

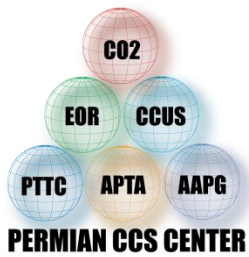
# Permian CCUS Center

**Carbon Capture, Utilization & Storage  
Technology**

Carbon Capture & CO<sub>2</sub> EOR  
Storage – Learning  
Through the Permian  
CCUS Center

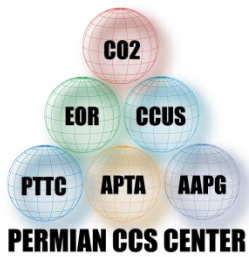
18<sup>th</sup> International Petroleum &  
Biofuels Environmental Conference  
Houston, Texas September 9, 2011

Dwight Rychel, PTTC



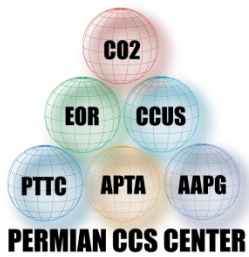
# TOPIC OUTLINE

- What is the Permian Basin Carbon Capture, Utilization and Storage Training Center?
- Training Media
- Other CCS Training Centers
- Changing Focus



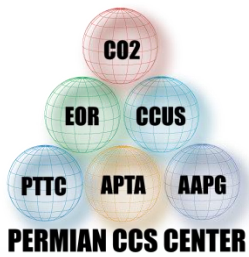
# About Permian CCUS Center

- World class training in carbon capture and storage (and EOR) for and by industry professionals, building on experience in the Permian Basin but through online presence available to individuals throughout the U.S. and the world
- Stimulated by a grant for the National Energy Technology Laboratory of the DOE and the American Recovery and Reinvestment Act of 2009
- Efforts guided by and Industry Advisory Board representing a broad spectrum of companies engaged in some aspect of CCS



# Permian Basin CCUS Approach

- By and For Industry – Industry organizations instructing industry professionals
- Targeted audience of wide range of energy professionals potentially involved in CCUS, engineers, geoscientists, regulators, academia, environmentalists, and power generators
- Its all about the money: for the individuals to advance, for PBCCS to become self-sustaining



# Three World Class Organizations



## Petroleum Technology Transfer Council

Tech Transfer, Workshops, Newsletter, Tech Alerts



## American Association of Petroleum Geologists

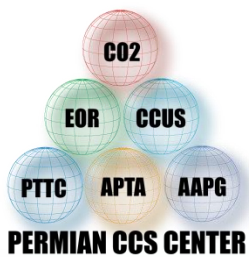
37,000 Members, Publications and Conferences

Distance Learning



## Applied Petroleum Technology Academy

CO<sub>2</sub> Course, CO<sub>2</sub> Conference

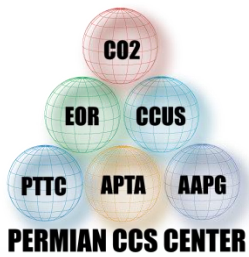


# Applied Petroleum Technology Academy

- The Applied Petroleum Technology Academy ("APTA") is a non-profit organization created to teach energy companies how to apply cost-effective technology in order to extend the lives of aging oil and gas fields around the world. APTA's mission statement is simple:

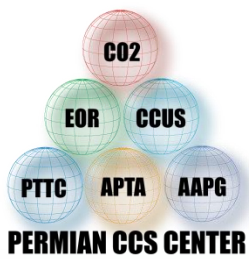
"To provide practical training of oilfield practices in a mature oilfield environment emphasizing cost savings with ample opportunity for field visitation."

- Headquartered in Midland, Texas - in the heart of the Permian Basin
  - APTA can provide access to hands-on practical training based on decades of CO<sub>2</sub> experience. Curricula can be customized to meet the specific needs of clients with respect to both their levels of experience and to the types of fields they are dealing with. APTA's curricula are designed to cover all aspects of petroleum production.



# Petroleum Technology Transfer Council

- PTTC provides a forum for technology transfer and learning
- The Petroleum Technology Transfer Council (PTTC) is a national not-for-profit organization led by an independent Board of Directors. PTTC was established to provide a forum for transfer of technology and best-practices within the producer community. Local Producer Advisory Groups ensure that PTTC activities in a particular region address the technology needs of producers in that area.
- PTTC is a partnership to connect independents with the technology and knowledge to safely and responsibly develop the nation's CCS and oil and gas resources. As such, it is an important part of America's energy solution



# American Association of Petroleum Geologists

- Founded in 1917, the American Association of Petroleum Geologists is currently the world's largest professional geological society.
- The membership of AAPG includes geologists, geophysicists, CEOs, managers, consultants, students and academicians. The purpose of the organization is to foster scientific research, advance the science of geology, promote technology and inspire high professional conduct.
- Leader in distance learning and Geology Technology Conferences
- Accredited Certificate Program

# Global emissions hit high

▪ Carbon emissions have jumped by the largest amount on record.

BY SETH BORENSTEIN

Associated Press

The global output of heat-trapping carbon dioxide jumped by the biggest amount on **1** Washington record, the U.S. Department of Energy calculated, a sign of how feeble the world's efforts are at slowing man-made global warming.

The new figures for 2010 mean that levels of greenhouse gases are higher than the worst case scenario outlined by climate experts just

four years ago.

"The more we talk about the need to control emissions, the more they are growing," said John Reilly, co-director of MIT's Joint Program on the Science and Policy of Global Change.

The world pumped about 564 million more tons of carbon into the air in 2010 than it did in 2009. That's an increase of 6 percent. That amount of extra pollution eclipses the individual emissions of all but three countries — China, the United States and India, the world's top producers of greenhouse gases.

It is a "monster" increase that is unheard of, said Gregg Marland, a professor of geology at Appalachian State University, who has helped calculate Department of Energy

figures in the past.

Extra pollution in China and the U.S. account for more than half the increase in emissions last year, Marland said.

"It's a big jump," said Tom Boden, director of the Energy Department's Carbon Dioxide Information Analysis Center at Oak Ridge National Lab. "From an emissions standpoint, the global financial crisis seems to be over."

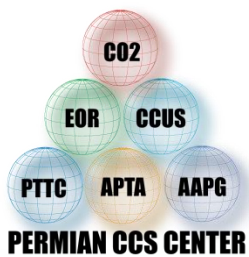
Boden said that in 2010 people were traveling, and manufacturing was back up worldwide, spurring the use of fossil fuels, the chief contributor of man-made climate change.

India and China are huge users of coal. Burning coal is the biggest carbon source worldwide, and emissions from that jumped nearly 8

percent in 2010.

In 2007, when the Intergovernmental Panel on Climate Change issued its last large report on global warming, it used different scenarios for carbon dioxide pollution and said the rate of warming would be based on the rate of pollution. Boden said the latest figures put global emissions higher than the worst case projections from the climate panel. Those forecast global temperatures rising between 4 and 11 degrees Fahrenheit by the end of the century with the best estimate at 7.5 degrees.

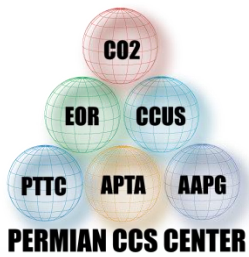
"Really dismaying," Granger Morgan of Carnegie Mellon University said of the new figures. "We are building up a horrible legacy for our children and grandchildren."



# Charles McConnell, COO of FE (nom. Asst. Sec. of Energy)

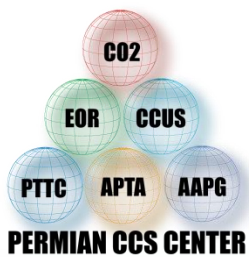
*Lead Plenary Session Presentation, 29<sup>th</sup> Annual  
Pittsburgh Coal Conference, 9/12-15/2011,  
Pittsburgh*

- CCS Moving to CCUS (U standing for Utilization)
- Lacking legislation, the path to move CCS to commerciality is CO<sub>2</sub> EOR
- Potential Impact w Next Generation Technologies (Stats from U.S. Carbon Sequestration Council)
  - >> \$10 Trillion in economic impact
  - >> 30 – 40% reduction in imported oil
  - >> Plus 2.5 million jobs



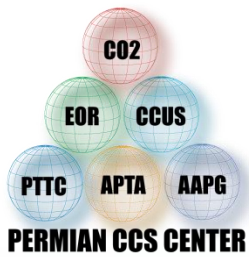
# Uniqueness of Permian CCUS Center

- From Industry for Industry
- Not Affiliated with a Partnership Project
- CO<sub>2</sub> EOR (CCUS) Focus
- Pulls from Capabilities of 3 Organizations
  - >> PTTC (regional & national tech transfer)
  - >> APTA (CO<sub>2</sub> conference; network w operators)
  - >> AAPG (distance learning; applications- and research-oriented forums)



# Major Elements of Permian Basin CCUS

- Custom Presentations at Numerous Professional, Technical and Regulatory Conferences
- Series of One-Day Workshops and Webinars (PTTC)
- E-Certificate (AAPG) and free Open Courseware
- Augmented by [www.permianbasinccs.org](http://www.permianbasinccs.org)
- Quarterly Newsletter and online e-alert
- Interactive Industry Forums (comparable to SPE ATWs (Applied Technology Workshops) and AAPG Geoscience Technology Workshops (GTWs))



# www.permianbasinccs.org



## CARBON CAPTURE & STORAGE TECHNOLOGY

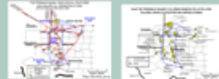
"World Class CCS Training for & by Industry Professionals"

*Imparting the needed skill sets to realize CCS opportunities*

Developed & Delivered by PTTC, APTA & AAPG with Grant Funding from the American Recovery and Reinvestment Act of 2009 through DOE

- Elements of the Program ▶
- Calendar of CCS Events
- Newsletter/Tech Alerts
- CCS News of Interest ▶
- Other DOE Regional CCS Training Programs
- DOE's regional Carbon Sequestration Partnerships
- Seminal Publications & Reports
- CCS-Related Links

*Click thumbnail to view maps*



**THE PERMIAN BASIN CCS CENTER IS PLEASED TO ANNOUNCE:**

### [THE CARBON CAPTURE AND STORAGE E-CERTIFICATION COURSE PROGRAM](#)



#### UPCOMING WORKSHOP

October 5-7, Rapid City, SD | [Carbon Capture & CO2 EOR---Learning Through the Permian CCS Center](#)

October 20, Webinar, Online | [Combining Carbon Capture & CO2 EOR---The Business Model](#)

[Subscribe to the \*Catch and Store\* Newsletter and CCS e-Alerts](#)

[View earlier recorded webinars presenting key concepts of CCS](#)

[AAPG CCS Free OpenCourseWare](#)

# Catch & Store Newsletter



## Carbon Capture and Storage Technology

# Catch & STORE

World Class CCS Training for and by Industry Professionals

pttc.org aptapb.org aapg.org permianbasinccs.org VOLUME 2, NUMBER 2 SEPTEMBER 2011

## RESIDUAL OIL ZONES, CO<sub>2</sub> EOR AND CCUS: IT WOULD SEEM "GLACIALLY PACED" BUT PROGRESS ABOUNDS

BY STEVE MELZER, MELZER CONSULTING, WORKING THROUGH THE APPLIED PETROLEUM TECHNOLOGY ACADEMY

In previous columns (*Catch & Store* Newsletters #1 (May '10) and #2 (Aug'10)) Bob Trentham and I discussed the widespread distribution and origins of Pervasively Dolomitized Intervals (PDIs) and Residual Oil Zones (ROZs). The opportunities afforded for capture followed by storage of CO<sub>2</sub> in these two subsurface intervals are enormous. Furthermore, for the case of ROZs, the opportunity is afforded for a huge oil resource development heretofore overlooked in the oil reserve picture of this and other nations. What is seen is a seemingly improbable convergence of the normally antagonistic goals of CO<sub>2</sub> emission reduction (environmentally-driven concerns) and energy production (oil resource development). Accordingly, one might anticipate immediate project implementation and results but these will be billion-dollar-scale projects. Many readers may

have the perception that progress is not occurring, but this column attempts to adjust that view and discuss both the research and project initiatives that are moving forward, sometimes out of the view of both the public and technical audiences.

### UNDERSTANDING THE ORIGIN, DISTRIBUTIONS, AND RESPONSE TO CO<sub>2</sub> OF ROZs

When thinking about identifying and exploiting new petroleum resources, one would normally expect industry to be very quiet and confidential as they line up title to the subsurface resources to develop. Such is the case. However, some public research is occurring thanks to the Research Partnership to Secure Energy for America (RPSEA) and the Department of Energy's Office of Fossil Energy and National Energy Technology Laboratory. There is now strong emphasis on CCUS, adding the

"U" to stress utilization of CO<sub>2</sub>. Captured CO<sub>2</sub> is not just securely stored in the subsurface but is utilized to make oil and help the economic and jobs picture so critically important to the future of this country. For further reference, specifically for ongoing work in the Permian Basin (PB), the reader is directed to several web resources identified in Figure 1.

Some have argued that the enormous ROZ resource in the PB is an anomaly in the grand scheme of U.S. and global oil assets. As author and a ROZ researcher, I disagree with my argument going like this: many petroleum provinces have undergone a second stage of tectonics subsequent to the original subsidence and entrapment stage. And, once the second stage occurs, the oil can be displaced from the original trap so that water invades a portion of the original entrapment interval. I call this mother nature's waterflood whereby the oil is displaced by the water. But much will remain behind and "stuck" to the rock as unmovable or residual oil. Just like man's waterfloods, the oil industry has become proficient at recovering a percentage of that oil using enhanced oil recovery methods. CO<sub>2</sub> is just one of those; steam, nitrogen, enriched hydrocarbons, and chemical floods are others. But CO<sub>2</sub> EOR has the double value mentioned above; it can assist with providing a secure place for captured CO<sub>2</sub> as well as providing incremental oil to the nation's future. Thus the "utilization" of the CO<sub>2</sub> is a key value proposition, both to the environment and to energy security.

But now back to the residual oil zones. When carbon capture is broadly implemented, there will be lots of captured CO<sub>2</sub>

Figure 1

### The PB ROZ Research Work

for more information see [www.residualoilzones.com](http://www.residualoilzones.com)  
<http://www.facebook.com/FossilEnergy>, and <http://www.rpsea.org/en/cms/4055/>

RPSEA I: Commercial Exploitation and The Origin of Residual Oil Zones: Developing a Case History in the Permian Basin of New Mexico and West Texas (Hydrodynamic Modeling: North and West Side of the Delaware Basin)



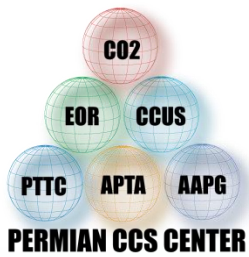
[http://www.rpsea.org/attachments/contentmanagers/3829/88123-19-Small\\_Producer\\_Program\\_Showcase\\_Presentation\\_Trentham-02-03-10.pdf](http://www.rpsea.org/attachments/contentmanagers/3829/88123-19-Small_Producer_Program_Showcase_Presentation_Trentham-02-03-10.pdf)

DOE Next Generation EOR: Commercial Exploitation and The Origin of Residual Oil Zones: Developing a Case History in The Permian Basin Of New Mexico And West Texas (Goldsmith-Landreth San Andres Unit) [http://www.netl.doe.gov/technologies/ccl/pav/pav-oleum/projects/ET/ETmp/overdifer/ETD005899\\_VUPermian.html](http://www.netl.doe.gov/technologies/ccl/pav/pav-oleum/projects/ET/ETmp/overdifer/ETD005899_VUPermian.html)



RPSEA II: Identifying and Developing Technology for Enabling Small Producers to Pursue the Residual Oil Zone (ROZ) Fairways of the Permian Basin, San Andres: Regional PB Studies and Extrapolation to the Bighorn and Southern Williston Basins <http://www.rpsea.org/en/articles/print/view.asp?350>





# Quarterly e-Alert News and Meeting Schedule



## Carbon Capture and Storage Technology e - ALERT

WEBINAR | 10 AM CDT | WED., OCT. 20 | [REGISTER](#)

### *Combining Carbon Capture & CO2 EOR - The Business Model*

Focused content from key perspectives

- Regulatory/legislative Environment (Darrick Eugene, Attorney & General Counsel of the Texas Carbon Capture and Storage Association)
- What Sources Need to Know About Oil or Gas Producers (Charles Fox, VP Operations and Engineering, Kinder Morgan CO2 Company)
- What Producers Need to Know About Sources (Mark Holtz, Director, International Business Development EOR, Praxair, Inc.)

### OTHER PERMIAN CCS EVENTS/ACTIVITIES

- Presentations
  - Oct. 5-7, Rapid City, SD, [Carbon Capture and CO2 EOR – Learning Through the Permian CCS Center](#) (SDSM&T New Horizons Oil & Gas Conference, PTTC's Lance Cole)
  - Nov. 8-10, Houston, TX, [Carbon Capture and CO2 EOR – Learning Through the Permian CCS Center](#) (18th International Petroleum & Bi8ofuels Environmental Conference, PTTC's Dwight Rychel)
- 2-Hr Miniworkshop
  - Nov. 7-8, Houston, TX, [Making Lemonade Out of Lemons – Using CO2 to Increase Production](#) (Texas Alliance of Energy Producers conference, APTA's Bob Kiker)

### [Catch & Store Newsletter \(September 2011\)](#) --- HOT OFF THE PRESS

- Summit Power's Texas Clean Energy Project (an IGCC plant in West Texas)
- ROZ Update – New Developments

Click [HERE](#) to unsubscribe

Permian CCS Center: CCS and CO2 EOR Training Center – for industry professionals by industry professionals from PTTC, APTA and AAPG

[Signup](#) to continue to receive e-alerts from Permian CCS Center

## events

October 9-14

[SPE CO2 Geological Storage: Will we be ready in time?](#) - Algarve, Portugal

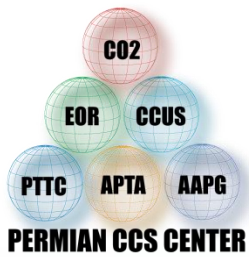
December 5-9

[2011 CO2 Conference Week](#) - Houston and Midland, TX.

**SIGN UP NOW** for the on-line, self-paced CARBON CAPTURE AND STORAGE E-CERTIFICATION COURSE PROGRAM on the Introduction to Carbon Capture and Storage (CCS). For more information and registration, view the [course description](#).

[www.permianbasinccs.org](http://www.permianbasinccs.org)

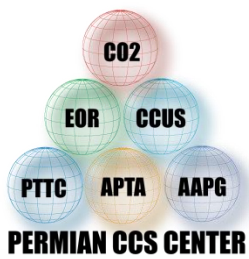
[www.pttc.org](http://www.pttc.org) | [www.aptapb.org](http://www.aptapb.org) | [www.aapg.org](http://www.aapg.org)



# Permian CCUS Workshops/Presentations

- Overview of the Elements of CCUS (and CO<sub>2</sub> EOR)
- The Reservoir – Characterization, Modeling and Monitoring – Lessons from the Permian Basin
- Carbon Sources, Capture, Transportation and CO<sub>2</sub> Flood Operations & Surface Facilities
- Business of CO<sub>2</sub> Flooding and Moving Forward with CCUS

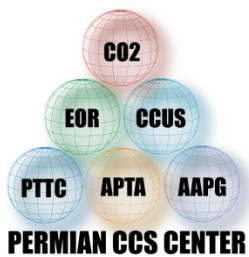
Courses are tailored in content and length to match the needs of the audience



# CCUS Permian Center Presentations

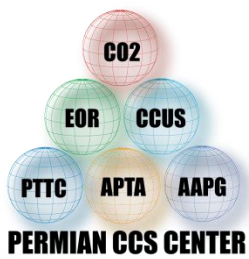
## Presentations with the Following Organizations

- Oil and Gas Compact Commission
- AAPG Annual and Regional Conferences
- West Texas Geological Society
- Texas Alliance of Energy Producers
- Southwest Petroleum Short Course
- International Biofuels and Environmental Conference
- DOE Regional Sequestration Partnership Meeting
- SPE Mid Continent Section
- Permian Basin Petroleum Association
- Texas Railroad Commission



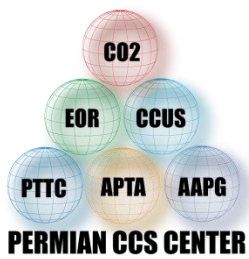
# Webinars – Slides and Voice

- The Promise and Performance of Next Generation CO<sub>2</sub> EOR by Advanced Resources International with Vello Kuuskraa and Michael Godec
- CCS (and CO<sub>2</sub> Flooding) in the Permian Basin – An Overview of the Science and Training Program with Steve Melzer and Dwight Rychel
- CCS in the Permian Basin, The Reservoir – Characterization, Modeling and Monitoring with Steve Melzer and Bob Trentham
- Combining Carbon Capture and CO<sub>2</sub> EOR – The Business Model with Chuck Fox (Kinder Morgan), Mark Holtz (Praxair) and Darrick Eugene (Texas CCS Association)



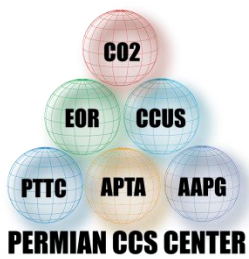
# Free Open Courseware - AAPG

- Carbon Capture and Sequestration: An Introduction
- Geological Models in CO<sub>2</sub> Separation
- CO<sub>2</sub> Supply, Demand: Legal and Regulatory Issues
- CO<sub>2</sub> Separation, Compression, Transportation and Marketing



# Permian CCUS e-Cert Program

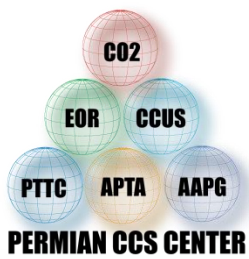
- Online program
- Proceed at your own pace
- Certification after demonstrated learning
- Similar topics as short courses
- Structure the same as recent AAPG Solar Energy Program
- Four Modules Total, Take One or All, CEUs awarded for each module
- Equivalent to 3 semester hour graduate course



# CCUS E-Certificate Program

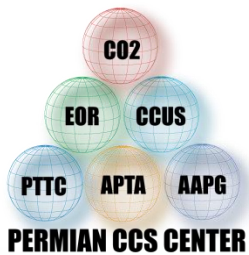
<http://www.permianbasinccs.org/ecertification.htm>

- An Overview of Carbon Capture and Storage and CO<sub>2</sub> Enhanced Oil Recovery
- The Reservoir – Characterization, Modeling and Monitoring
- CO<sub>2</sub> Sources, Marketing and Legal and Regulatory
- CO<sub>2</sub> Separation, Transportation and Operations



# Permian CCUS Center Advisory Board

<b>Name</b>	<b>Company</b>
John Allison	Legado Resources
Martin Cassidy	Consultant
Paul Colwell	Whiting Petroleum
Mark Holtz	Praxair
Jeff James	Tenaska
Gordon Moore	Denbury
Ed Payne	Whiting Petroleum
Dwight Peters	Schlumberger
Rodney Reynolds	Kinder Morgan
Mike Rushing	Apache
Hoxie Smith	Midland College PPDC
Mike Stell	Ryder Scott



# Other CCS Training Organizations

Midwest Geological Sequestration Consortium – Sequestration Training and Education Center – MGSC-STTC (<http://sequestration.org/step/index.html>) by Illinois State Geological Survey.

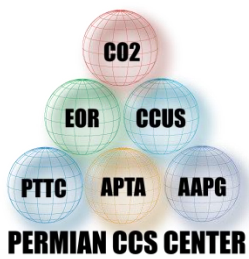
Carbon Capture and Storage Training (CCST) Northwest – Carbon Tech Alliance ([www.carbontechalliance.org](http://www.carbontechalliance.org)) by Environmental Outreach and Stewardship Alliance.

Southwestern United States CO<sub>2</sub> Sequestration Training Center – CO2TC (New Mexico Institute of Mining and Technology)  
[www.southwestcarbonpartnership.org/default.aspx](http://www.southwestcarbonpartnership.org/default.aspx).

Southeast Regional CO<sub>2</sub> Sequestration Technology Training Program – SECARB-Ed ([www.sseb.org/secarb-ed.php](http://www.sseb.org/secarb-ed.php)) by Southern States Energy Board ([www.sseb.org](http://www.sseb.org)).

Sequestration Training, Outreach, Research & Education – STORE ([www.storeco2now.com](http://www.storeco2now.com)) by University of Texas at Austin..

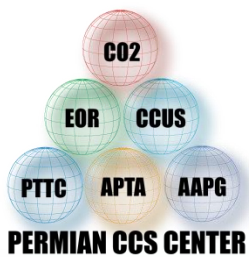
Wyoming CCS Technology Institute – WCTI (<http://wcti.uwyo.edu>) by University of Wyoming.



# Permian Basin CCUS Training Center

## What Has Worked

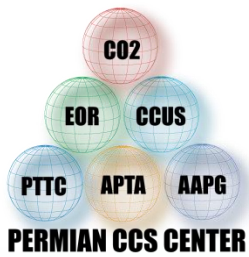
- Highly qualified and responsive Advisory Board
- Newsletter and e-Alert informative, hundreds of readers
- Broad encompassing curriculum
- Content in place for structured short Courses and Webinars
- E-Certificate program launched May, 2011



# Permian Basin CCUS Training Center

## Challenges

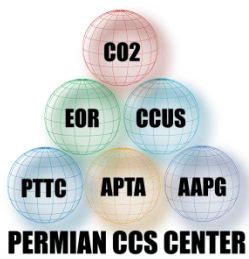
- Lack of congressional action regarding climate control providing incentives to capture and sequester CO<sub>2</sub> causing otherwise interested parties to lose interest
- Targeted Oil and Gas Professionals in Permian Basin have skills in place for sequestration via CO<sub>2</sub> EOR and little interest in geological storage in saline formations
- Consequently low interest in early produced workshops and webinars



# Permian Basin CCUS Training Center

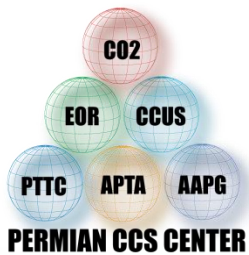
## Where We Are Today

- Broadened targeted audience to include regulators, environmentalists, scientists, electric generating industry and other CCS stakeholders
- Slowed the pace of delivery somewhat until the audience is broadened and more definition in potential climate change legislation
- Focused more on electronic delivery, versus the local workshops
- DOE recently promoting CCUS (CO<sub>2</sub> EOR as sink)



# Conclusions

- Absent meaningful climate control legislation and breakthrough on the cost of separation, interest in CCUS is focusing more on CO<sub>2</sub> EOR for revenue stream
- The market is saturated in CCS training offerings
- CCUS training is clearly price sensitive
- The CCS training market is demanding more online, self-paced, less expensive alternatives to traditional face to face course work
- CO<sub>2</sub> EOR as storage is an important aspect of CCUS



# Permian Basin CCUS Training Center

## Questions?

Dwight Rychel  
rychel@cox.net  
918-492-6964