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**Mastering the Subsurface through Technology Innovation  
and Collaboration: Carbon Storage and Oil and Natural  
Gas Technologies Review Meeting**

**U.S. Department of Energy**

**Fossil Energy and National Energy Technology Laboratory**

**August 16–18, 2016**

**Sheraton Station Square, Pittsburgh, Pennsylvania**

**TUESDAY, AUGUST 16, 2016 – GRAND STATION BALLROOM**

7:00 a.m.      **Meeting Registration/Continental Breakfast**

**WELCOME - PLENARY SESSION**

**Moderator:**      Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory

8:00 a.m.      **Introductions**  
Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory

8:05 a.m.      **Welcoming Remarks and NETL Overview**  
**TBD**

8:40 a.m.      **Subsurface Technology and Engineering Research, Development, and  
Demonstration (SubTER) Crosscut initiative**  
**TBD**

9:15 a.m.      **DOE's Clean Coal R&D Program**  
Mark Ackiewicz, Office of Fossil Energy, U.S. Department of Energy

9:35 a.m.      **BREAK – Grand Station III – IV**

**PLENARY SESSION**

**Moderator:**

9:50 a.m.      **DOE's Oil and Natural Gas R&D Program**  
Shareen Yawanarajah, Office of Fossil Energy, U.S. Department of Energy

10:10 a.m.      **International Offshore Carbon Storage Panel Discussion**  
Panel Chair: Tim Dixon, IEAGHG Manager Technical Program, and CCS and  
Regulatory Affairs  
Panel: Melissa Batum, U.S. Department of Interior - Bureau of Ocean Energy  
Management; Jun Kita, Research Institute of Innovative Technology for the Earth; Tip  
Meckel, University of Texas - Bureau of Economic Geology; Owain Tucker, Shell

10:55 a.m.      **IEAGHG Monitoring Network Panel Discussion**

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Panel Chair: Tim Dixon, Manager Technical Program, and CCS and Regulatory Affairs  
Panel: Tom Daley, Lawrence Berkeley National Laboratory; Simon O'Brien, Shell;  
Katherine Romanak, University of Texas - Bureau of Economic Geology

11:40 a.m. **LUNCH – Reflections and Waterfront**

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## PARALLEL SESSIONS – TUESDAY, AUGUST 16, 2016

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2	
Session Moderator	Geomechanics 1		SubTER 1		Monitoring 1	
<b>12:40 PM</b>	P1	Geomechanical Properties of Mesozoic Rift Basins: Applications for Geosequestration - Geostock Sandia LLC - Daniel Collins	P1	Novel 3D Acoustic Borehole Integrity Monitoring - LANL - Cristian Pantea	P1	Methods for Monitoring Migration of CO <sub>2</sub> /Brine Plumes and Groundwater Impacts - National Energy Technology Laboratory - Christina Lopano
<b>1:05 PM</b>	P2	Development of Geomechanical Screening Tools to Identify Risk: An Experimental and Modeling Approach - University of Texas at Austin - Mary Wheeler	P2	Ultrasonic Phased Arrays and Interactive Reflectivity Tomography - Oak Ridge National Laboratory - Hector Santos-Villalobos	P2	Monitoring of Geological CO <sub>2</sub> Sequestration using Isotopes and PF Tracers - Oak Ridge National Laboratory - David Graham
<b>1:30 PM</b>	P3	Integrated Characterization of CO <sub>2</sub> Storage Reservoirs on the Rock Springs Uplift Combining Geomechanics, Geochemistry, and Flow Modeling - University of Wyoming - John Kaszuba	P3	Imaging Fracture Networks using Joint Seismic and Electrical Change Detection - Sandia National Laboratory - Hunter Knox	P3	Science of CO <sub>2</sub> Sequestration - Los Alamos National Laboratory - Rajesh Pawar
<b>1:55 PM</b>	P4	A Probabilistic Assessment of the Geomechanical Response to CO <sub>2</sub> Injections in Large Igneous Provinces - Virginia Polytechnic Institute and State University - Ryan Pollyea	P4	Multi Variate Examination of the Cause of Increasing Induced Seismicity - National Energy Technology Laboratory – Kelly Rose	P4	Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO <sub>2</sub> -Enhanced Oil Recovery Pilot, Anadarko Basin, Texas - Oklahoma State University - Peter Clark

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<b>2:20 PM</b>	P5	A Coupled Geomechanical, Acoustic, Transport and Sorption Study of Caprock Integrity in Carbon Dioxide (CO <sub>2</sub> ) Sequestration - Colorado School of Mines - Manika Prasad	P5	SLAC National Accelerator Laboratory Coupling of Geochemical and Geomechanical Processes in the Manipulation of Fracture Systems in Subsurface Formations used for Carbon Sequestration - SLAC National Accelerator Laboratory - Andrew Kiss	P5	Field Testing of Emerging Technologies – The Otway Project - Lawrence Berkeley National Laboratory – Barry Freifeld
<b>2:45 PM</b>	P6	Quantitative Characterization of Impacts of Coupled Geomechanics and Flow on Safe Permanent Geological Storage of Carbon Dioxide (CO <sub>2</sub> ) in Fractured Reservoirs - Colorado School of Mines - Yu-Shu Wu	P6	Borehole Muon Detector for 4D Density Tomography - Pacific Northwest National Laboratory - Alain Bonneville	P6	Nonlinear Acoustic Methods for the Detection and Monitoring of CO <sub>2</sub> /Brine Leakage Pathways in Wellbore Systems - Los Alamos National Laboratory- Pierre-Yves LeBas

3:10 p.m.      **BREAK – Grand Station III – IV**

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2	
Session Moderator	Hydraulic Fracturing 1		SubTER 2		Geologic Storage 1	
<b>3:25 PM</b>	P1	Laboratory and Numerical Investigations of Hydraulic Fracture Propagation and Permeability Evolution in Heterogeneous and Anisotropic Shale - Lawrence Berkeley National Laboratory - Seiji Nakagawa	P1	Luminescence Spect Stress Sensor In Situ Measurement - Oak Ridge National Laboratory - Yarom Polsky	P1	Small-Scale Field Test Demonstrating CO <sub>2</sub> Sequestration in Arbuckle Saline Aquifer and by CO <sub>2</sub> -EOR at Wellington Field, Sumner County, Kansas - University of Kansas Center for Research - Lynn Watney
<b>3:50 PM</b>	P2	Understanding Water Controls on Shale Gas Mobilization into Fractures - Lawrence Berkeley National Laboratory - Tetsu Tokunaga	P2	Evaluating the State of Stress Beyond the Borehole - Los Alamos National Laboratory - Andrew Delorey	P2	CO <sub>2</sub> Utilization in Unconventional Reservoirs - Pacific Northwest National Laboratory - Peter McGrail
<b>4:15 PM</b>	P3	Development of Nanoparticle-stabilized Foams To Improve Performance of Waterless Hydraulic Fracturing - University of Texas at Austin - Masa Prodanovic	P3	Hydraulic Fracture and Stimulation in a Deep Mine Investigation - Lawrence Berkeley National Laboratory - Curtis Oldenburg/Patrick Dobson	P3	Sequestration in Basalt Formations - Pacific Northwest National Laboratory - Peter McGrail

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<b>4:40 PM</b>	P4	Advanced Hydraulic Fracturing - Gas Technology Institute - Jordan Ciezobka	P4	Development of microBayesloc Location Method - Lawrence Livermore National Laboratory - Steve Myer	P4	Exploring the Behavior of Shales as Seals and Storage Reservoirs for CO <sub>2</sub> - National Energy Technology Laboratory - Ernest Lindner
				<b>Offshore Systems</b>		
<b>5:05 PM</b>	P5	A Geomechanical Analysis of Gas Shale Fracturing and its Containment - Texas A&M - George Moridis	P1	Risk Assessment for Offshore Systems – National Energy Technology Laboratory – Kelly Rose	P5	Central Appalachian Basin Unconventional (Coal/Organic Shale) Reservoir Small Scale CO <sub>2</sub> Injection Test - Virginia Tech - Mike Karmis
<b>5:30 PM</b>	P6	Fracture Design, Placement, and Sequencing In Horizontal Wells - University of Texas at Austin - Mukul Sharma	P2	Metal-based systems in Extreme Environments – National Energy Technology Laboratory – Jeff Hawk		

6:15 p.m. **Poster Session – Grand Station III–V**

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## WEDNESDAY, AUGUST 17, 2016 – GRAND STATION BALLROOM

7:00 a.m. **Meeting Registration/Continental Breakfast**

8:00 a.m. **WELCOME – OPENING PLENARY SESSION**

**Moderator:**

8:05 a.m. **Microseismicity Panel Discussion**

Panel Chair: Grant Bromhal, U.S. Department of Energy, National Energy Technology  
Panel: **TBD**

8:55 a.m. **National Risk Assessment Partnership Panel Discussion**

Panel Chair: George Guthrie, Los Alamos National Laboratory  
Panel: **TBD**

9:35 a.m. **Water Nexus – Water Treatment Technologies**

Jessica Mullen, National Energy Technology Laboratory

9:55 a.m. **BREAK – Grand Station III – IV**

### **PLENARY SESSION – RESEARCH UPDATES**

**Moderator:**

10:10 a.m. **Oil and Natural Gas Program Update**

Jared Ciferno, U.S. Department of Energy, National Energy Technology Laboratory

10:30 a.m. **Overview of NETL Subsurface Intramural Research**

Grant Bromhal, U.S. Department of Energy, National Energy Technology Laboratory

### **PLENARY SESSION – REGIONAL CARBON SEQUESTRATION PARTNERSHIP LARGE-SCALE FIELD PROJECTS**

10:50 a.m. **Kevin Dome, Big Sky Regional Carbon Sequestration Partnership**

Lee Spangler, Energy Research Institute, Montana State University

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11:25 a.m.      **LUNCH – Reflections and Waterfront**

## PARALLEL SESSIONS – WEDNESDAY, AUGUST 17, 2016

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2			
Session Moderator	Monitoring 2		Fracture Diagnostics		Pressure Management		Offshore Resource Assessments	
12:30 PM	P1	MVA Field Activities - National Energy Technology Laboratory - Hank Edenborn	P1	Fracture Diagnostics Using Low Frequency Electromagnetic Induction And Electrically Conductive Properties - University of Texas at Austin - Mukul Sharma	P1	Phase II Field Demonstration at Plant Smith Generating Station: Assessment of Opportunities for Optimal Reservoir Pressure Control, Plume Management and Produced Water Strategies - Electric Power Research Institute - Robert Trautz	P1	Offshore CO <sub>2</sub> Storage Resource Assessment of the Northern Gulf of Mexico - University of Texas at Austin - Tip Meckel
12:55 PM	P2	Field Testing of Emerging Technologies – The Aquistore Project - Lawrence Berkeley National Laboratory – Tom Daley	P2	Injection and Tracking of Micro Seismic Emitters to Optimize UOG Development - Paulsson Inc. - Bjorn Paulsson	P2	Developing and Validating Pressure Management and Plume Control Strategies in the Williston Basin Through a Brine Extraction and Storage Test (BEST) - Phase II - University of North Dakota Energy & Environmental Research Center - John Hamling	P2	Mid-Atlantic U.S. Offshore Carbon Storage Resource Assessment Project - Battelle Memorial Institute - Neeraj Gupta
			<b>Geophysics 1</b>		<b>Capacity/Storage Efficiency</b>			
1:20 PM	P3	Pressure-Based Inversion and Data Assimilation System (PIDAS) for CO <sub>2</sub> Leakage Detection - University of Texas at Austin - Alexander Sun	P1	Relationship between Microseismicity and Rock Properties: Not all Marcellus is the Same – National Energy Technology Laboratory - Erich Zorn	P1	Enhanced Analytical Simulation Tool for CO <sub>2</sub> Storage Capacity Estimation and Uncertainty Quantification - University of Texas at Austin - Seyyed Hosseini	P3	Assessment of CO <sub>2</sub> Storage Resources in Depleted Oil and Gas Fields in the Ship Shoal Area, Gulf of Mexico - Geomechanics Technologies, Inc. - Jean Young

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1:45 PM	P4	Optical Spectroscopy and Microseismicity tools for EOR and Coal Bed MVA Analyses - Los Alamos National Laboratory - Sam Clegg	P2	4D Integrated Study Using Geology, Geophysics, Reservoir Modeling & Rock Mechanics to Develop Assessment Models for Potential Induced Seismicity Risk – University of Oklahoma - Jeremy Boak	P2	Optimizing and Quantifying CO <sub>2</sub> Storage Resource in Saline Formations and Hydrocarbon Reservoirs - University of North Dakota - Charles Gorecki	P4	Offshore Storage Resource Assessment - NITEC LLC - Chet Ozgen
2:10 PM	P5	Real-Time In-Situ Carbon Dioxide Monitoring Network for Sensitive Subsurface Areas in Carbon Capture and Storage - Intelligent Optical Systems Inc. - Jesus Delgado-Alonso	P3	Scalable Automated, Semipermanent Seismic Method for Detecting CO <sub>2</sub> Plume Extent During Geological CO <sub>2</sub> Injection - University of North Dakota - John Hamling	P3	Commercial Scale CO <sub>2</sub> Injection and Optimization of Storage Capacity in the Southeastern United States - Advanced Resources International, Inc. - George Koperna	P5	Southeast Offshore Storage Resource Assessment - Southern States Energy Board - Ken Nemeth
2:35 PM	P6	Understanding Impacts to Air Quality from Unconventional Natural Gas Development – National Energy Technology Laboratory - Natalie Pekney	P4	Improved Microseismic Monitoring - Lawrence Livermore National Laboratory - Metzel/White	P4	Resource Assessment - National Energy Technology Laboratory - Angela Goodman		

3:00 p.m.

## BREAK – Grand Station III – IV

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2			
Session Moderator	Mitigation		Geomechanics 2		Associated Storage		Wellbore Integrity	
3:15 PM	P1	Programmable Sealant-Loaded Mesoporous Nanoparticles for Gas/Liquid Leakage Mitigation - C-Crete Technologies, LLC - Rouzbah Shasavari	P1	Pressure Management and Geomechanical Behavior at Industrial Partner Projects - Lawrence Livermore National Laboratory - Josh White	P1	Improved Characterization and Modeling of Tight Oil Formations for CO <sub>2</sub> Enhanced Oil Recovery Potential and Storage Capacity Estimation - University of North Dakota - James Sorensen	P1	Integrated Wellbore Integrity Analysis Program for CO <sub>2</sub> Storage Applications - Battelle Memorial Institute - Mark Moody

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<b>3:40 PM</b>	P2	Wellbore Leakage Mitigation using Advanced Mineral Precipitation Strategies - Montana State University - Adrienne Phillips	P2	Characterizing and Interpreting the In Situ Strain Tensor During CO <sub>2</sub> Injection - Clemson University - Larry Murdoch	P2	Liquid-rich Shale Potential of Utah's Uinta and Paradox Basins: Reservoir Characterization and Development - Utah Geological Survey - Michael Vandenberg	P2	Wellbore and Seal Integrity - Los Alamos National Laboratory – Bill Carey
<b>4:05 PM</b>	P3	Methods to Enhance Wellbore Cement Integrity with Microbially-induced Calcite Precipitation (micp) - Montana State University - Adrienne Phillips	P3	Impact of Thermal Stress on Wellbore Integrity - Lawrence Livermore National Laboratory - Joe Morris/Pratanu Roy	P3	Optimizing CO <sub>2</sub> Sweep Based on Geochemical and Reservoir Characterization of the Residual Oil Zone of Hess Seminole Unit - University of Texas at Austin - Ian Duncan	P3	Improving Science-Base for Wellbore Integrity, Barrier Interface Performance – National Energy Technology Laboratory - Nick Huerta
<b>4:30 PM</b>	P4	Targeted Mineral Carbonation to Enhance Wellbore Integrity - University of Virginia - Andres Clarens	P4	Geomechanics of CO <sub>2</sub> Reservoir Seals - University of Texas at Austin - Peter Eichhubl	P4	Identification of Residual Oil Zones in the Williston and Powder River Basins - University of North Dakota - Wesley Peck	P4	Development of Methods to Prohibit and Remediate Loss of Annular Isolation in Shale Gas Wells: Prevention and Remediation of Sustained Casing Pressure and Other Isolation Breaches - CSI Technologies, LLC - Jeff Watters/Kyle Comb
					<b>Improved Recovery</b>			
<b>4:55 PM</b>	P5	Nanoparticle Injection Technology for Remediating Leaks of CO <sub>2</sub> Storage Formation - University of Colorado - Yunping Xi	P5	Geophysical and Mineralogical Controls on the Rheology of Fracture Slip and Seal Breaching - Pennsylvania State University - Derek Elsworth	P1	Simulation of the Shale Oil System: from Molecular Fluid Dynamics to Reservoir Scale - Lawrence Berkeley National Laboratory - George Moridis	P5	Nxis Well Integrity Inspection in Unconventional Gas Wells - General Electric Company - Matthias Kasten

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<b>5:20 PM</b>	P6	Statistical Analysis of CO <sub>2</sub> Exposed Wells to Predict Long Term Leakage through the Development of an Integrated Neural-Genetic Algorithm - University of Louisiana at Lafayette - Boyan Guo	P6	Geomechanical Framework for Secure Carbon Dioxide CO <sub>2</sub> Storage in Fractured Reservoirs and Caprocks for Sedimentary Basins in the Midwest United States - Battelle Memorial Institute - Joel Sminchak	P2	Maximize Liquid Oil Production from Shale Oil and Gas Condensate Reservoirs by Cyclic Gas Injection - Texas Tech University System - James Sheng	P6	Wellbore Integrity and Mitigation - National Energy Technology Laboratory - Barbara Kutchko
<b>5:45 PM</b>	P7	Wellbore Seal Repair Using Nanocomposite Materials - University of New Mexico - John Stormont	P7	Results from the In Situ Fault Slip Experiment at Mont Terri – Lawrence Berkeley National Laboratory – Jens Birkholzer	P3	Nano-scale and Laboratory-scale Investigations of Shale Oil Systems - Lawrence Berkeley National Laboratory - George Moridis	P7	Nanite For Better Wellbore Integrity and Zonal Isolation - Oceanit Laboratories - Vinod Veedu

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## THURSDAY, AUGUST 18, 2016 – GRAND STATION BALLROOM

- 7:00 a.m.      **Meeting Registration/Continental Breakfast**
- 8:00 a.m.      **WELCOME – PLENARY SESSION – REGIONAL CARBON SEQUESTRATION PARTNERSHIP LARGE-SCALE FIELD PROJECTS**
- Moderator:**
- 8:05 a.m.      **Farnsworth Unit, Southwest Regional Partnership on Carbon Sequestration**
- 8:40 a.m.      **Michigan Basin, Midwest Regional Carbon Sequestration Partnership**
- 9:15 a.m.      **Citronelle Project, Southeast Regional Carbon Sequestration Partnership**
- 9:50 a.m.      **Cranfield Project, Southeast Regional Carbon Sequestration Partnership**
- 10:25 a.m.     **BREAK – Grand Station III – IV**
- 10:40 a.m.     **Bell Creek Field Project, Plains CO<sub>2</sub> Reduction Partnership**  
Charles Gorecki, Energy & Environmental Research Center
- 11:15 a.m.     **Illinois Basin - Decatur Project, Midwest Geological Sequestration Consortium**  
Sallie Greenberg, Illinois State Geological Survey
- 11:50 a.m.     **Carbon Storage Program Future Direction**  
Traci Rodosta, U.S. Department of Energy, National Energy Technology Laboratory
- 12:00 p.m.     **LUNCH – Reflections and Waterfront**

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## PARALLEL SESSIONS – THURSDAY, AUGUST 18, 2016

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2	
Session Moderator	Geophysics 2		Hydraulic Fracturing 2		Modeling	
1:00PM	P1	Deep Controlled Source Electro-Magnetic Sensing: A Cost Effective, Long-Term Tool for Sequestration Monitoring - Multi Phase Technologies LLC - Douglas LaBrecque	P1	Hydraulic Fracturing Test Sites Institute of Gas Technology - Jordan Ciezobka	P1	Model Complexity and Choice of Model Approaches for Practical Simulations of CO <sub>2</sub> Injection, Migration, Leakage, and Long-term Fate - Trustees of Princeton University - Michael Celia
1:25 PM	P2	Methods for Locating Legacy Wells - National Energy Technology Laboratory – Rick Hammack	P2	Marcellus Shale Energy and Environment Laboratory (MSEEL) West Virginia University - Tim Carr	P2	Optimal Model Complexity in Geological Carbon Sequestration: A Response Surface Uncertainty Analysis - University of Wyoming - Ye Zhang
1:50 PM	P3	Field Testing of Emerging Technologies - The CMC Containment and Monitoring Field Station - Lawrence Berkeley National Laboratory - Tom Daley and Barry Freifeld	P3	Utica Shale Energy and Environment Laboratory Ohio State University - Jeff Daniels	P3	Enhanced Simulation Tools to Improve Predictions and Performance of Geologic Storage Coupled Modeling - Massachusetts Institute of Technology - Ruben Juanes
2:15 PM	P4	Distributed Fiber Optic Arrays: Integrated Temperature and Seismic Sensing for Detection of CO <sub>2</sub> Flow, Leakage and Subsurface Distribution - Electric Power Research Institute Inc. - Robert Trautz	P4	Chemical Control of Fluid Flow and Contaminant Release in Shale Microfractures SLAC National Accelerator Laboratory - John Bargar	P4	Evolution of Carbonate CO <sub>2</sub> Storage Reservoirs - Lawrence Livermore National Laboratory - Susan Carroll
	<b>Geologic Storage 2</b>					
2:40 PM	P1	Reservoir Performance - National Energy Technology Laboratory – Johnathan Moore	P5	Development and Field Testing Novel Natural Gas Surface Process Equipment for Replacement of Water as Primary Hydraulic Fracturing Fluid – Southwest Research Institute - Griffin Beck and Sandeep Verma	P5	Multiscale Modeling of Carbon Dioxide Migration and Trapping in Fractured Reservoirs with Validation by Model Comparison and Real-Site Applications - Princeton University - Michael Celia

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<b>3:05 PM</b>	P2	Impact of Microstructure on the Containment and Migration of CO <sub>2</sub> in Fractured Basalts - Washington University - Daniel Giammar	P6	Geochemical Evolution of Hydraulically-Fractured Shales – National Energy Technology Laboratory - Ale Hakala	
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3:30 p.m.      **BREAK – Grand Station III – IV**

Room	Haselton 1 & 2		Brighton 3 & 4		Ellwood 1 & 2	
Session Moderator	Associated Storage (EOR)		Hydraulic Fracturing 2 (con't)		Intelligent Monitoring Systems	
<b>3:45 PM</b>	P1	A Nonconventional CO <sub>2</sub> -Enhanced Oil Recovery Target in the Illinois Basin: Oil Reservoirs of the Thick Cypress Sandstone - University of Illinois - Nathan Webb	P7	Mechanistic Approach to Analyzing and Improving Unconventional Hydrocarbon Production - Los Alamos National Laboratory - Satish Karra	P1	Development of a Framework for Data Integration, Assimilation, and Learning for Geological Carbon Sequestration - University of Texas at Austin - Alexander Sun
			<b>Energy Data eXchange</b>			
<b>4:10 PM</b>	P2	Carbon Life Cycle Analysis of CO <sub>2</sub> -EOR for Net Carbon Negative Oil (NCNO) Classification - University of Texas at Austin - Vanessa Nunez-Lopez	P1	Advances in Data Discovery, Mining, & Integration for Energy R&D Using the Energy Data eXchange (EDX) - National Energy Technology Laboratory - Kelly Rose	P2	Development of Intelligent Monitoring System (IMS) Modules for the Aquistore CO <sub>2</sub> Storage Project - University of North Dakota - John Hamling
<b>4:35 PM</b>	P3	Development of Swelling-Rate-Controllable Particle Gels to Enhance CO <sub>2</sub> Flooding Sweep Efficiency and Storage Efficiency - Missouri University of Science and Technology - Baojun Bai	P3		P3	Intelligent Monitoring Systems and Advanced Well Integrity and Mitigation - Archer Daniels Midland Corporation - Scott McDonald