology Field Trip

Members of STORE will lead a field trip focused on sedimentary geology for the Summer Undergraduate Research Internship (SURI) program at The University of Texas at Austin Petroleum and Geosystems Engineering (UT PGE) Department. The program enables undergraduates to research hot energy topics with world-class faculty members.



June 13, 2013

STORE Education: EarthLabs - Confronting the Challenges of Climate

Members of STORE participated as instructors in a workshop on Confronting the Challenges of Climate Literacy in partnership with an EarthLabs workshop at The University of Texas at Austin for high school teachers.



April 13, 2013

STORE Outreach: GirlTalk:
Conversations on Energy, Climate and
Water.

STORE partnered with GirlTalk for a
hands-on STEM program. The half-day
event was held at St. Gabriel's Catholic
School for 5th-8th grade girls.
Registration and more information
at www.girl-talk.org.



April 8, 2013

STORE Education: Carbon Capture and Geologic Storage

STORE member Tip Meckel introduces Geological Carbon Storage to a class of graduate students in petroleum engineering. The lecture is recorded by the Faculty Innovation Center at UT Austin and made available on the STORE website.



April 5, 2013

**STORE Training: Carbon Capture and
Geologic Storage: Global Research
Centered in Texas**

A half-day open house during the
Geological Society of America South
Central Section Annual Meeting at The
University of Texas at Austin.



April 5, 2013

STORE Training: Carbon Capture and Geologic Storage: Global Research Centered in Texas

Store member & TXESS Revolution partner to lead a geology field trip for local teachers and the public during the Geological Society of America South Central Section Annual Meeting at The University of Texas at Austin.



April 1-4, 2013

STORE Education: *Tópicos Avançados em Captura e Armazenamento de Carbono*

Vanessa Nuñez-Lopez of STORE and the Gulf Coast Carbon Center serves as an instructor for an advanced course on Carbon Capture and Storage sponsored by The Center of Excellence in Research and Innovation in Petroleum, Mineral Resources and Carbon Storage (CEPAC) and the Carbon Sequestration Leadership Forum (CSLF). Location: Pontifical Catholic University of Rio Grande do Sul Porto Alegre, Brazil.



March 25-29, 2013

STORE Education: CO2 Injection for Geological Storage

STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin teach a core workshop from STORE activities to graduate students in petroleum and geosystems engineering as part of a UT Austin course, "Geological Concepts for Engineers."

Student Contact Hours at UT Austin:

Total student contact hours = 42 hours (2 hrs/students)

Location: The University of Texas at Austin, Austin, TX

Total Participants: 21 students (graduate) in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Hilary Olson and PGE Teaching Assistant**



Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin

Description: Dr. Hilary Olson utilized parts of the module "CO2 Injection for Geological Storage", originally developed by Dr. Steve Bryant, in her course on geological concepts for engineers. Students included graduate students in petroleum and geosystems engineering.

March 18-22, 2013

STORE Education: *CO2 Injection for Geological Storage*

Several STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin collaborated to introduce carbon capture and storage technology to their incoming class of freshmen engineers.

Location: The University of Texas at Austin, Austin, Texas

Student Contact Hours at UT Austin:

580 student contact hours, including lab and lecture (4 hrs/student)

Total Participants 145 students in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Jon Olson and PGE Teaching Assistants**

Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin

Description: STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin collaborate to introduce carbon capture and storage technology to their incoming class of freshmen engineers. Activities developed for STORE workshops and short courses are being utilized for undergraduate as well as graduate students.

March 2 (Sat), 2013

STORE Outreach: *What to do with CO2: Cures for the Feverish Earth*

An outreach booth at The University of Texas at Austin's 12th annual Explore UT, a day of events, performances, exhibits, lectures and activities for the entire family, with more than 50,000 K-12 students on the campus.

Location: The University of Texas at Austin

Total Participants: Estimated 50,000 visitors to Explore UT day

STORE instructors: **Ramon Trevino and UT Jackson School of Geosciences graduate students and other scientists**

Description: University of Texas at Austin hosted its 14th annual Explore UT, a day of events and activities for the entire family, on March 2, 2013. The day offered the estimated 50,000 visitors an introduction to university life, and specifically, insights into some of the current research activities going on at the university. Numerous STORE members, as well as students from the Jackson School of Geosciences, participated in the annual Explore UT outreach event with a booth entitled "What to Do with CO2". The booth provided a variety of outreach activities on fossil fuels, physical properties of CO2, porosity and reservoir fluid storage, and carbon sequestration.



February 20-23 (Wed-Sat), 2013

STORE Outreach: Austin Energy Regional Science Festival

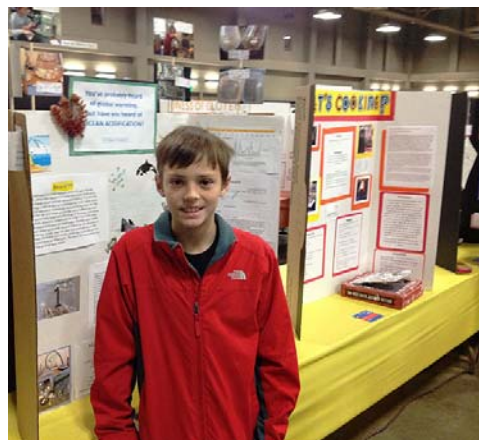
STORE member Katherine Romanak mentored a 5th-grade student in a science fair project on CO₂ and Ocean Acidification. The student advanced to the Austin Energy Regional Science Festival where he and the project won a blue ribbon.

Katherine Romanak mentored a 5th grader at a local elementary school in a science fair project entitled "You've probably heard of global warming but have you heard of ocean acidification?"

The student tested the hypothesis that CO₂ in the atmosphere absorbed by the oceans causes the pH of oceans to drop, thereby harming the calcium carbonate bodies of sea life such as corals, mollusks and plankton. He used two reaction chambers, one experimental chamber with shells, water and CO₂ bubbling through and a control chamber with shells water and air bubbling thorough.

The student observed and recorded the pH changes in both chambers over a week then weighed the shells to assess the change in the mass of shells in each flask. The conclusion was that CO₂ does cause pH level to drop which dissolves calcium carbonate which could threaten sea life. An additional conclusion was that the pH of oceans could recover if CO₂ in the atmosphere could be decreased.

This project won 3rd place in the local Elementary School science fair and advanced to the Austin Energy Regional Science Festival held at Palmer Auditorium on Feb 20-23, 2013 in Austin Texas where it won a blue ribbon.



November 2012

STORE video highlights process-based soil gas technique

A new video produced by STORE highlights a new process-based soil gas technique applied by Katherine Romanak and colleagues as part of IPAC-CO2's investigation at the Farm in Saskatchewan.

Using footage captured in the field, the video shows specific aspects of the technique and assists in the transfer of this technology to others who would like to apply the simple yet novel, technique to other carbon storage projects. The video adds a visual 'how-to' component to recent papers published by Romanak and colleagues on the technique.



November 18-22, 2012

STORE Research and Tech Transfer: *GHGT-11*

STORE members attended the GHGT-11 meeting in Kyoto, Japan to present papers on research and outreach efforts. Hilary Olson of STORE had been working with the steering committee and Striker Communication to assist with the inviting video for GHGT-11. This video was part of the closing session of GHGT-11, and formally invited participants to attend GHGT-12 in 2014 in Austin, Texas.



November 26-December 7, 2012

STORE Research and Tech Transfer: *UNFCCC and COP18*

STORE attended the UNFCCC and COP18 meeting in Qatar to promote technology transfer of carbon storage technology. STORE hosted a side event on capacity building in partnership with the Carbon Capture and Storage Association. In addition, STORE had an exhibits booth on capacity building programs at the meeting.

CCS Capacity Building and Global Status: Educational Opportunities and Lessons Learned

Knowledge transfer, training and educational programs serving Qatar, Asia, and North America, and available to other countries, was presented by policy, educational and technical experts within the framework of recent developments on the role CCS plays in emission reductions.



Tuesday, November 27, 2012

16:45-18:15

Room: Side Event Room 1

Hosts: **The University of Texas at Austin (STORE)**
and **Carbon Capture and Storage Association**

Program:

Welcome

Katherine Romanak
Research Associate, Bureau of Economic Geology, The University of Texas at Austin

CCS: Current status and future deployment needs

Luke Warren
Deputy Chief Executive, Carbon Capture and Storage Association

Building CCS workforce capacity through teacher professional development and girl-centered educational programs

Hilary Clement Olson, *Director, STORE Program*
The University of Texas at Austin



The CCS Summer School Series: 326 alumni from 49 countries and growing

Tim Dixon
Manager CCS and Regulatory Affairs, IEAGHG

CCS collaborative capacity and know-how building at Shell

Marcus Schwander

CO₂ Technical Manager, Qatar Shell Science and Technology Centre

UK Government action on CCS in developing countries

James Godber

First Secretary Climate Change, UK Foreign and Commonwealth Office, Doha

October 26, 2012

STORE at the CSLF Annual Meeting

On October 26, STORE member Victoria Osborne gave a presentation at the Carbon Sequestration Leadership Forum's Annual Meeting in Perth, Australia. She was invited to speak about public relations issues during uncertain times for CCS and CCUS policy issues.

The invitation to speak came as a follow-up to her attendance at the CSLF's Workshop on Risk and Liability in Paris this July.



STORE member J.P. Nicot also attended CSLF workshop in Paris.

September 21 (Fri), 2012

STORE Research and Tech Transfer and Outreach: *Exchange on Research and Outreach with Representatives of Japan CCS Co., Ltd.*

Along with the Gulf Coast Carbon Center, STORE helped host visitors from JCCS (involved in the Tomakomai Project), to exchange ideas on research, tech transfer and outreach related to CCS.

Agenda and discussions:

10:00-10:10: Greetings and Introductions

10:10-11:00: Overview of Japan CCS Co., Ltd. and CCS Demonstration Projects in Japan (focusing on Tomakomai Project)
Aramaki and Ohkawa

11:00-12:00: Overview of Cranfield Project (Surface Monitoring)
Katherine Romanak – Process based method in gas and marine
Changbing Yang – Groundwater

Lunch

13:00-14:00: Overview of Cranfield Project (Geophysical Monitoring)
Tip Meckel

15:00-15:45: Other Topics
Jiemin Lu – Risk Management
Hilary Olson – Outreach and Tech Transfer opportunities

15:45-16:00 : Wrap-up / Adjourn

JCCS Representatives: Satoshi Aramaki, Manager, Environment and Regulation Group and Shiro Ohkawa, Manager and Senior Geophysicist, Technology and Planning Department

STORE Presenters: **Dr. Katherine Romanak, Dr. Tip Meckel, and Dr. Hilary Clement Olson**

August 20-23 (Mon-Thu), 2012

STORE Research and Tech

Transfer: *DOE NETL*

Carbon Storage R&D

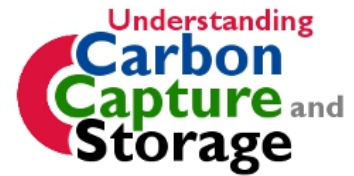
Project Review Meeting

STORE members gave a report on their training, outreach, research and tech transfer, and education activities at the review meeting in Pittsburgh, Pennsylvania.

STORE Presenters and Attendees: **Dr. Steve Bryant, Dr. Hilary Clement Olson, Victoria Osborne and Dr. Sue Hovorka.**



July 30-August 3 (Mon-Fri), 2012



STORE Education: *Curso Básico (1) “Compreendendo a Captura e o Armazenamento de Carbono”*

[1st Basic Course (1) “Understanding Carbon Capture and Storage”]

Vanessa Nuñez-Lopez of STORE and the Gulf Coast Carbon Center served as an instructor for an introductory course on Carbon Capture and Storage, sponsored by The Center of Excellence in Research and Innovation in Petroleum, Mineral Resources and Carbon Storage (CEPAC) and the Carbon Sequestration Leadership Forum (CSLF)*. The course targeted industry, academia, government and non-governmental agency audiences, with some degree of interest or involvement in the field.



Location: Pontifical Catholic University of Rio Grande do Sul, Porto Alegre, Brazil.



Sponsors: The Center of Excellence in Research and Innovation in Petroleum, Mineral Resources and Carbon Storage (CEPAC) and the Carbon Sequestration Leadership Forum (CSLF)

STORE Instructor: Vanessa Nuñez-Lopez

Topics taught by STORE:

(1) Enhanced Oil Recovery (EOR) and CCS, (2) Monitoring Measuring and Verification (MMV) in CCS, and (3) CCS Risk Analysis. - Vanessa Nuñez-Lopez

Number of Participants: 20, with credits awarded through Pontifical Catholic University of Rio Grande do Sul

*No DOE Funds were used for international travel.

July 10-11 (Tue-Wed), 2012

STORE Outreach: *CSLF Workshop on Risk and Liability of Geologic Storage of CO₂, Paris, France*

The CSLF, in collaboration with the International Energy Agency and the Global CCS Institute, conducted a workshop in Paris on July 10-11, 2012 to improve understanding of geological risks associated with CO₂ storage and their relationship to financial liabilities, including communication aspects related to risk and liability.

Attendance in the workshop was by invitation only and included experts from around the world with diverse backgrounds.

STORE Attendees: Victoria Osborne (Striker Communications) and J.P. Nicot (Bureau of Economic Geology)

Location: Paris, France*

*No DOE funds were used for travel

June 28 (Thu), 2012

STORE Education: *Energy, Engineering and the Environment*

STORE members partner with the Department of Petroleum and Geosystems Engineering at The University of Texas at Austin and The Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching (TRC) to host teachers from the 18th Annual TRC Meeting for a Symposium on Energy, Engineering and the Environment.

Location: The University of Texas at Austin, Petroleum & Geosystems Engineering Department

Total Participants: 32 Teachers attended; 32 CEUS awarded

STORE Instructors: **Dr. Paul Bommer, Dr. Matt Balhoff and Dr. Sue Hovorka.**

Partners include: Shell Oil Company, TXESS Revolution program at UT Austin and the Education, Training and Outreach Program at the Center for Petroleum and Geosystems Engineering



June 27 (Wed), 2012

STORE Education: *Making a Difference in the Field of Energy and the Environment*

STORE member Dr. Katherine Romanak spoke at the 18th Annual Meeting of The Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching (TRC). The talk was given at.

Location: The Arboretum in Austin, Texas

Total Participants: 32 Teachers attended

STORE Instructor: **Dr. Katherine Romanak**

June 13 (Wed), 2012

STORE Education: *Energy and the Environment: Intersection of Science, Technology and International Climate Policy in Carbon Capture and Storage (CCS)*

Dr. Hilary Olson of STORE presented a session on CCS and international policy at "Confronting the Challenges of Climate Literacy: A Summer Workshop for High School Teachers". Partners include: Center for Science Teaching and Learning at TERC in Cambridge, Massachusetts, the Science Education Resource Center (SERC) at Carleton College in Northfield, Minnesota, and the TXESS Revolution program at The University of Texas at Austin.

Location: The Arboretum in Austin, Texas

Total Participants: 35 Teachers attended; CEUs awarded by TERC

STORE Instructors: **Dr. Hilary Olson**

March 3 (Sat), 2012

STORE Outreach: *What to do with CO2: Cures for the Feverish Earth*

An outreach booth at The University of Texas at Austin's 12th annual Explore UT, a day of events, performances, exhibits, lectures and activities for the entire family, with more than 50,000 K-12 students on the campus.

Location: The University of Texas at Austin

Total Participants: Estimated 50,000 visitors to Explore UT day

STORE instructors: **Susan Hovorka and UT Jackson School of Geosciences graduate students and other scientists**

Description: University of Texas at Austin hosted its 13th annual Explore UT, a day of events and activities for the entire family, on March 3, 2012. The day offered the estimated 50,000 visitors an introduction to university life, and specifically, insights into some of the current research activities going on at the university. Numerous STORE members, as well as students from the Jackson School of Geosciences, participated in the annual Explore UT outreach event with a booth entitled "What to Do with CO2". The booth provided a variety of outreach activities on fossil fuels, physical properties of CO2, porosity and reservoir fluid storage, and carbon sequestration.

February 9 (Thu), 2012

STORE Research and Tech Transfer: *Carbon Management Technology Conference*

As part of the 2012 Carbon Management Technology Conference, held 7–9 February, 2012 in Orlando, Florida, STORE member Vanessa Nuñez-Lopez presented a manuscript entitled “Subsurface monitoring of Large Scale CO₂ Injection at SECARB’s Phase-III Cranfield Site”, in the “Monitoring Session” of the Technical Program.

Location: Orlando, Florida

STORE Participant: **Vanessa Nuñez-Lopez**

Description: Vanessa Nuñez-Lopez presented a manuscript entitled “Subsurface monitoring of Large Scale CO₂ Injection at SECARB’s Phase-III Cranfield Site”, in the “Monitoring Session” of the 2012 Carbon Management Technology Conference.

February 6-10, 2012 and March 19-21, 2012

STORE Education: *CO2 Injection for Geological Storage*

STORE member from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin collaborate to introduce carbon capture and storage technology to senior petroleum engineering students and graduate students in petroleum, geosystems, mechanical and geotechnical engineering.

Student Contact Hours at UT Austin:

scale of CO2 storage: 171 student contact hours (3 hrs/student)

core workshop: 171 student contact hours (3 hrs/student)

Total student contact hours = 342 hours

Location: The University of Texas at Austin, Austin, TX

Total Participants: 57 students (graduate and 4th year undergraduate) in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Hilary Olson and PGE Teaching Assistant**

Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin

Description: Dr. Hilary Olson utilized parts of the module "CO2 Injection for Geological Storage", originally developed by Dr. Steve Bryant, in her course on geological concepts for engineers. Students included senior petroleum engineering students and graduate students in petroleum, geosystems, mechanical and geotechnical engineering. Specifically, the scale of carbon storage needed for climate mitigation was calculated in a problem set (February 6-10, 2012), and cores from a potential injection site for the problem set were analyzed (March 19-21, 2012).



February 3-6 (Fri-Mon), 2012

STORE Research and Tech Transfer: *Tim Dixon of IEAGHG at The University of Texas at Austin*

In conjunction with the Gulf Coast Carbon Center and the Department of Petroleum and Geosystems Engineering at UT Austin, STORE hosted a visit from Tim Dixon (Manager CCS and Regulatory Affairs, IEAGHG). During his visit, Tim presented "Energy and the Environment: the Intersection of Science, Technology and International Climate Policy in Carbon Capture and Storage" to three different groups.

Student Contact Hours at UT Austin:

"Energy and the Environment: the Intersection of Science, Technology and International Climate Policy in Carbon Capture and Storage":
207 student contact hours (1 hr/student)

Location: The University of Texas at Austin, Austin, TX

Total Participants 207 students in Dept. of Petroleum and Geosystems Engineering



Partners: Dept. of Petroleum and Geosystems Engineering and Bureau of Economic Geology

Description: In conjunction with the Gulf Coast Carbon Center and the Department of Petroleum and Geosystems Engineering at UT Austin, STORE hosted a visit from Tim Dixon (Manager CCS and Regulatory Affairs, IEAGHG). During his visit, Tim presented "Energy and the Environment: the Intersection of Science, Technology and International Climate Policy in Carbon Capture and Storage" for professionals at the Bureau of Economic Geology, undergraduate freshmen in the Department of Petroleum and Geosystems Engineering (150 students), and graduate students in the Department of Petroleum and Geosystems Engineering and the Department of Chemical Engineering (57 students). He also visited the Luminant Capture Facility on campus and promoted the IEAGHG CCS Summer School Program.

January 30 (Mon), 2012

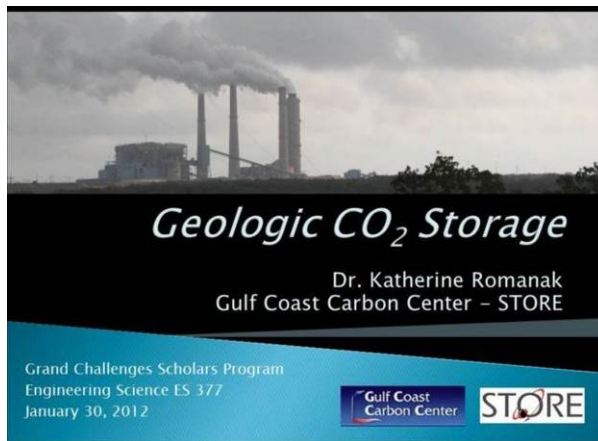
STORE Education: Grand Challenges Scholars Program Presentation

On January 30, 2012, Dr. Katherine Romanak spoke on *Geologic CO₂ Storage* as part of the National Academy of Engineering initiative called the Longhorn Grand Challenges Scholars Program at The University of Texas at Austin.

Location: The University of Texas at Austin, Austin, Texas

Student Contact Hours at UT Austin:
16 student contact hours (1 hr/student)

STORE Participants: **Katherine Romanak**



Description: Dr. Katherine Romanak spoke as part of the National Academy of Engineering initiative called the Longhorn Grand Challenges Scholars Program at The University of Texas at Austin. Engineering students are studying the Grand Challenges in engineering as outlined by the National Academy of Engineering. Carbon capture and storage is one of the Grand Challenges. Katherine spoke about geologic CO₂ storage and careers in carbon management. The video of the presentation is linked to online from the STORE website.

January 30-February 2 (Mon-Fri), 2012

STORE Education: *CO2 Injection for Geological Storage*

Several STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin collaborated to introduce carbon capture and storage technology to their incoming class of freshmen engineers.

Location: The University of Texas at Austin, Austin, Texas

Student Contact Hours at UT Austin:

600 student contact hours (4 hrs/student)

Total Participants 150 students in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Jon Olson and PGE Teaching Assistants**

Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin

Description: STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin collaborate to introduce carbon capture and storage technology to their incoming class of freshmen engineers. Activities developed for STORE workshops and short courses are being utilized for undergraduate as well as graduate students.

January 25-27 (Wed-Fri), 2012

STORE Research and Tech Transfer: *University of Texas UTCCS-1 Conference*

STORE and GCCC hosted a session on Knowledge Sharing at the first University of Texas Carbon Capture and Storage Conference (UTCCS-1) in Austin, Texas.

Location: The University of Texas at Austin

STORE participants: Drs. Katherine Romanak (Bureau of Economic Geology), Becky Smyth (Bureau of Economic Geology) and Hilary Olson (Institute for Geophysics).

Description: STORE and GCCC hosted a session on Knowledge Sharing at the first University of Texas Carbon Capture and Storage Conference (UTCCS-1) in Austin, Texas. In cooperation with the Luminant Capture Program in the Department of Chemical Engineering and Geological CO₂ Storage JIP at the Center for Petroleum and Geosystems Engineering in the Cockrell School of Engineering, and the Gulf Coast Carbon Center at the Bureau of Economic Geology, UT hosted a three-day long meeting for sponsors and stakeholders that included both oral presentations and poster sessions by staff.

January 19 (Thu), 2012

STORE Education: *Carbon Capture and Storage and EOR in Texas Workshop*

STORE members Jon Olson, Hilary Olson and Vanessa Nuñez-Lopez are sponsored by Chevron and partner with Denbury Resources to put on an educational workshop for 50 visiting students from the University of Stavanger who are visiting the United States. Graduate students from the Dept. of Petroleum and Geosystems Engineering (Iona Precious Williams and Li Ji) will also help deliver the workshop.



Location: Chevron office, Houston, Texas and Denbury Resources' Hastings Field, Texas

Total Participants 50 students from the University of Stavanger

STORE instructors: **Jon Olson, Hilary Olson, Vanessa Nuñez-Lopez**



Partners: Chevron and Denbury Resources

Description: STORE members Jon Olson, Hilary Olson and Vanessa Nuñez-Lopez were contracted by Chevron to put on an educational workshop for 50 visiting students from the University of Stavanger who spent a week in Houston, Texas learning more about U.S. oil and gas operations. Graduate students from the Dept. of Petroleum and Geosystems Engineering (Iona Precious Williams and Li Ji) helped deliver the workshop on January 19, 2012 at Chevron's office. In addition, Denbury Resources partnered with STORE to host the students at a field trip of the Hastings Field, south of Houston. Students from the University of Stavanger spent the morning working a STORE problem set on Storage of CO₂ in Geological Formations, followed by an afternoon field trip to Denbury's Hastings Field.



December 6 (Tue), 2011

STORE Research and Tech Transfer: *American Geophysical Union Annual Meeting*

Members of STORE co-chaired and presented at a session entitled "Combining Learnings from Natural Releases of CO₂ for CO₂ Storage: Processes, Impacts, and Scale" at the AGU Annual Meeting, San Francisco, California.

Location: *American Geophysical Union Annual Meeting*, Moscone Convention Center, San Francisco, California

Conference Participants 21,116 attendees at the 2011 Annual AGU Conference

STORE co-convenor: **Katherine Romanak**

STORE presenters/authors: **Hilary Olson, Sue Hovorka, Katherine Romanak**

Partners: IEAGHG

Description: Members of STORE co-chaired and presented at a session entitled "Combining Learnings from Natural Releases of CO₂ for CO₂ Storage: Processes, Impacts, and Scale" at the AGU Annual Meeting, San Francisco, California.

December 5 (Mon), 2011

STORE Research and Tech Transfer: CCS, MRV and Texas Workshop

In partnership with the Texas Carbon Capture and Storage Association, STORE co-hosted a pre-conference workshop on Monday morning before the start of the CO₂ Conference hosted in Houston, Texas. Vanessa Nuñez-Lopez of STORE presented on "Monitoring CO₂ Retention in an EOR Setting" at the workshop.



Location: JW Marriott, Houston, Texas

Total Participants 13 workshop participants

CEUs: 2.4 CEUs total awarded (.3 CEU/participant)

STORE coordinator: **Vanessa Nuñez-Lopez**

Partners: Texas Carbon Capture and Storage Association

Description: In partnership with the Texas Carbon Capture and Storage Association, STORE co-hosted a pre-conference workshop on Monday morning before the start of the CO₂ Conference hosted in Houston, Texas. Vanessa Nuñez-Lopez of STORE presented on "Monitoring CO₂ Retention in an EOR Setting" at the workshop.

December 2-3 (Fri-Sat), 2011

STORE Research and Tech Transfer: *Carbon Capture and Storage Workshop*

Members of STORE collaborated with the UK Consulate (Dr. May Akrawi) in Houston to host a workshop for international visitors on carbon capture and storage at The University of Texas in Austin. Delegates to the meeting were from both the UK and Norway.



Location: Jackson School of Geosciences, The University of Texas at Austin

Total Participants 30 participants (11 who were international)

CEUs: 11 CEUs total awarded (1 CEU/international participant)

STORE participants: Tip Meckel (organizer), Becky Smyth, JP Nicot, Sue Hovorka, Sanjay Srinivasan, Larry Lake and Jon Olson

Partners: British Consulate in Houston, Texas

Description: Members of STORE collaborated with the UK Consulate (Dr. May Akrawi) in Houston to host a workshop for international visitors on carbon capture and storage at The University of Texas in Austin. Delegates to the meeting were from both the UK and Norway.

December 2 (Fri), 2011

STORE Research and Tech Transfer: *Petroleum Engineering Club of Dallas*

STORE member Vanessa Nuñez-Lopez presented a talk on Carbon Capture and Storage at the Petroleum Engineering Club of Dallas.

Location: Dallas Petroleum Club, Dallas, Texas

Total Participants: 60 attendees

STORE presenter: **Vanessa Nuñez-Lopez**

Partners: Petroleum Engineering Club of Dallas

Description: STORE member Vanessa Nuñez-Lopez (Bureau of Economic Geology) presented a talk on Carbon Capture and Storage at the Petroleum Engineering Club of Dallas. Her talk focused on an introduction to carbon capture and storage technology, as well as her research at Hastings Field, south of Houston, operated by Denbury Resources. Deborah Hempel-Medina (Williams), program chair, invited the talk based on our interaction with her at the *Energy, Climate and Water in the 21st Century* symposium STORE organized in Dallas in 2010.



November 27-December 4 (Sat-Sun), 2011

STORE Outreach: *United Nations Climate Change Conference (COP17/CMP7)*

Hilary Olson and Katherine Romanak of STORE attended the United Nations Climate Change Conference in Durban, South Africa (Nov. 27-Dec. 4). This meeting was an important step for CCS as it was formally accepted as part of the Clean Development Mechanism due to negotiations at this meeting.

Location: Durban, South Africa

STORE Participants: **Katherine Romanak, Hilary Olson**

Partners: Global CCS Institute, Carbon Capture and Storage Association

Description: Hilary Olson and Katherine Romanak of STORE attended the United Nations Climate Change Conference in Durban, South Africa (Nov. 27-Dec. 4). Dr. Romanak presented a talk on "Geologic Carbon Storage: Monitoring and Environmental Impacts" at a side event sponsored by the Carbon Capture & Storage Association at the conference. Drs. Olson and Romanak helped draft the end of conference statement for the RINGOs (Research and Independent Non-governmental Organisations to the United Nations Framework Convention on Climate Change).



November 15-16 (Tue-Wed), 2011

STORE Reporting: *2011 Carbon Storage Program Infrastructure Annual Review Meeting, sponsored by the Department of Energy, National Energy Technology Laboratory*

Members of STORE attended, presented and hosted a booth at the Carbon Storage Program Infrastructure Annual Review Meeting (featuring DOE's Regional Carbon Sequestration Partnerships) in Pittsburgh, PA.

Location: DOE NETL Review Meeting in Pittsburgh, PA.



STORE participants: Hilary Olson, Tip Meckel, Victoria Osborne

Description: Members of STORE attended, presented and hosted a booth at the Carbon Storage Program Infrastructure Annual Review Meeting (featuring DOE's Regional Carbon Sequestration Partnerships) in Pittsburgh, PA.

October 20-22 (Thu-Sat), 2011

STORE Education: *Florida Association of Science Teachers 2011 Meeting*

STORE, in partnership with the [TXESS Revolution](#), provided the keynote speakers on Energy and Climate Mitigation Technology, along with workshops for teachers and science specialists, at the **2011 Florida Association of Science Teachers Annual Conference in Orlando, Florida**.

Location: Florida Association of Science Teachers Annual Conference in Orlando, Florida

Total Participants Over 800 people participated in the conference; 60 workshop participants

CEUs: 6 CEUs total awarded (.1 CEU/participant)

STORE instructors: Drs. Katherine Romanak (Bureau of Economic Geology), Kathy Ellins (Institute for Geophysics), Hilary Olson (Institute for Geophysics) and Jon Olson (Department of Petroleum and Geosystems Engineering).

Partners: Florida Association of Science Teachers, TXESS Revolution Program

Description: STORE, in partnership with the [TXESS Revolution](#), provided the keynote speakers on Energy and Climate Change Mitigation Technology, along with workshops for teachers and science specialists, at the **2011 Florida Association of Science Teachers Annual Conference in Orlando, Florida** (October 19-22, 2011).



October 7-8 (Fri-Sat), 2011

STORE Education: *Energy and You in the 21st Century*

The Fall 2011 [Rio Grande Valley Science Association](#) Annual Conference was attended by over 500 teachers from across the Rio Grande Valley, October 7-8, 2011, at PSJA (Pharr-San Juan-Alamo) North High School in Pharr, Texas. STORE provided the opening speaker and several small-group workshops for the conference, highlighting energy sources and challenges, as well as carbon sequestration.

Location: Rio Grande Valley Science Association Meeting in Pharr, Texas

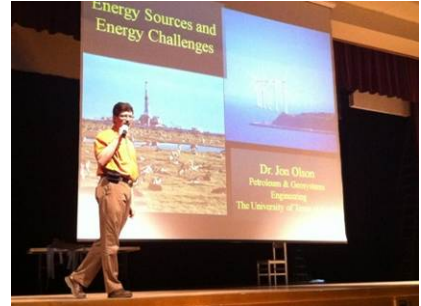
Total Participants 500 teachers at conference to attend workshops and general sessions; CEUs given for teacher workshop only (not for lecture); 12 workshop participants

CEUs: 1.3 CEUs total awarded (.1 CEU/participant)

STORE instructors: **Jon Olson, Hilary Olson**

Partners: Rio Grande Valley Science Association

Description: The Fall 2011 [Rio Grande Valley Science Association](#) Annual Conference was attended by over 500 teachers from across the Rio Grande Valley, October 7-8, 2011, at PSJA (Pharr-San Juan-Alamo) North High School in Pharr, Texas. STORE provided the opening speaker (Jon Olson on *Energy Sources and Energy Challenges*), and several workshops (***What to do with CO₂?*** and ***Where are fluids stored in the Earth?***) for the conference, highlighting energy sources and challenges, as well as carbon sequestration. Middle school girls from the 2011 Summer workshop (June 6-9) given by STORE on *Energy and You in the 21st Century* presented as part of the opening session by Jon Olson (see photo above).



September 28 (Wed) 2011

STORE Research and Tech Transfer: *Midwestern Governors Association Delegation*



The Midwestern Governors Association, in partnership with the Great Plains Institute, STORE, Denbury Resources, Southern Co. and the Southern States Energy Board, organized a public-private regional delegation for professionals to Texas and Mississippi, September 27-30, to focus on commercial enhanced oil recovery using carbon dioxide.

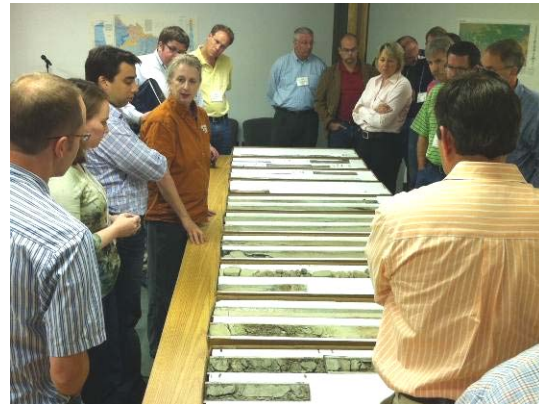
Location: Houston Research Center, Houston, Texas and Hastings Field, Denbury Resources

Total Participants 27 professionals (e.g., gubernatorial energy staff, regulators) from the Midwest

CEUs: 10.8 CEUs total awarded (.4 CEU/participant)

STORE instructors: **Larry Lake, Sue Hovorka, Hilary Olson**

STORE sends out thanks to Darrick Eugene (General Counsel, Texas Carbon Capture and Storage Association), Laura Miller (Director of Projects, Summit Power) and Gregory Kunkel (VP, Environmental Affairs for Tenaska) for contributing content to the STORE workshop.



Partners: Midwestern Governors Association, Great Plains Institute and Denbury Resources

Description: The Midwestern Governors Association, in partnership with the Great Plains Institute, STORE, Denbury Resources, Southern Co. and the Southern States Energy Board, organized a public-private regional delegation to Texas and Mississippi, September 27-30, to focus on commercial enhanced oil recovery using carbon dioxide.

The delegation visited commercial CO₂-EOR operations and received expert briefings about technical, economic, project development, and environmental aspects of EOR. In addition the group heard about successful policies and public-private partnerships that have helped expand the commercial CO₂-EOR industry in the Gulf Coast region, including opportunities for using this technology for carbon sequestration.

September 25 (Sun), 2011

STORE Outreach: *What to do with CO2: Cures for the Feverish Earth*



A booth at the *Women in Science Annual Event*, inspiring young women to pursue career in science, September 25, 2011, Lady Bird Johnson Wildflower Center, Austin TX.

Location: Lady Bird Johnson Wildflower Center, Austin TX

Total Participants: 700 attendees from the community

STORE instructor: **Hilary Olson**

Partners: Dept. of Petroleum and Geosystems Engineering (Dr. Masa Pradonovic and ten undergraduate and graduate students from the department)

Description: STORE partnered with the Department of Petroleum and Geosystems Engineering at UT Austin to host a booth at the *Women in Science Annual Event*, inspiring young women to pursue career in science, September 25, 2011, Lady Bird Johnson Wildflower Center, Austin TX. STORE provided hands-on activities on rock properties, hydrocarbon exploration and CO2 storage.



September 7-8 (Wed-Thu), 2011

STORE Research and Tech Transfer: *Workshop - UNFCCC Subsidiary Body for Scientific and Technological Advice*



Katherine Romanak presented a talk on groundwater at a technical workshop in Abu Dhabi, which made important progress toward allowing support for carbon capture and storage (CCS) projects under the Clean Development Mechanism (CDM) of the UN Framework on Climate Change.

Location: Abu Dhabi, United Arab Emirates

Total Participants: Ninety-one delegates from 33 countries and an array of expert organizations attended the workshop

STORE participant: **Katherine Romanak**

Partners: UNFCCC (paid for partial travel to the workshop)

Description: In September, Dr. Katherine Romanak of STORE presented a talk on groundwater at a technical workshop in Abu Dhabi, which made important progress toward allowing support for carbon capture and storage (CCS) projects under the Clean Development Mechanism (CDM) of the UN Framework on Climate Change. Ninety-one delegates from 33 countries and an array of expert organizations attended the workshop on September 7-8, 2011. Presentations inform the UNFCCC Secretariat who is preparing options in a negotiating text for Parties in Durban.

“In accordance with decision 7/CMP.6, paragraph 5, the UNFCCC secretariat conducted this workshop with technical and legal experts in order to consider the submissions made by Parties and admitted observer organizations on this subject, as well as the synthesis report prepared by the UNFCCC secretariat, and to discuss how the issues referred to in decision 7/CMP.6, paragraph 3, can be addressed in modalities and procedures.”

August 28-September 1 (Sun-Thu), 2011

STORE Outreach: *Kerr Investigation Outreach Communication*



STORE tracked the scientific investigation work of Dr. Katherine Romanak as she leads the Kerr Investigation for IPAC-CO2 in Saskatchewan, Canada.

Location: Weyburn Field, Saskatchewan, Canada

STORE Participants: **Katherine Romanak, Hilary Olson, Amy Castner (Striker Communications)**

Partners: IPAC-CO2 <http://www.ipac-co2.com>

Description: IPAC-CO2 Research Inc. assembled a team of international experts, led by Dr. Katherine Romanak of STORE, to conduct an independent inquiry into events at the Kerr farm located at SW30-5-13-W2M southeast of Weyburn, Saskatchewan. The program is a fact-based review with the objective to simply conduct an analysis of whether there is leakage and, if so, to discover its root cause. Results of this independent study will help establish the “best practices” for future CCS projects that include an Enhanced Oil Recovery component.

An outreach video on the project will be produced by STORE in early 2012.



August 24 – December 16, 2011

STORE Education: *Advances in CO2 Injection and Storage in Geological Formations*

A cross-disciplinary, project-based course for students covering new technology for greenhouse gas emissions reductions.

Student Contact Hours at UT Austin: 301 student contact hours (43 hrs/student)

Location: The University of Texas at Austin, Austin, TX

Total Participants 7 students

STORE instructors: **Sue Hovorka, J.P. Nicot, Tip Meckel**

GEO391 (unique number 27140)

Four instructors teach from their research expertise:

Farzam Javadpour – multiphase fluid flow, pore scale studies, imaging micromodels, pore to reservoir upscale, capillary and viscous processes. Farzam brings this course material from University of Calgary to UT.

Susan Hovorka (STORE personnel) – project development. Susan has led four of the world's premier field research teams injecting CO2 and monitoring reservoir and ecosystem response.



Tip Meckel (STORE personnel) – Structure and sedimentology. Evaluation of elevated pressure effects – seal and structure. Integration of field observations and theory.

Jean-Philippe (J.-P) Nicot (STORE personnel) – introduction to multiphase fluid flow modeling using GEM and other models, rock-water interaction. J.P. started his career as a mining geologist in North Africa and has worked on a variety of fluid flow problems.

Description: Eight labs teach students the techniques to complete the term project, developing the complete plan for a real-world CCS project. Project can be aligned with thesis or other research.

August 22-23 (Mon-Tue), 2011

STORE Education and Training: Emerging Workforce Trends in the U.S. Energy and Mining Industries

The National Research Council conducted a study entitled, "Emerging Workforce Trends in the U.S. Energy and Mining Industries", sponsored by the National Energy Technology Laboratory to examine the need for and availability of workers for the oil, natural gas, coal, **geologic carbon sequestration**, nuclear, geothermal, solar, wind, and non-fuel minerals industries and the availability of workers in these fields, and made recommendations on actions needed to meet these labor requirements.

Location: Golden, Colorado

STORE Participant: **Jon Olson**

Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin (paid for travel)

Description: The National Research Council conducted a study entitled, "Emerging Workforce Trends in the U.S. Energy and Mining Industries", sponsored by the National Energy Technology Laboratory. The third meeting of the study committee was held August 22-24, 2011 in Golden, CO. The study examined the need for and availability of workers for the oil, natural gas, coal, **geologic carbon sequestration**, nuclear, geothermal, solar, wind, and non-fuel minerals industries and the availability of workers in these fields, and made recommendations on actions needed to meet these labor requirements. Dr. Jon Olson of STORE and the Petroleum and Geosystems Engineering Department at UT Austin was invited to meet with the committee to discuss engineering enrollment, education and training issues with regard to the oil and gas sector and **geologic carbon sequestration**.



August 20 (Sat), 2011

STORE Education: Energy Resources: Engineering and Earth Science Concepts for the Classroom

In partnership with The University of Texas Pan American Texas Regional Collaborative for Excellence in Science Teaching (Edinburg, TX) and the TeXas Earth and Space Science (TXESS) Revolution, STORE provided instruction on energy, climate and carbon sequestration to K-12 science teachers from South Texas.



Location: The University of Texas Pan American, Edinburg, TX

Total Participants 32 teachers

CEUs: 25.6 CEUs total awarded (.8 CEU/participant)

STORE instructors: **Hilary Olson, Jon Olson**

Partners: TeXas Earth and Space (TXESS) Revolution, Dr. Kathy Ellins

Description: In partnership with The University of Texas Pan American Texas Regional Collaborative for Excellence in Science Teaching (Edinburg, TX) and the TeXas Earth and Space Science (TXESS) Revolution, STORE provided instruction on energy, climate and carbon sequestration to K-12 science teachers from South Texas.

June 13-25 (Mon-Sat), 2011

STORE Education: *Energy, Climate and Water in the 21st Century*

In collaboration with TXESS Revolution, STORE provided instructors for a two-week professional development workshop for K-12 teachers at The University of Texas at Austin on *Energy, Climate and Water in the 21st Century*.

CEUs (awarded by UT Austin): 201.6 CEUs awarded total (8.4 CEUs/participant)

Location: The University of Texas at Austin, Austin, TX

Total Participants 24 K-12 teachers from throughout the state of Texas

STORE instructors: **Jon Olson, Hilary Olson, Paul Bommer, Larry Lake, Paul Bommer, Sue Hovorka, Katherine Romanak, Becky Smyth**

Partners: TXESS Revolution program at UT Austin, Jackson School of Geosciences at UT Austin, Dept. of Petroleum and Geosystems Engineering at UT Austin, Luminant, Baylor University, Waco Wetlands.

Description: In collaboration with TXESS Revolution, STORE provided instructors for a two-week



professional development workshop for K-12 teachers at The University of Texas at Austin on *Energy, Climate and Water in the 21st Century*. STORE instructors discussed and led activities on various energy resources, concepts and technologies (photo right); water resources and monitoring; and climate change and climate change mitigation technologies (i.e., carbon sequestration) at the workshop. The two-week workshop included a one field trip to Luminant's Oak Grove Power Plant (photo left) and Kosse Coal Mine to explore energy generation and future carbon mitigation technology, as well as an excursion to Baylor University and Waco Wetlands to focus on natural carbon sinks and water.

June 6-9 (Mon-Thu), 2011

STORE Outreach: *Energy and You in the 21st Century*

In partnership with the Rio Grande Valley Science Association, STORE provided curriculum and instruction for an energy workshop for incoming 6th- to 8th-grade girls from the Rio Grande Valley area as part of the organization's *Engaging Girls in Science Camp*.

Location: St. Anne's Catholic Church, Pharr, TX

Total Participants 24 middle-school girls

STORE instructors: **Jon Olson, Hilary Olson**

Partners: Rio Grande Valley Science Association, St. Anne's Catholic Church (Pharr, TX), Diocese of Brownesville



Description: STORE members, Dr. Jon Olson and Dr. Hilary Olson provided curriculum and instruction for a summer workshop, *Energy and You in the 21st Century*, for incoming 6th- to 8th-grade girls from the Rio Grande Valley area. Topics included energy resources and challenges, climate change, carbon mitigation and carbon sequestration. Students completed hands-on lab activities as well as problem sets that involved higher level math, including some algebra, that helped them understand energy concepts

and give them insight into an engineering and science profession. Two local middle school teachers also attended the workshop and assisted with instruction.

Due to budget cuts, the workshop could not be held in the local middle school as planned, and we were therefore unable to take advantage of the National School Lunch Program for meals for the girls. However, the Rio Grande Valley Science Association was able to gain community support for this workshop to promote STEM education for girls. St. Anne's Catholic Church in Pharr, Texas offered to provide space for the workshop, and the Diocese of Brownesville provided breakfasts, snacks and lunches for the girls during the four days.



May 2 (Fri), 2011

STORE Research and Tech Transfer: *CO2 Goes Underground: A Texas Love Story*

STORE member Rebecca Smyth was invited to talk about the relationship between enhanced oil recovery and carbon capture and storage technology to members of the Austin Geological Society.

Location: The University of Texas at Austin, Austin, TX

Total Participants 75 professionals

STORE instructors: **Rebecca Smyth**

Partners: Austin Geological Society

Description: STORE member Rebecca Smyth was invited to talk about the relationship between enhanced oil recovery and carbon capture and storage technology to members of the Austin Geological Society. Approximately 75 professionals attended the meeting, hosted at the Bureau of Economic Geology, and heard about the relationship between carbon sequestration and enhanced oil recovery in Texas.



April 25-29 (Mon-Fri), 2011

STORE Education: CO₂ Injection for Geological Storage

Several STORE members from the Petroleum and Geosystems Engineering Department at The University of Texas at Austin have collaborated to introduce carbon capture and storage technology to their incoming class of freshmen.

Student Contact Hours at UT Austin: 600 student contact hours (4 hrs/student)

Location: The University of Texas at Austin, Austin, TX

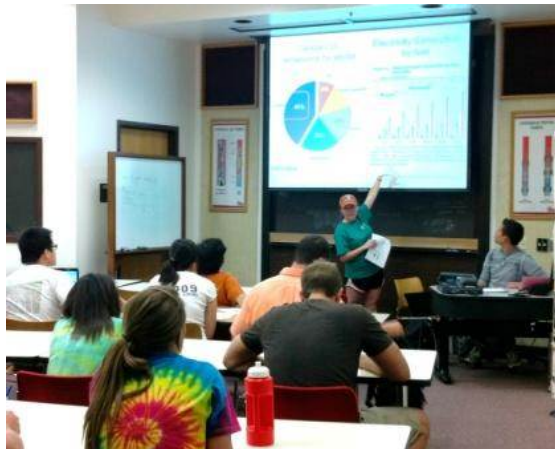
Total Participants 150 students in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Jon Olson and PGE Teaching Assistants**

Partners: Dept. of Petroleum and Geosystems Engineering at UT Austin

Description: Dr. Jon Olson has adapted the module "CO₂ Injection for Geological Storage", originally developed by Dr. Steve Bryant, for use with his introductory class for first year students in the department. Olson worked with his teaching assistants (seniors in the department) to enable them to gain the needed experience to teach the smaller sections of 10-15 students in lab during the week of the module.

Dr. Jon Olson (right) includes a carbon storage module as part of his introductory course for over 150 freshmen in the Petroleum and Geosystems Engineering Department at The University of Texas at Austin.



Graduating seniors (left) assisted with the module during smaller lab sections.

April 8 (Fri), 2011

STORE Education: *Monitoring CO2 Storage in Geological Formations*

A talk by STORE member Dr. Katherine Romanak at noon at the Environmental Science and Engineering CE 6221 Graduate Seminar for the Department of Civil and Environmental Engineering at the University of Texas San Antonio on her work in the Southeast U.S. Regional Carbon Sequestration Partnership in Cranfield Mississippi.

Student Contact Hours at UT San Antonio: 30 student contact hours (1 hr/student)

Location: The University of Texas at San Antonio, San Antonio, TX

Total Participants 30 students in Dept. of Petroleum and Geosystems Engineering

STORE instructors: **Katherine Romanak**

Partners: Department of Civil and Environmental Engineering at the University of Texas San Antonio

Description: The University of Texas at San Antonio hosted Dr. Katherine Romanak of STORE for their Environmental Science and Engineering CE 6221 Graduate Seminar in the Department of Civil and Environmental Engineering on April 8th. Approximately 30 students and faculty came out to hear Dr. Romanak speak on: "Monitoring CO2 Storage in Geological Formations", a summary of her work in the Southeast U.S. Regional Carbon Sequestration Partnership project at Cranfield Mississippi. Dr. Romanak is an internationally-recognized expert who has conducted geochemical analyses of soil gas samples at a number of sites including a carbon sequestration project in Cranfield, Mississippi.



March 7 – 8, 2011

STORE Education: *Energy and You: What to do with CO2*

STORE members presented a teacher professional development workshop for the GeoFORCE Texas Program (<http://www.jsug.utexas.edu/geoforce>), the nation's largest college prep program for Earth Sciences.

Location: Radisson Hotel, Austin, TX

Total Participants 48 teachers

CEUs (awarded by GeoFORCE, UT Austin): 57.5 CEUs awarded total (1.2 CEUs/participant)

STORE instructors: **Hilary Olson, Jon Olson, Sue Hovorka, Katherine Romanak**

Partners: Austin Energy, Society of Petroleum Engineers and GeoFORCE Texas Program

Description: STORE members, Dr. Jon Olson, Dr. Hilary Olson, Dr. Susan Hovorka and Dr. Katherine Romanak partnered with GeoFORCE Texas, the nation's largest college prep program for earth sciences, to provide a two-day professional development workshop for almost 50 teachers at the Radisson Hotel in Austin on March 7-8, 2011.



The workshop, entitled "Energy and You: What to do with CO2", exposed middle- and high-school teachers from southwest Texas and the Houston, Texas area to the broad issue of our future energy mix, how fossil fuels fit into that mix, and how technological solutions, such as carbon capture and storage, play a role in the options for 21st century low-carbon footprint energy sources. Austin Energy partnered with

STORE to provide the teachers with a site visit to the solar installation at the Austin Bergstrom International Airport and an introduction to Smart Grid Technology.

We thank Russell Cowen (Austin Energy Education Coordinator), Shayna Lee (Austin Energy Multi-Family & Solar Programs), and Beverly Bonevac (Austin Energy Advanced Metering Infrastructure Project Coordinator) for putting together a very complementary program to our STORE activities. We would like to extend our appreciation to the Society of Petroleum Engineers for providing classroom materials from their Energy4Me program.



March 5, 2011

STORE Outreach: *What to do with CO₂: Cures for the Feverish Earth*

An outreach booth at The University of Texas at Austin's 11th annual Explore UT, a day of events, performances, exhibits, lectures and activities for the entire family, with more than 50,000 K-12 students on the campus

Location: The University of Texas at Austin

Total Participants: Estimated 50,000 visitors to Explore UT day

STORE instructors: **Susan Hovorka, Katherine Romanak, Hilary Olson and UT Jackson School of Geosciences graduate students and other scientists**

Description: University of Texas at Austin hosted its 12th annual Explore UT, a day of events and activities for the entire family, on March 5, 2011. The day offered the estimated 50,000



visitors an introduction to university life, and specifically, insights into some of the current research activities going on at the university. Numerous STORE members, as well as students from the Jackson School of Geosciences, participated in the annual Explore UT outreach event with a booth entitled "What to Do with CO₂". The booth provided a variety of outreach activities on fossil fuels, physical properties of CO₂, porosity and reservoir fluid storage, and carbon sequestration.

March 1 (Tue), 2011

STORE Outreach: *Put It Back: Geologic Sequestration for Greenhouse Gas Emissions Reductions*

A talk by STORE member Dr. Tip Meckel at the Austin Forum on his involvement in the Southeast U.S. Regional Carbon Sequestration Partnership in Cranfield Mississippi, as well as the Texas research initiative to identify sequestration potential in state offshore lands.

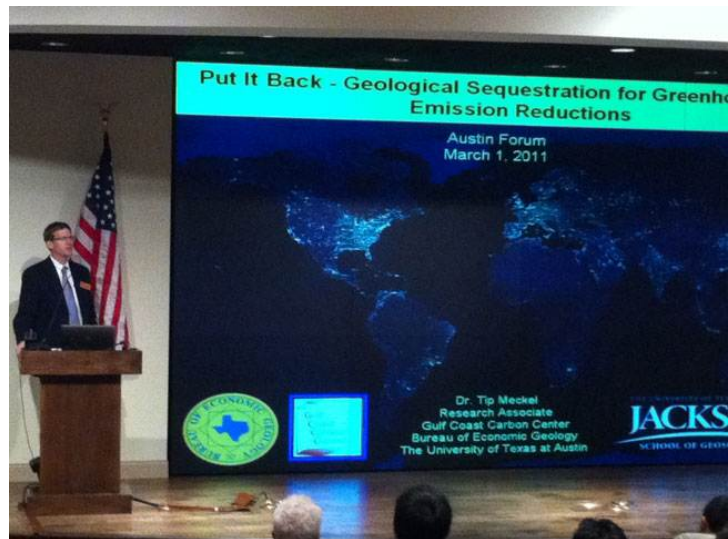
Location: AT&T Conference Center, The University of Texas at Austin

Total Participants: Greater than 100 attendees

STORE participants: **Tip Meckel and Hilary Olson**

Partner: Austin Forum (<http://www.austinforum.org>)

Description: On March 1, 2011, STORE partnered with the Austin Forum, a monthly speaker series that hosts distinguished industry professionals who share their knowledge about the confluence of science, technology and society in the 21st century, for an evening seminar on carbon sequestration. STORE member Dr. Timothy Meckel was the featured speaker for this lecture at the AT&T Conference Center Amphitheater in Austin. Over 100 participants listened to Dr. Meckel speak on "Put It Back - Geological Sequestration for Greenhouse Gas Emission Reductions", which not only presented current research on and implementation of carbon sequestration technology, but placed carbon



capture and storage within the broader framework of our future energy mix. The event was preceded by a happy hour networking mixer and was followed by a lively question and answer session. Information on STORE and links to our website were distributed to all participants. A few lucky folks even won STORE t-shirts! Many thanks to the sponsors of this event, including IBM, Sun Oracle, Dell, AMD, Intel, The Cockrell School of Engineering, Microsoft, Austin Chamber of Commerce and TACC.

February 1 (Tue), 2011

STORE Research and Tech Transfer: *Making Capacity Estimates for Geologic Storage of CO₂ for Carbon Capture and Storage (CCS) Projects*

A seminar presented by STORE member Dr. Sue Hovorka, organized by the Florida Geological Survey and hosted at the USGS field office in Tallahassee, Florida.

Location: USGS field office in Tallahassee, FL

Total Participants 18 professionals

CEUs: 3.6 CEUs total awarded (.2 CEU/participant)

STORE instructor: **Sue Hovorka**

Partners: Florida Geological Survey and the U.S. Geological Survey in Tallahassee, FL.

Description: *Making Capacity Estimates for Geologic Storage of CO₂ for Carbon Capture and Storage (CCS) Projects*, a seminar organized by the Florida Geological Survey, recently featured STORE member Dr. Sue Hovorka. The February 1st program was hosted at the USGS field office in Tallahassee. STORE appreciates the contributions of **Tina Roberts-Ashby**, USGS, who also took part in the discussions.



November 9 (Tue), 2010

STORE Training: Storage of CO₂ in Geologic Formations

One-day short course on CO₂ Sequestration in association with SPE International Conference on CO₂ Capture Storage and Utilization (Nov 10-12), New Orleans, Louisiana

CEUs (awarded by SPE): 23.2 CEUs awarded total (.8 CEU/participant)

Location: Hilton Riverside, New Orleans, Louisiana

Total Participants 29 professionals

STORE instructors: **Steve Bryant, J.P. Nicot, Rebecca Smyth, Dan Collins, Tip Meckel, Traci Rodosta, Hilary Olson**



Description: STORE members presented a one-day short course on CO₂ Sequestration in association with Society of Petroleum Engineers International Conference on CO₂ Capture Storage and Utilization (Nov 10-12), New Orleans, Louisiana.

October 26 (Tue), 2010

STORE Outreach: Lecture to The University of Texas QUEST group, which is part of the Osher Lifelong Learning Institute

Location: Austin, Texas

STORE attendees: **Rebecca Smyth**

Presentation: *Carbon Capture and Storage (aka CO2 Sequestration)*

Description: STORE member **Rebecca Smyth** gave an outreach lecture on *Carbon Capture and Storage (aka CO2 Sequestration)* to the University of

Texas QUEST group, which is part of the Osher Lifelong Learning Institute. UT Quest™ (Opportunities for Learning) is a self directed membership program within UT Austin's Division of Continuing Education (CE) Third Age University. Its membership is limited to 335 members with no age restrictions. The goal is to provide its members, who reflect a very wide range of professional and life experiences, with continuing intellectual growth in a campus environment. These sessions are held at the Thompson Conference Center on the UT campus.



October 10 (Sun), 2010

STORE Training: Carbon Sequestration: Storage of CO₂ in Geologic Formations

One-day short course on CO₂ Sequestration in association with Gulf Coast Association of Geological Societies Annual Meeting (Oct 10-12) in San Antonio, Texas

CEUs: 10.5 CEUs awarded total (.75 CEU/participant)

Location: Convention Center, San Antonio, Texas

Total Participants 14 professionals and graduate students

STORE instructors: **Steve Bryant, Rebecca Smyth, Bill Kardos, Tip Meckel, Hilary Olson**



Description: STORE members presented a one-day short course on CO₂ Sequestration in association with the Gulf Coast Association of Geological Societies Annual Meeting (Oct 10-12) in San Antonio, Texas.

October 5-7 (Tue-Thu), 2010

STORE Reporting: 2010 Regional Carbon Sequestration Partnerships Annual Review Meeting, sponsored by the Department of Energy, National Energy Technology Laboratory.

Location: Sheraton, Pittsburgh, Pennsylvania

STORE attendees: **Hilary Olson, Victoria Osborne, Tip Meckel**

Presentation: *Alliance for Sequestration Training, Outreach, Research and Education* (Hilary Olson)

Booth: *Sequestration Training, Outreach, Research and Education* (Hilary Olson, Victoria Osborne and Tip Meckel)

Description: STORE members attended the annual RCSP Review Meeting in Pittsburgh. An overview report of the first year's progress was given by Hilary Olson, director of STORE. A booth highlighting the various aspects of the STORE training center was present at the welcoming reception on the first evening of the meeting.



October 1-2 (Fri-Sat), 2010

STORE Outreach: *Energy, Water and Climate in the 21st Century*

An Open House for high school and middle school girls, and the public on critical issues surrounding energy, water and climate at Ursuline Academy, Dallas, Texas. The relationship between energy, groundwater, climate and carbon sequestration was the focal point of the event.

Location: Ursuline Academy, Dallas, Texas

High School Student Participants: 800

High School Teacher Participants: 100

Middle School Students and Mentor Participants: 150

TOTAL IMPACT: 1,050 people



STORE Member and Partner Presenters: Cliff Clark (Luminant), Dr. Carlos Torres-Verdin (UT PGE), Becky Smyth (UT BEG), sPrecious Williams (UT grad student, PGE), Angelica Hernandez (UT grad student, PGE), Dr. Sue Hovorka (UT BEG), Dr. Hilary Olson (UTIG), Dr. Kathy Ellins (UTIG), Deborah Hempel-Medina (Williams and SPE), Dr. Katherine Romanak (UT BEG), Diane Brownlee (Ellison-Miles Geotechnology Institute), Dr. Jon Olson (UT PGE)

Guest Presenters: Dr. Linda Knight (Past President Texas Earth Science Teachers Association and the National Earth Science Teacher Association), Dr. Scott Tinker (Director, UT BEG).

Description: GirlTalk, has as its mission to promote and present Science, Technology, Engineering and Mathematics (STEM) topics of importance to communities in a manner that will engage all people, and in particular girls. We bring together community leaders, STEM experts, local businesses, policy and regulatory experts, teachers and educational institutions (from elementary to higher ed) and community members to focus on relevant topics and issues critical to the local community.

August 23 – December 15, 2010

STORE Education: *Advances in CO2 Injection and Storage in Geologic Formations*

A new cross-disciplinary, project-based course for students covering new technology for greenhouse gas emissions reductions.

Student Contact Hours at UT Austin: 344 student contact hours (43 hrs/student)

Location: The University of Texas at Austin, Austin, TX

Total Participants 8 students

STORE instructors: **Sue Hovorka, J.P. Nicot, Tip Meckel**

GEO391 (unique number 27140)

Four instructors teach from their research expertise:

Farzam Javadpour – multiphase fluid flow, pore scale studies, imaging micromodels, pore to reservoir upscale, capillary and viscous processes. Farzam brings this course material from University of Calgary to UT.

Susan Hovorka (STORE personnel) – project development. Susan has led four of the world's premier field research teams injecting CO2 and monitoring reservoir and ecosystem response.



Tip Meckel (STORE personnel) – Structure and sedimentology. Evaluation of elevated pressure effects – seal and structure. Integration of field observations and theory.

Jean-Philippe (J.-P) Nicot (STORE personnel) – introduction to multiphase fluid flow modeling using GEM and other models, rock-water interaction. J.P. started his career as a mining geologist in North Africa and has worked on a variety of fluid flow problems.

Description: Eight labs teach students the techniques to complete the term project, developing the complete plan for a real-world CCS project. Project can be aligned with thesis or other research.

May 8 (Sat), 2010

STORE Research and Tech Transfer: Cranfield Sequestration Project, Mississippi, USA (field trip)

Field trip to Cranfield Site for participants in IEA Greenhouse Gas Monitoring Network Meeting

Location: Natchez, MS

Total Participants 36

CEUs: 28.8 CEUs awarded total (.8 CEU/participant)

STORE field trip leaders and organizers: **Sue Hovorka, Tip Meckel, Katherine Romanak, Hilary Olson**



Description: The carbon sequestration site at Cranfield Field outside of Natchez, Mississippi is a centerpiece of STORE's Research and Technology Transfer Initiative. See the description listed under April 9-10, 2010 field trip below for information on field trip content. **Victoria Osborne**, Marketing and Communications specialist for STORE, was present during the field trip, helping with photography and logistics.

May 6-7 (Thu-Fri), 2010

STORE Research and Tech Transfer: IEA Greenhouse Gas 6th Monitoring Network Meeting, Natchez, Mississippi

Co-sponsorship, Organization, On-site Management and Steering Committee for the IEA Greenhouse Gas Monitoring Network Meeting

STORE Steering Committee members and conference co-organizers: **Sue Hovorka** and **Hilary Olson**

STORE attendees and presenters included: **Sue Hovorka, Hilary Olson, J.P. Nicot, Tip Meckel, Katherine Romanak**

Description: STORE worked with Tim Dixon of the IEA Greenhouse Gas Monitoring Network to organize their annual meeting in Natchez, Mississippi (May 6-7, 2010). In addition, STORE and the Gulf Coast Carbon Center hosted a welcome reception at the historic Dunleith mansion and organized a field trip on Saturday, May 8, for attendees to the Cranfield Sequestration Project Site. STORE officially launched their web site during the IEA Greenhouse Gas Monitoring Network annual conference. **Victoria Osborne**, Marketing and Communications specialist for STORE, was present at the meeting. Numerous other presentations were given by STORE members on carbon sequestration research and the STORE effort including:

EPA-CCP Study: **Sue Hovorka**

Phase III SECARB Project Cranfield: **Sue Hovorka**

Post-injection Monitoring at Frio: **Sue Hovorka**

Carbon Storage Outreach and Education with STORE: **Hilary Olson**

Sue Hovorka served on a monitoring network panel at the end of the conference.



This meeting served as an important opportunity for members of STORE to learn about other monitoring programs and share their research. Monitoring expertise is a key component that will be part of a package of skills required by those working in the GCS industry. Monitoring is also an important aspect of outreach as it gives the public a feeling of security about CSS technology. Several other outreach and training specialists also attended the meeting and/or subsequent field trip to Cranfield, including **Steve Meltzer and Bob Kiker (Permian CCS Center) and Kim Sams (SECARB Ed)**.

April 30 (Fri), 2010

STORE Outreach: *What to do with CO2: Cures for the Feverish Earth*

An outreach booth at Brentwood Elementary's Earth Day Celebration in Austin, TX

Location: Austin, TX

STORE participants: Hilary Olson, Jon Olson

Total Participants: 200 elementary students, teachers and parents



Description: The booth looked at several questions: What is energy and how do we consume it? How does the burning of fossil fuels release greenhouse gases into the atmosphere? How do greenhouse gases, such as carbon dioxide, affect the temperature of the Earth? What is carbon dioxide and where can it be found? How are scientists pumping carbon dioxide underground to store it in rock layers and keep it out of our atmosphere?

April 9-10 (Fri-Sat), 2010

STORE Research and Tech Transfer: CO2 EOR and Sequestration Project near Natchez, Mississippi (field trip)

Pre-convention field trip to Cranfield Site for participants the 2010 AAPG Annual Convention (Apr 11-14) in New Orleans, Louisiana.

Location: New Orleans, LA to Natchez, MS

STORE field trip leaders and organizers: **Sue Hovorka, Tip Meckel, Katherine Romanak, Hilary Olson**

Total Participants 26

CEUs: 31.2 CEUs awarded total (1.2 CEUs/participant)



Description: The carbon sequestration site at Cranfield Field outside of Natchez, Mississippi is a centerpiece of STORE's Research and Technology Transfer Initiative. Highlights of field trips to Cranfield include a tour of Denbury Resources' gas-separation facility, venting of CO2 from a flow line at an injection well, viewing of core of the injection and confining zone intervals of the Tuscaloosa Formation, and viewing of monitoring instrumentation designed and operated with funding from the National Energy Technology Laboratory in collaboration with Sandia Technologies, LBNL, ORNL, USGS and LLNL. BEG research at Cranfield, part of the Phase 3 SECARB regional partnership program in sequestration managed by the Southern States Energy Board, has effectively monitored a million-ton injection with diverse methodologies. **Kim Sams of SECARB Ed** attended the field trip and gave an overview presentation about SECARB efforts.

March 9-10 (Tue-Wed), 2010

STORE Research and Tech Transfer: *3rd Meeting of North America Carbon Atlas Partnership (NACAP)*

Presentation in Cuernavaca, Mexico on the Gulf Coast Carbon Center's current DOE-sponsored efforts in the Gulf of Mexico at the 3rd meeting of NACAP: a partnership among Canada, Mexico and the United States to identify the sources of CO₂ and the sinks for storing it in North America

Location: Cuernavaca, Mexico

STORE participants: **Ramón Treviño**



Description: NACAP is a partnership among Canada, Mexico and the United States to identify the sources of CO₂ and the sinks for storing it in North America in order to advance the potential for carbon capture and storage to mitigate climate change. **Ramón Treviño** was invited to the meeting by the Department of Energy to present GCCC's current DOE-sponsored efforts in the Gulf of Mexico. Trevino's trip was jointly funded by the Southeast Carbon Partnership (SECARB Phase III) and STORE.

March 6 (Sat), 2010

STORE Outreach: *What to do with CO2: Cures for the Feverish Earth*

Location: Austin, Texas

STORE participants: **Hilary Olson, Sue Hovorka, Jon Olson**

Total attendance at Explore UT: more than 50,000 K-12 students on the campus

Description: The University of Texas at Austin hosted its 11th annual Explore UT, a day of events, performances, exhibits, lectures and activities for the entire family. More than 50,000 K-12 students flooded the 40 Acres at the 11th annual Explore UT event. This is the first year that out-of-state schools, one from Oklahoma and two from Louisiana, have participated in the event.



STORE presented a booth entitled "What To Do with CO₂: Cures for the Feverish Earth". The booth looked at several questions: What is energy and how do we consume it? How does the burning of fossil fuels release greenhouse gases into the atmosphere? How do greenhouse gases, such as carbon dioxide, affect the temperature of the Earth? What is carbon dioxide and where can it be found? How are scientists pumping carbon dioxide underground to store it in rock layers and keep it out of our atmosphere? Booth presenters included: **Dr. Susan Hovorka** (BEG), **Dr. Hilary Olson** (UTIG) and **Dr. Jon Olson** (PGE) of STORE, Dr. Jiemin Lu (post-doc) and students Stuart Coleman and Silvia Solano from the Jackson School of Geosciences.

December 6-7 (Sun-Mon), 2009

STORE Research and Tech Transfer: *UK-Texas CSS Technology and Legislation Pre-Workshop Event*

Location: Houston, Texas

Attendees, including those from STORE (in bold): From left to right: Catherine Santamaria (British Consulate), Erin Miller (BEG), Dr. Carey King (Center for International Energy and Environmental Policy, University of Texas), Dr. May Arkawi (British Consulate), **Rebecca Smyth (STORE and BEG)**, **Dr. Jon Olson (STORE and Department of Petroleum and Geosystems Engineering, University of Texas)**, **Dr. Susan Hovorka (STORE and BEG)**, **Dr. Tip Meckel (STORE and BEG)**, Dr. John Gluyas (University of Durham), **Dr. Steve Bryant (STORE and Department of Petroleum and Geosystems Engineering, University of Texas)**, Nick Huerta (Department of Petroleum and Geosystems Engineering, University of Texas), Ian Havercroft (University College, London), Dr. Mike Stephenson (British Geological Survey), and Stuart Coleman (BEG).



Description: UK-Texas CSS Technology and Legislation Pre-Workshop Event (before the EOR Carbon Management Workshop) for researchers studying carbon capture and sequestration (CCS) from the United Kingdom and the University of Texas at Austin, hosted by the British Consulate in Houston. **Jon Olson** and **Steve Bryant** made presentations on petroleum engineering and the future GCS workforce, as well as the new **STORE Alliance**.
