Program Announcement

The 48th International Technical Conference on Clean Energy

June 16 to 19, 2024

Clearwater, Florida, USA

In Person & Virtual Conference

To Learn More About Innovations That Are Meeting the Challenges to Energy Utilization From The World's Key Planners, Leading Engineers and Experts and "Super Scientists" in The Most Comprehensive Program on Energy Technologies With Representatives From Five Continents, Then You Must Attend

The Clearwater Clean Energy Conference

- Topics are highly relevant and advanced;
- Science and Technology driven;
- Aimed at Clean Energy Supply;
- Attendance can be actual or virtual;
- Prime location;
- Reasonably priced;
- Participants are very qualified and from many countries with 35% of the papers coming from China, Australia, Canada, United Arab Emirates, Sweden, Japan, Germany, Poland and India

CONFERENCE HIGHLIGHTS

The Keynote Presentations, Short Courses, Workshop and Technical Sessions cover all the critical technological issues of the day as we explore the issues of the day. To accommodate speakers and attendees, we are offering in person and virtual presentations.

The **Clearwater Clean Energy Conference** offers participants approximately 180 technical presentations in four days. All presentations will be offered in person and virtually.

Leading the way for us are our four committee cochairs who represent government, academia and industry:

- Dr. Lawrence E. Bool, Linde, Inc.
- Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy
- Dr. Ashwani Gupta, University of Maryland and
- Dr. Edmundo Vasquez, Clean Energy Technologies

MISSION STATEMENT – This conference has earned a reputation for excellence as one of the premiere conferences on energy technologies as it grew in size and scope since its inception in 1975.

Through the Technical Sessions, Workshop, Short Courses, and Keynote presentations, cutting-edge developments dealing **with technical solutions to problems; specific strategies; projects; innovations; industry trends; and/or regulatory compliance** will be offered. The program presents an extensive overview of emerging, evolving, and innovative technologies, fuels and/or equipment in the power generation industry. We offer papers from all countries worldwide. The **Clearwater Clean Energy Conference** will offer participants approximately 180 technical presentations in three days along with luncheons, breaks and Continental breakfasts.

Increased demand – coupled with energy security issues, and uncertainty in the oil sector **– make this conference a must for those involved in all aspects of power generation** who must meet the competitive pressures and environmental concerns in the 21st century.

CO_2 WORKSHOP

To highlight this year's conference theme, on Monday, June 17th, we are offering an all-day Workshop on various aspects of **CO_2: removal, point source capture, conversion and sequestration**. We plan on giving attendees an overview of what is happening now and what the future holds.

SHORT COURSES On Sunday, June 16th, we will offer four extensive Short Courses on topics important to the energy community. Participation is optional and is included in the registration fee. Topics will be announced shortly.

BEST STUDENT PAPER AWARD

Student papers have been an integral part of this comprehensive and informative program on clean energy technologies since its inception. Therefore, the Conference Committee has set high standards for students/speakers so that the conference maintains its reputation as the premier vehicle for presenting the latest technological developments in improving and enhancing clean energy technologies. Through the dedicated efforts of Dr. Edmundo Vasquez, chair of the Best Student Paper Award Committee, the conference can present this annual award to the most deserving students. Dr. Vasquez secures the distinguished evaluators who review and grade the papers submitted from all over the world.

JOURNAL PUBLICATION

The Conference organizers plan to have a *Special issue of International Journal of Energy for a Clean Environment (IJECE)* after peer review of the papers. All authors are welcome to submit their manuscript for journal publication. For any further query, please contact, Dr. Ashwani Gupta, at: akgupta@umd.edu
Instructions for submission of papers will soon be posted on the Clearwater Clean Energy Conference website:
www.ClearwaterCleanEnergyConference.com

HEADQUARTERS

The Sheraton Sand Key has been the home of this conference for 35 years. Sand Key is one of the 20 Best Beaches in the U.S., according to many travel and tourism organizations. **Sheraton Sand Key,** 1160 Gulf Boulevard, Clearwater, Florida – Phone: 727-595-1611.

These are the links to use to book your room:

Book your group rate for Clearwater Clean Energy Gov. Conference

Book your group rate for Clearwater Clean Energy Conference

The hotel offers the conference $214/night for Single or Double accommodations.

Tampa International Airport is the closest major airport to the Sheraton Sand Key. Taxis and shuttle services are available to take you out to the Sheraton Sand Key.

CONFERENCE FEES

The registration fee covers one Proceedings, and participation in all short courses, Workshop, technical sessions and panels, breakfasts, breaks and luncheons, plus all conference materials. The Spouse's Fee covers participation in all breakfasts, breaks and luncheons throughout the conference.

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The Agenda
Clearwater Clean Energy Conference
48th International Technical Conference on Clean Energy

Sunday, June 16, 2024

Four Consecutive Short Courses:

9:00 a.m. to 10:30 a.m.
Introduction to Catalysts and Sorbents, *Evan J. Granite, U.S. Department of Energy*

- 10:45 a.m. to 12:15 p.m
- 2:00 p.m. to 3:00 p.m.

3:15 p.m. to 4:30 p.m. **Effect of Mill Performance and Coal Properties on Combustion and Emissions**
J.J. Letcavits, Consultant and Alan Paschedag, Consultant

Monday, June 17, 2024

7:30 a.m. – Continental Breakfast – Island Ballroom

8:00 a.m. to 4:00 p.m. – Workshop on Carbon Dioxide

- **8:00 a.m. – Panel: Community Benefits and Engagement for CCS Projects**
  Moderator: *Andrew Hlasko, U.S. Department of Energy*

10:00 a.m. – Break—Island Ballroom

- **10:30 a.m. – Panel: Policy, Regulations and Permitting for CCS Projects**
  Moderator: *Andrew Hlasko, U.S. Department of Energy*

12:30 p.m. – Lunch – Island Ballroom

- **2:00 p.m.** – **Panel on Technology: Demonstrations, Pilot Plant. Installation Projects**
  Moderator: *Timothy Fout, U.S. Department of Energy*

4:00 p.m. – Conclusion of the Program

Tuesday, June 18, 2024

7:30 a.m. – Continental Breakfast – Island Ballroom

8:00 to 10:00 a.m. – Four Concurrent Sessions

- **Session 1** **NH_3 Combustion**
  Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 2** **Pyrolysis & Gasification Fundamentals I**
  Prof. Weihong Yang, KTH Royal Institute of Technology, SWEDEN; and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy
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- **Session 3** **Oxy-Fuel Combustion**
  Dr. Richard Axelbaum, Washington University in St. Louis, and Xuebin Wang, Xi'an Jiatong University, CHINA

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- **Session 4** **CO_2 Conversion & Low Carbon Products**
  Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab

10:30 a.m. – Break – Island Ballroom

11:00 a.m. to 12:20 p.m. – Five Concurrent Sessions

- **Session 5** **Carbon Dioxide as a Working Fluid**
  Eric Liese and Matthew Searle, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Andrew Fry, Brigham Young University

- **Session 6** **Pyrolysis & Gasification Fundamentals II**
  Prof. Weihong Yang, KTH Royal Institute of Technology, SWEDEN; and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 7** **Modeling & Simulation for Environmental Applications**
  Dr. Edmundo Vasquez, Clean Energy Technologies

- **Session 8** **CO_2 Conversion & Low Carbon Products II**
  Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab

- **Session 9** **Modeling and Combustion of Low Carbon Fuel**
  Dr. Wu Yuxin and Dr. Hai Zhang, Department of Power Engineering, Tsinghua University, CHINA

12:10 to 1:30 p.m. – Luncheon – Island Ballroom

- **Welcome:** *Barbara A. Sakkestad, Clearwater Clean Energy Conference*
- **Overview:** *Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy and Chairman of the Clearwater Clean Energy Conference*

1:30 to 3:30 p.m. – Five Concurrent Sessions

- **Session 10** **Biomass Conversion to Power and/or Chemicals I**
  Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 11** **Pyrolysis & Gasification Fundamentals III**
  Prof. Weihong Yang, KTH Royal Institute of Technology, SWEDEN; and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 12** **Energy Conversion in Rotary Kilns**
  Klas Andersson, Chalmers University, SWEDEN and Prof. Lunbo Duan, and Prof. Yueming Wang, Ph.D., Southeast University, CHINA

- **Session 13** **Hydrogen from Pyrolysis and Gasification**
  Howard Meyer, GTI Energy, Prof. Ramees Khaleel Rahman, Center for Advanced Turbomachinery and Energy Research; and Dr. Jarrett Riley, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 14** **Modular Systems for Carbon Based Fuels**
  Jonathan W. Lekse, National Energy Technology Laboratory, U.S. Department of Energy and Fred Baddour, National Renewable Energy Lab

3:30 to 4:00 p.m. – Break – Island Ballroom

4:00 to 5:40 p.m. – Four Concurrent Sessions

- **Session 15** **Biomass Conversion to Power and/or Chemicals II**
  Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 16** **Low Carbon Plant Conversions**
  Tim Fuller, The Babcock & Wilcox Co., and Brian Vitalis, Riley Power

- **Session 17** **Hydrogen Technology**
  Dr. Marc Cremer, Reaction Engineering International and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 18** **Novel Approaches to CO_2 Point Sources**
  Dr. Ronald Breault and James Tran, National Energy Technology Laboratory, U.S. Department of Energy

Wednesday, June19, 2024

7:30 a.m. – Breakfast – Island Ballroom

8:00 to 10:00 a.m. – Five Concurrent Sessions

- **Session 19** Cyber-Physical Systems for Control and Controls Development
  Dr. Dave Tucker, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 20** Systems Studies of Point Source Capture
  Bob Slettehaugh, Kiewit, and Tim Fout, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 21** Carbon Dioxide Removal
  Dr. Ronald W. Breault and Jan Steckel, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 22** Biomass Conversion to Power and/or Chemicals III
  Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy

- **Session 23** sCO_2 Power Cycle Components and Fundamentals
  Matthew Searle, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Andrew Fry, Brigham Young University

10:00 to 10:30 a.m. – Break – Island Ballroom

10:30 a.m. to 12:10 p.m. – Five Concurrent Sessions

- **Session 24** Recovery of Rare Earth Elements
  Melanie Mackay, Mining Engineering, University of British Columbia, CANADA; Dr. Evan Granite, U.S. Department of Energy and Dr. Dave Osborne, Somerset Coal, AUSTRALIA

- **Session 25** PC Fired Units
  J.J. Letcovits, Consultant, and Alan Paschedag, Consultant

- **Session 26** U.S. Regional Carbon Sequestration Initiatives
  Joshua Stanislowski, Energy and Environmental Research Center, University of North Dakota

- **Session 27** Systems Studies for CDR
  Sally Homsy, National Energy Technology Laboratory, U.S. Department of Energy *and Mustapha Soukri, RTI*

- **Session 28** CO_2 Conversion & Low Carbon Products II
  Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab

12:10 p.m. – Luncheon – Island Ballroom

- Presentation of the Best Student Paper Award
- Roundtable/Wrap-up Discussion
- Conference Committee Meeting

Clearwater Clean Energy Conference

Sunday, June 16, 2024

Four Consecutive Short Courses

9:00 a.m. to 10:30 a.m. **Introduction to Catalysts and Sorbents**, *Evan J. Granite, U.S. Department of Energy*

Catalysts and sorbents are widely employed in the processing of fossil fuels, for both pollution control, as well as for conversion to value-added products. Atoms and molecules are not faithful partners on the surface of a solid, with competitive adsorption ("forming a couple"), desorption ("kicking a spouse to the curb"), and reaction ("a most radical makeover") occurring over, and over, again. The surface of a catalyst or sorbent is a "chemical soap opera", and not for the faint of heart. The drama occurring on the surface of a catalyst, and its close cousin the sorbent, easily exceeds that of any Hollywood movie. Like the ancient marriage brokers, these solids help make extraordinary unions and transformations of atoms and molecules. Our modern economy would not be possible without these magical materials, and many important examples will be shown for the processing of coal, natural gas, and petroleum.

Catalysts or sorbents typically transform atoms and molecules through the Langmuir-Hinshelwood, Mars-Maessen, or Eley-Rideal mechanisms, and these will be illustrated. The "seven sacred steps" that occur during the use of any catalyst or sorbent will be shown. Poisoning, deactivation, pressure drop, sintering, mass and heater transfer, characterization techniques, regeneration, sorbent breakthrough curves, cost considerations, and future research challenges will be discussed. The instructor will make information available from his research, as well as his courses on chemical kinetics and petroleum and natural gas processing, available to interested students.

10:45 a.m. to 12:15 p.m.

2:00 p.m. to 3:00 p.m.

3:15 p.m. to 4:30 p.m. **Effect of Mill Performance and Coal Properties on Combustion and Emissions**
J.J. Letcavits, Consultant and Alan Paschedag, Consultant

Just like your automobile, the fuel makes a difference on performance and emissions. Knowing the whys and hows to best utilize the fuels available cost effectively provide maximum benefit to the business of power production.

Clearwater Clean Energy Conference

Monday, June 17, 2024

7:30 a.m. Breakfast – Island Ballroom

Carbon Dioxide Workshop

8:00 a.m. Community Benefits and Engagement for CCS Projects – Panel Discussion

Moderator: *Andrew Hlasko, U.S. Department of Energy*

- **Community Benefit Plans, Vision and Framework**
  Samual Herbert, Senior Energy & Environmental Justice Policy Advisor, Office of Economic Impact and Diversity, U.S. Department of Energy
  This presentation reviews the DOE's Community Benefits Plan framework and vision particularly for the implementation of President Biden's Justice 40 Initiative. It describes the Justice 40 initiatives and the DOE policy priorities for directing at least 40% of benefits to Disadvantaged Communities. It also discusses the reporting framework for Community Benefits Plans in Bipartisan Infrastructure Law and Inflation Reduction Act funded projects initiated by Department of Energy.

- **Community Engagement, Benefits and Public Awareness for CCS Projects**
  Jill Capotosto, Energy Justice Liaison, Office of Clean Energy Demonstrations, U.S. Department of Energy
  Community advocates have voiced both concern and hope about the potential impacts of carbon capture, transport, storage, and utilization, including concerns about safety and potential environmental impacts of CO2 infrastructure and a lack of benefits for local communities. This talk will look at the risks posed by no or poor engagement, including community- or organization-led lawsuits or protests, and discuss pathways for meaningful engagement and well-tailored community benefit plans that address community concerns, build trust, and may lead to successful deployment of carbon management technologies in the eyes of both developers and communities. Projects can mitigate risks (both to the project and caused by the project) by being aware of potential community impacts, taking proactive steps to maximize project benefits and minimize harms, and engaging in early, frequent, transparent, and two-way dialogue with impacted groups.

- **U.S. Department of Energy's Community Benefit Plans Framework implementation in Carbon Management R&D**
  Kelli Roemer, Ph.D., Social Science Program Advisor, Office of Fossil Energy and Carbon Management, U.S. Department of Energy
  The US Department of Energy (DOE) requires Community Benefits Plans as part of all BIL and IRA funding opportunity announcements (FOAs) and loan applications. Community Benefits Plans are based on a set of four core policy

priorities: investing in America's workforce; engaging communities and labor; advancing diversity, equity, inclusion, and accessibility; and implementing Justice 40. These key principles, when incorporated comprehensively into project proposals and applications and executed upon, will help ensure broadly shared prosperity in the and successful deployment of a clean energy transition. This presentation will provide insight into the United States' Community Benefit Plans framework, guidance, and lessons learned in the context of carbon management.

- **Navigating Challenges in Industrial Infrastructure for Climate Goals: A Focus on Community Engagement/Benefits**
  Moana McClellan, Community Engagement Manager, RMI
  Substantially more industrial infrastructure is required to meet our climate goals, and it has been increasingly difficult to build this infrastructure because a successful transition to clean energy involves more than just deploying technology; People must see a future for themselves and their communities in this energy transition. Understanding this, the Department of Energy requires project applicants to develop a Community Benefits Plan across four key pillars: Community and Labor Engagement, DEIA, Investing in the American Workforce, and the Justice40 Initiative. I'll discuss the unique challenges related to CO2 policy, permitting, and infrastructure development, and share insights and lessons learned from heavy industry and transport on developing meaningful two-way engagement strategies.

- **A Holistic Approach to Effective CCUS Deployment: Prioritizing Tangible Community Benefits**
  Daryl-Lynn Roberts, VP of Business Development, Visage Energy Corp.
  This presentation will focus on the incorporation of community benefits into Carbon Capture Utilization and Storage (CCUS) projects, emphasizing the need for a comprehensive framework for engagement of stakeholders. Such a multifaceted approach is critical for mitigating environmental and safety concerns, establishing stakeholder trust, and gaining public support. The discussion will aim to share proactive strategies that ensure project benefits align with potential risks, considering the broader economic and social impact. The integration of community advantages into the procedures for stakeholder involvement is crucial for the successful execution of projects.

10:00 a.m. – **Break** – Island Ballroom

10:30 a.m. **Panel: Policy, Regulations and Permitting for CCS Projects**
Moderator: *Andrew Hlasko, U.S. Department of Energy*

- **Federal Regulatory and Permitting Policies for CCS Projects**
  Rory Jacobson, Director of DOE-FECM CO_2 Removal Group (CDR)
  The U.S. Department of Energy's Office of Fossil Energy and Carbon Management's (FECM) core mission is to address the climate crisis. FECM supports this mission through research, development, demonstration and deployment of technologies and solutions to ensure clean and affordable energy, a healthy climate, policy development and

stakeholder engagement. Key focus is on minimizing the environmental impacts of fossil fuels and helping the nation achieve net-zero greenhouse gas (GHG) emissions as envisioned by the current administration through support of R&D of new carbon capture and storage (CCS) technologies. Successful deployment and widespread use of new CCS technologies is driven by established policy measures and dependents on satisfactory completion of permitting and regulatory requirements. All of these factors ensure that public health and environment considerations are fully considered as part of any CCS project implementation. This presentation will address key federal regulatory and permitting considerations for CCS projects.

- **DOE FECM Activities Related to the Federal Regulatory and Permitting Landscape for CCS Projects**
  Mark de Figueiredo, Director of DOE-FECM Office of Policy, Analysis and Engagement
  The U.S. Department of Energy's Office of Fossil Energy and Carbon Management's core mission is to address the climate crisis. The office supports this mission through investments in research, development, demonstration and deployment of technologies and solutions to ensure clean and affordable energy, a healthy climate, policy development and stakeholder engagement—specifically focused on minimizing the environmental impacts of fossil fuels and helping the nation achieve net-zero greenhouse gas (GHG) emissions through activities such as expanding the reach of carbon capture and storage (CCS) technologies. The successful widespread deployment of responsible CCS technologies will require strong and effective permitting, efficient regulatory regimes, meaningful public engagement early in the review and deployment process, and measures to safeguard public health and the environment. FECM fosters and leverages connections with domestic partners, including collaboration with government partners, in order meet these goals. This presentation will provide an overview of FECM activities related to the United States federal regulatory and permitting landscape for CCS projects.

- **Status of Permitting CO_2 Storage Wells**
  Neeraj Gupta, Battelle Technical Director - Carbon Management
  The presentation will provide an overview of CO2 injection well permitting requirements and status in the US, based on the information collected under the DOE funded Midwest Regional Carbon Initiative (MRCI) program. The national overview will include key steps in getting Class VI Underground Injection Control (UIC) permits, State level primacy development, and some observations from currently submitted permits.

- **State's Perspective on Regulating CO_2 Storage and Permitting UIC Class VI Injection Wells**
  Kevin Connors, Assistant Director for Regulatory Compliance and Energy Policy, EERC
  States have an important role to play in regulating geologic storage of carbon dioxide (CO_2). Currently, three States (North Dakota, Wyoming, and Louisiana) have obtained primary regulatory enforcement authority (i.e. primacy) from the United States Environmental Protection Agency (EPA) for underground injection control (UIC) program Class VI injection wells. States that are able to provide the Carbon Capture, Utilization, and Storage (CCUS) industry with regulatory certainty and a well-defined permitting process for storage are at the forefront of commercial CCUS deployment. This presentation will give an overview of State regulatory frameworks, the Class VI primacy process,

demonstrated pathways to permit approval, and project development timelines for geologic storage of CO_2, including Class VI injection well permitting.

12:30 p.m. – Lunch – Island Ballroom

2:00 p.m. **Panel on Technology: Demonstrations, Pilot Plant, Installation Projects**
Moderator: *Timothy Fout, U.S. Department of Energy*

Overview of Status of Current U.S. DOE Plant Source Capture Program Large Scale Projects
Timothy Fout, U.S. Department of Energy

Engineering, Procurement, and Construction Perspectives
Bob Slettehaugh, PE, Director, Carbon Capture & Carbon Removal, KIEWIT ENGINEERING GROUP INC.

UK IDEA Pilot RD&D: 2015-2030
Heather Nikolic, University of Kentucky

The Proof is in the Pilots - 10 Tonne per Day Enterprise: ION's Process Design with NGCC Flue Gas
N.A. Fine, ION Clean Energy

4:00 p.m. – Conclusion

Clearwater Clean Energy Conference

Tuesday, June 18, 2024

7:30 a.m. – Breakfast – Island Ballroom

8:00 to 10:00 a.m. – Five Concurrent Sessions

	Session 1 **NH_3 Combustion** *Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 2** **Pyrolysis & Gasification Fundamentals I** *Prof. Weihong Yang, KTH Royal Institute of Technology,* ***SWEDEN;*** *and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 3** **Oxy-Fuel Combustion** *Dr. Richard Axelbaum, Washington University in St. Louis, and* Xuebin Wang, Xi'an Jiatong University, CHINA	**Session 4** **CO_2 Conversion & Low Carbon Products I** *Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab*	
8:00 a.m.	**9. Experimental Study on Co-firing of Ammonia to Pulverized Coal Combustion System for Application to Power Generation System** *Taeyoung Chae, Jae Wook Lee, Woo Hyeun Sim, Sung Hwan Hwang, and Won Yang (Korea National University of Science and Technology), Decarbonization and Emission Control Technology R&D Department, Korea Institute of Industrial Technology,* ***SOUTH KOREA***	**17. Fluidization Regime Mapping Analysis for 200 µm Glass Beads in a Circulating Fluidized Bed Riser** *Steven L. Rowan, Dr. Ronald W. Breault and Justin M. Weber, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	**50. Experimental and Modeling Study on Pre-heated Ignition Behavior of Pulverized Coal Particles under Oxy-fuel Combustion Atmosphere** *Yixiang Shu, Hanlin Zhang, Zhaochen Shi, Su Zhang , Min Wang , Houzhang Tan , Xuebin Wang, MOE Key Laboratory of Thermo-Fluid Science and Engineering, Xi'an Jiaotong University; and Zhongfa Hu, College of Energy, Soochow University,* ***CHINA***	**Paper from Ron Breault**	
8:20 a.m.	**71. Kinetic Modelling Study of NH_3 Oxidation in a Flow Reactor** *Jianting Lin, Huanran Wang, and Xianchun Li (School of Chemical Engineering, University of Science and Technology Liaoning,* ***CHINA****); Yuanyuan Zhang, and Fangqin Cheng, (State Environmental*	**18. The Advanced Scale Up Reactor Experiment (ASURE) Facility: A Testbed for Advancing the Art of Biomass and Waste Co-Gasification Systems.** *Steven L. Rowan and Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	**56. Effect of Temperature and Pressure on the Structure and Reactivity of Biomass Char in Pressurized Oxy-Combustion** *Gaofeng Dai, Xuebin Wang, Hui Lin, Jiaye Zhang, Yili Zhang, Houzhang Tan, MOE Key Laboratory of Thermo-Fluid*	**37. Enhanced Biochar for Carbon Sequestration and Improved Crop Growth in Acidic Soils** *Nehru Chevanan, John T Kelly and Shawn Hawkins, Altex Technologies Corporation,* ***USA***	

	Protection Key Laboratory of Efficient Utilization Technology of Coal Waste Resources, Shanxi University, ***CHINA****); and Zhezi Zhang, Samuel Ronald Holden and Dongke Zhang, Centre for Energy (M473), The University of Western Australia,* ***AUSTRALIA***		*Science and Engineering, Xi'an Jiaotong University,* ***CHINA***		
8:40 a.m.	**24. A Study on Flue Gas Emission Trends and Optimal Combustion Conditions in Ammonia-Pulverized Coal Co-firing Using Computational Fluid Dynamics (CFD)** *Dongkwon Choi, Jiyong Hwang, Jihoon Jang and Sangbin Park, Kyoungil Park, Korean Electric Research Institute,* ***KOREA***	**20. Porosity of Biomass Char: A Novel Determination Method and Changes in Walnut Shell with Progressing Pyrolysis** *E. Freisewinkel, D. Tarlinski, L. Pörtner, M. Schiemann, V. Scherer, R. Span, and T. Eisenbach, Ruhr-University Bochum,* ***GERMANY****; and O. Senneca and F. Cerciello, Istituto di Scienze e Tecnologia per l'Energia e la Mobilità Sostenibili (STEMS)-CNR,* ***ITALY***	**78. Modular Staged Pressurized Oxy-Combustion (SPOC) Power Plant for Coal and Biomass – Integration of Combustor Boiler and DCC** *Duarte Magalhaes, Mao Cheng, Zachariah Wargel, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis,* ***USA***	**52. Bioconversion of Carbon Dioxide: From Flue Gas to Bioplastic** *Dr. Sim, Sang Jun, Dept. of Chemical and Biological Engineering, Korea University,* ***KOREA***	
9:00 a.m.	**8. Characteristics of Ammonia-Coal Co-combustion in Pilot Scale Coal-fired Combustors** *Kyoungil Park, Dong-Won Kim, Sang-Bin Park, Gyu-Hwa Lee, Gang-Min Kim, Dong-Kwon Choi, Ji-Yong Hwang, KEPCO Research Institute,* ***KOREA***	**45. Design Space Exploration of an Entrained Flow Gasifier Using a Reduced Order Model** *Eric Monson, Bradley Adams, Andrew Fry, Brigham Young University,* ***USA***	**91. Conceptual Design of a High Temperature Oxy-combustion Retrofit for an Existing Coal-Fired Boiler Utilizing Various Fuels** *Andrew Chiodo, Brydger Van Otten, Reaction Engineering International,* ***USA***	**65. Permanent Sequestration of CO_2 into Valuable Multiwall Carbon Nanotubes via Combined Molten Carbonate Electrolysis and Thermochemical Uptake** *Dr. David L. Wood, III and Dr. Anna Douglas, SkyNano, LLC,* ***USA***	
9:20 a.m.	**51. A Deep Insight into Catalytic Effects of Alkali and Alkaline Earth Metals (AAEMs) in Coal Ash on NH_3 Oxidation** *Su Zhang, Yixiang Zhang, Yili Zhang, Xin Yao, Zhan Li, Yixiang Shu, Min Wang, Hanlin Zhang, Houzhang Tan, Xuebin Wang, MOE Key Laboratory of Thermo-Fluid Science and*	**1. Optical Measurements of Pulverized Pine Needles Burning in a Drop Tube Furnace** *D. Tarlinski, M. Schiemann, and V. Scherer, Energy Plant Technology, Ruhr-University Bochum,* ***GERMANY****; and Y. Yao, D. Chang, and Y. Levendis, Mechanical and Industrial Engineering Department, Northeastern University,* ***USA***		**12. Dehydration Membrane Reactor for the Production of Valuable Chemicals from CO_2 and H_2** *Shiguang Li, Weiwei Xu, Qiaobei Dong, and Howard Meyer, GTI Energy; Kaiying Wang, and Xinhua Liang, Washington University in St. Louis; and Richard Ciora, Miao Yu, The State University of New York at Buffalo* ***USA***	

	Engineering, Xi'an Jiaotong University, ***CHINA***				
9:40 a.m.		**117. Microwave Assisted Catalytic Conversion of Tar Using an Iron Catalyst Doped with Ni/La/Ce.** *Anitha S. Gowda; Xinwei Bai; Pranjali Muley, NETL Support Contractors, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***		**32. Microalgae-Powered Plastic Biodegradation: A Dual Path Towards Sustainability** *João Vitor Dutra Molino, Barbara Saucedo, Kalisa Kang, Crisandra Jade Diaz, Marissa Tessman, Stephen Mayfield, Division of Biological Sciences and Algenesis, University of California San Diego,* ***USA***	
10:00 to 10:30 a.m. – Break – Island Ballroom					

10:30 a.m. to 12:10 p.m. – Five Concurrent Sessions					
	Session 5 **Carbon Dioxide as a Working Fluid** *Eric Liese and Matthew Searle, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Andrew Fry, Brigham Young University*	**Session 6** **Pyrolysis & Gasification Fundamentals II** *Prof. Weihong Yang, KTH Royal Institute of Technology, **SWEDEN;** and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 7** **Modeling & Simulation for Environmental Applications** *Dr. Edmundo Vasquez, Clean Energy Technologies*	**Session 8** **CO_2 Conversion & Low Carbon Products II** *Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab*	**Session 9** **Modeling and Combustion of Low Carbon Fuel** *Dr. Wu Yuxin and Dr. Hai Zhang, Department of Power Engineering, Tsinghua University, CHINA*
10:30 a.m.	**5. A Methodology for Simulating Supercritical CO_2 Heat Transfer Experiments using Machine Learning Models** *Owen Grabowski (NETL Suport Contractor), Matthew Searle, and Doug Straub, National Energy Technology Laboratory, **USA***	**28. Experimental Investigation of the Gasification Kinetics of Biogenic Residues under Pressurized Entrained-Flow Conditions** *Weiss Naim; Tobias Netter; Lukas Springmann; Sebastian Fendt and Hartmut Spliethoff Technical University of Munich, **GERMANY***	**4. Numerical Simulation of Focused Ultrasound Enhanced Emulsification at Elevated Frequencies** *Idowu Adeyemi, Department of Mechanical Engineering, and Mahmoud Meribout and Khalid AlHammadi, Department of Electrical Engineering and Computer Science Khalifa University, **UNITED ARAB EMIRATES**; and Lyes Khezzar and Nabil Kharoua, Ecole Nationale Polytechnique de Constantine, **ALGERIA***	**67. Production of CO_2-Negative Building Composites** *Keerti Kappagantula, Yuan Jiang, Francesca Pierobon, Nick Nelson, Jose Ramos, Raveen John, MD Reza E. Rabby, Aditya Nittala, Yelin Ni, Ethan Nickerson, Nathan Canfield, Jaelynne King, Wontae Joo, John C. Linehan, David J. Heldebrant, and Satish K. Nune, Pacific Northwest National Laboratory, **USA***	**121. Nonadiabaticity Effect on Emissions of Premixed NH3/H2/air Rich-Lean-Staged Combustion** *Zhaoxing LI, Yang Zhang, Hai Zhang, Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Department of Energy and Power Engineering, Tsinghua University, **CHINA***
10:50 a.m.	**68. Compressor Development for CO_2-based Pumped Thermal Energy Storage (PTES) Systems** *Timothy J. Held, Jason Miller, Kyle Sedlacko,*	**33. Effects of CO_2 Atmosphere on Co-pyrolysis of Straw and Waste Plastics** *Na Guo, Zhiwei Wang, Gaofeng Chen, School of Environmental*	**10. Heat Transfer and Reflection Phenomena between Convex Particles Using Pixel-resolved Temperature Distribution**	**76. Innovative Design and Performance Assessment of a Novel Modular Reactor for One-Step Liquid Fuel Production from Stranded Natural Gas**	**118. Effects of Turbulent Mixing on Structural Evolution and Combustion Characteristics of Single Biomass Particles**

	Echogen; JeongSeek Kang, Scott Morris, Josh Cameron, University of Notre Dame; and Mark Turner, University of Cincinnati, ***USA***	*Engineering and Institute for Carbon Neutrality, Henan University of Technology; and Tingzhoui Lei, Institute of Urban and Rural Mining, Changzhou University,* ***CHINA***	*M. Tyslik and M. Schiemann, Energy Plant Technology, Ruhr-University Bochum,* ***GERMANY***	*Tanay A. Jawdekar, Sudeshna Gun, Cong Wen Lu, Anuj Joshi, Sonu Kumar, Joel Paulson, Liang-Shih Fan, Department of Chemical and Biomolecular Engineering, The Ohio State University,* ***USA***	*Huina Guo, Yuxin Wu, Xin Li, Department of Energy and Power Engineering, Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Tsinghua University; and Jie Liu, Lele Feng, School of Safety Engineering, China University of Mining and Technology,* ***CHINA***
11:10 a.m.	**46. Off-Design Analysis of the sCO_2 Bottoming Cycle for a Natural Gas Combined Cycle Power Plant with Carbon Capture** *Anderson Soares Chinen, Sandeep Pidaparti, and Eric Liese, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	**42. Co-gasification and Pyrolysis Characterization of Polypropylene with Pine Wood** *Ruijie Liu, Zhiwei Wang, Gaofeng Chen, Huina Zhu, Qun Wang, Zhuo Li, Jiawei Wu, School of Environmental Engineering, Institute for Carbon Neutrality, Henan University of Technology, and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste Conversion; Zaifeng Li, Shuhua Yang, Mengju Zhang, Henan Academy of Sciences; and Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University,* ***CHINA***	**21. Numerical Study of Residence Time and Contact Heat Transfer of Spherical Particles on a Continuously Operated Hearth Furnace Floor Using the Discrete Element Method (DEM)** *N. Hilse, and V. Scherer, Institute of Energy Plant Technology (LEAT), Ruhr-University Bochum (RUB),* ***GERMANY***	**27. *Ex-situ* CO_2 Mineralization Methods of Traditional and non-Traditional Supplementary Cementitious Materials** *Ana Aday, PhD, and Adewale Odukomaiya, Materials Science Building Technologies and Science Center, National Renewable Energy Laboratory (NREL),* ***USA****; and Jennifer Kingsbury, Ryan Bourns and Apoorv Sinha, Carbon Upcycling Technology,* ***CANADA***	**120. Burning the Mixtures of Low Calorific Value Syngas and Air in the Porous Media: Effect of Porosity, Pore Size and Tortuosity** *Liang LI, Yang Zhang, Hai Zhang, Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Department of Energy and Power Engineering, Tsinghua University, Beijing,* ***CHINA***
11:30 a.m.		**127. Co-gasification of Liquid and Gaseous Feeds Using Linde's Hot Oxygen Burner (HOB)** *Lawrence E. Bool III and Bradley Darmstedt, Linde,* ***USA***	**REI Paper**	**102. Modeling, Technoeconomic and Life Cycle Analysis of CO_2 Conversion to Fuels and Chemicals** *Pingping Sun, Amgad Elgowainy, Vincenzo Cappello, Hernan Delgado, Kyuha Lee, Lili Sun, Kwang Hoon Baek, Clarence Ng,*	**119. Error Analysis and Modeling Improvement for Assumed PDF in FGM** *Guihua Zhang, Yuxin Wu, Xin Li, Guangxi Yue, Department of Energy and Power Engineering, Key Laboratory for Thermal Science and Power*

				Systems Assessment Center, Argonne National Laboratory, ***USA***	*Engineering of Ministry of Education, Tsinghua University,* ***CHINA***
11:50 p.m.			**93. Modeling and Optimization of Zeolites for Contaminant Removal from Coal Combustion Impoundment Leachates** *John Findley, Eric Grol; and Jan Steckel, National Energy Technology Laboratory; and Evan Granite, U.S. Department of Energy,* ***USA***	**103. Integrating Biomass Chemical Looping and Iron making Process for Generating High-Purity Syngas** *Ishani Karki Kudva, Shekhar G Shinde, Ashin A Sunny, Tanay Jawdekar, Sudeshna Gun, Rushikesh K Joshi, Sonu Kumar, Liang–Shih Fan, Department of Chemical and Biomolecular Engineering, The Ohio State University,* ***USA***	**125. Experimental Research on Transitional Jet Diffusion Flame of Hydrogen-rich Fuels** *Xin Li, Yuxin Wu, Jiahao Wu, Jie Liu, Department of Energy and Power Engineering, Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Tsinghua University,* ***CHINA***

12:10 p.m. Luncheon – Island Ballroom

- **Welcome:** *Barbara A. Sakkestad, Clearwater Clean Energy Conference*
- **Overview:** *Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy and Chairman of the Clearwater Clean Energy Conference*

1:30 to 3:30 p.m. – Five Concurrent Sessions

	Session 10 **Biomass Conversion to Power and/or Chemicals I** *Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 11** **Pyrolysis & Gasification Fundamentals III** *Prof. Weihong Yang, KTH Royal Institute of Technology, **SWEDEN;** and Dr. Ashwani K. Gupta, University of Maryland; and Dr. Steven Rowan, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 12** **Energy Conversion in Rotary Kilns** *Klas Andersson, Chalmers University, **SWEDEN** and Prof. Lunbo Duan, and Prof. Yueming Wang, Ph.D., Southeast University, **CHINA***	**Session 13** **Hydrogen from Pyrolysis and Gasification** *Howard Meyer, GTI Energy, Prof. Ramees Khaleel Rahman, Center for Advanced Turbomachinery and Energy Research; and Dr. Jarrett Riley, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 14** **Modular Systems for Carbon Based Fuels** *Jonathan W. Lekse, National Energy Technology Laboratory, U.S. Department of Energy and Fred Baddour, National Renewable Energy Lab*
1:30 p.m.	**104. Modeling the Advanced Scale-up Reactor Experiment (ASURE) Facility at NETL as a Temperature Controlled Pyrolizer Using ASPEN** *John G. Van Osdol, Steven L. Rowan and Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy, **USA***	**54. Plastic Wastes to Hydrogen: Versatile Oxygen Carrier Redox Gasification Pathways with High H_2 Yield, Low CO_2 Emission, and No Net Heat Input** *Rushikesh K. Joshi†, Eric Falascino, Sonu Kumar, Tanay Jawdekar, Ishani K. Kudva, Shekhar G. Shinde, Zhuo Cheng, Andrew Tong, Liang-Shih Fan, William G. Lowrie Department of Chemical Engineering, The Ohio State University, **USA***	**19. Evaluating Heat Transfer Sources in 150 kWth Cement Rotary Kiln** *Ibrahim Qasim, Adrian Gunnarsson, Klas Andersson, Fredrik Normann and Bodil Wilhelmsson, Department of Space, Earth and Environment, Chalmers University of Technology, and Alexander Zether, Heidelberg Materials Cement Sverige AB, **SWEDEN***	**107. Point-of-Use Decarbonization of Natural Gas: Zero-Emission, Cost-Effective Hydrogen Production via Microwave Plasma Pyrolysis** *Vignesh Viswanathan, Kurt Zeller and George Skoptsov, H-Quest, **USA***	**129. Biomass Processing with the Szego Mill: Deacetylated Corn Stover** *Olev Trass, University of Toronto, CANADA and Narendra Kumar Gadval, University of Alabama, **USA***
1:50 p.m.	**38. Coupling of a Pilot Entrained Flow Gasifier with a Pilot Cold Gas Cleaning System, A**	**57. Effect of Operating Conditions on Stability of Biomass Pyrolysis Liquid**	**36. Heat Transfer Modelling of a Plasma Heated Rotary Kiln for Cement Production**	**26. Overview of DOE/FECM Hydrogen Program** *Jai-woh Kim, Senior Program Manager-*	

	Study on Process Stability *P. Leuter, S. Fendt, and H. Spliethoff, Technical University of Munich TUM, Energy Systems CES, Garching,* ***GERMANY***	*Jianting Lin and Xianchun Li (School of Chemical Engineering, University of Science and Technology Liaoning), Zhezi Zhang, Jialiang Xu, Yuanyuan Zhang (State Environmental Protection Key Laboratory of Efficient Utilization Technology of Coal Waste Resources, Shanxi University), Kai Zheng and Fangqin Cheng, (Beijing Key Laboratory of Pollutant Monitoring and Control in Thermal Power Production Process, North China Electric Power University),* ***CHINA*** *and Dongke Zhang, Centre for Energy (M473), The University of Western Australia,* ***AUSTRALIA***	*Alice Fakt, Adrian Gunnarsson, Fredrik Normann, and Klas Andersson, Department of Space, Earth and Environment, Chalmers University of Technology; and Bodil Wilhelmsson and Arvid Stjernberg, Heidelberg Materials Cement Sverige AB,* ***SWEDEN***	*Hydrogen with Carbon Management, U.S. Department of Energy,* ***USA***	
2:10 p.m.	***58.*** **A Techno-economic Analysis of Miniaturised Methanol Production as Hydrogen Carrier from Biomass Wastes Pyrolysis Syngas** *Mengqing Zhao, Zhezi Zhang, Sabar Pangihutan Simanungkalit, Kai Zhang (Beijing Key Laboratory of Pollutant Monitoring and Control in Thermal Power Production Process, North China Electric Power University,* ***CHINA****), Fangqin Cheng (State Environmental Protection Key Laboratory of Efficient Utilization Technology of Coal Waste Resources, Shanxi University,* ***CHINA****) and Dongke Zhang, Centre*	**75. Catalyst Position and Reactor Temperature Effects on Pyrolysis of Polyethylene Terephthalate** *Fatih Aktas (Department of Mechanical Engineering, Faculty of Engineering, Gazi University,* ***TURKEY****), Kiran G. Burra, and Ashwani K. Gupta, The Combustion Laboratory, University of Maryland, Department of Mechanical Engineering,* ***USA***	**29. Radiation Models for CFD-Simulations of Hydrogen and Coal Flames in Rotary Kiln Applications** *Elias Ehlmé, Adrian Gunnarsson, Fredrik Normann, and Klas Andersson, Division of Energy Technology, Chalmers University of Technology; and Ehsan Fooladgar, LKAB,* ***SWEDEN***	**30. Modeling Hydrogen Utilization for the Blast Furnace and Reheating Furnace** *Nicholas J. Walla, Tyamo Okosun, Samuel E. Nielson, Misbahuddin Syed, Abhisek Kolakotla, Armin Silaen, Chenn Q. Zhou, Center for Innovation through Visualization and Simulation, Purdue University Northwest,* ***USA***	

	for Energy (M473), The University of Western Australia, ***AUSTRALIA***				
2:30 p.m.	**41. Techno-Economic Comparison of Entrained Flow Gasification-based Biomass-to-X Routes** *Vincent Dieterich, Andreas Hanel, Sebastian Bastek, Hartmut Spliethoff, Sebastian Fendt, Technical University of Munich, TUM School of Engineering and Design,* ***GERMANY***	**105. Reduction of Iron (III) Oxide in Microwaves towards Gasification Studies** *Divakar R. Aireddy and Pranjali Muley (NETL Support Contractors) National Energy Technology Laboratory,* ***USA***	**98. Promoted Conversion of C/N/S/Cl in Solid Waste via Oxygen Carrier-Aided Combustion in the Rotary Kiln** *Xue Liu (Key Laboratory of Low Carbon Energy and Chemical Engineering of Gansu Province, School of Petrochemical Engineering, Lanzhou University of Technology) and Lunbo Duan, Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University,* ***CHINA***	**22. A Standard Approach to the Analysis of Carbon Products Generated from Natural Gas Pyrolysis** *Jarrett Riley, Ranjani Siriwardane, James Poston, Hayat Adawi (Support Contractor), and Chris Atallah (Support Contractor), National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	
2:50 p.m.	**6. Preparation of Hydrogen-based Liquid Fuel from Straw-based Syngas and Economic Analysis** *Gaofeng Chen, Zhiwei Wang, Huina Zhu, Qun Wang, and Na Guo, School of Environmental Engineering, and Institute for Carbon Neutrality, Henan University of Technology and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste Conversion; and Tingzhou Lei, Institute of Urban and*	**81. Effects of CO_2 Atmosphere on Co-pyrolysis of Straw and Waste Plastics** *Na Guo, Zhiwei Wang, Gaofeng Chen, School of Environmental Engineering, Henan University of Technology, Institute for Carbon Neutrality, Henan University of Technology, and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste Conversion; and Tingzhoui Lei, Institute of Urban and Rural Mining,*	**99. Research on the Novel Cement Production Process Based on Green Electricity and Carbonate Hydrogenation Reaction** *Duan Yuanqiang, Gao Siyuan, Wang Yueming, Duan Lunbo, Key Laboratory of Energy Thermal Conversion and Control, Ministry of Education, School of Energy and Environment, Southeast University,* ***CHINA***	**34. Sorted Municipal Solid Waste Characterization, Pre-Processing and Ultra Dense Phase Feeding in the R-Gas ™ Pilot Gasifer** *Zach El Zahab, GTI Energy,* ***USA***	

	Rural Mining, Changzhou University, ***CHINA***	*Changzhou University,* ***CHINA***			
3:10 p.m.	**61. Beyond Combustion – Coal in the 21st Century – Carbon Products from Coal** *Evan J. Granite, U.S. Department of Energy, Fossil Energy & Carbon Management,* ***USA***		**100. Coal Low-Carbon Combustion in Cement Kiln** *Qiangqiang Ren, Insitute: Institute of Engineering Thermophysics, Chinese Academy of Sciences,* ***CHINA***		
3:30 to 4:00 p.m. – Break – Island Ballroom					

4:00 to 6:00 p.m. – Four Concurrent Sessions					
	Session 15 **Biomass Conversion to Power and/or Chemicals II** *Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 16** **Low Carbon Plant Conversions** *Tim Fuller, The Babcock & Wilcox Co., and Brian Vitalis, Riley Power*	**Session 17** **Hydrogen Technology** *Dr. Marc Cremer, Reaction Engineering International and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 18** **Novel Approaches to CO_2 Point Sources** *Dr. Ronald Breault and Dr. James Tran, National Energy Technology Laboratory, U.S. Department of Energy*	
4:00 p.m.	**64. Thermodynamic Optimization of Bimetallic Redox Carriers for Enhanced Process Efficiency in Chemical Looping Technologies for High Purity Syngas and Hydrogen Production** *Sudeshna Gun, Tanay A. Jawdekar1, Sonu Kumar1, Falguni Akulwar1, Liang-Shih Fan, The Ohio State University, **USA***	**90. The Need for Fuel Flexibility in the New Energy Generation Market** *Diane Fischer, Kiewit, **USA***	**70. High-Speed OH Planar Laser-Induced Fluorescence Diagnostics of Flame Flashback in Low Swirl Hydrogen-Enriched Flames** *Dr. Pradeep Parajuli (NETL Support Contractor) and Peter Strakey, National Energy Technology Laboratory, **USA***	**49. Computational Modeling of CO_2 Cryogenic Capture and Storage Processes** *Rameche Candane Somassoundirame and Muhammad Sami, Ansys Inc., **USA***	
4:20 p.m.	**69. High purity Hydrogen Production via Biomass Gasification Using Calcium Ferrite Based Chemical Looping** *Shekhar Ganapa Shinde, Ishani Karki Kudva, Rushikesh Joshi, Liang-Shih Fan, Ohio State University, **USA***	**72. A Technical Review on Direct Reduction of Iron Ore Using Ammonia** *Kaijie Li, Jialiang Xu, Zhezi Zhang, Dongke Zhang, Xianchun Li (School of Chemical Engineering, University of Science and Technology Liaoning, **CHINA**), Centre for Energy (M473), The University of Western Australia, **AUSTRALIA**; and Guangyu Ma, Environment & Resource Institute, Angang Steel Company Limited, **CHINA***	**74. Compact Electric Reforming of Hydrocarbon Fuels for Reliable Hydrogen Production** *Kiran Raj Goud Burra, Murat Sahin, and Ashwani K. Gupta, The Combustion Laboratory, University of Maryland, Department of Mechanical Engineering, **USA***	**25. University of Kentucky Compact Absorber Technology Leads to Significant Reduction in the Cost of Point Source CO_2 Capture** *Heather Nikolic; Reynolds Frimpong and Kunlei Liu, University of Kentucky Institute for Decarbonization and Energy Advancement, **USA***	
4:40 p.m.	**80. Preparation of High Quality Hydrogen from Catalytic Pyrolysis of Cellulosic Biomass** *Jiawei Wu, Zhiwei Wang, Gaofeng Chen, Huina Zhu, Qun*	**73. A Modelling Study of Direct Reduction of Single Iron Ore Particles in Ammonia and Hydrogen** *Jialiang Xu, Kaijie Li, Zhezi Zhang, Xianchun Li (School of*	**89. Electrolyzer Technologies: A Comparative Analysis of Cost and Performance** *William Klassen, Kiewit, **USA***	**77. Process Design and Techno-Economic Analysis of the Modular Staged Pressurized Oxy-Combustion (SPOC) Power Plant for Biomass**	

	Wang, Ruijie Liu, Zhuo Li, School of Environmental Engineering, Henan University of Technology, Institute for Carbon Neutrality, Henan University of Technology, and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste Conversion; Zaifeng Li, Shuhua Yang, and Mengju Zhang, Henan Academy of Sciences; and Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University, ***CHINA***	*Chemical Engineering, University of Science and Technology Liaoning,* ***CHINA****) Dongke Zhang, Centre for Energy (M473), The University of Western Australia,* ***AUSTRALIA***		*Duarte Magalhaes, Mao Cheng, Andrew Maxson, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis; Gabrielle Farrell and Babul Patel, NexantECA; and Scott Hume, Electric Power Research Institute, Inc. (EPRI),* ***USA***	
5:00 p.m.	**63. Effect of Al Loading on the Performance of $Cu/ZnO/Al_2O_3$ Catalyst in Methanol Synthesis from Biomass Pyrolysis Syngas** *Sabar Pangihutan Simanungkalit (Research Centre for Chemistry, National Research and Innovation Agency, INDONESIA), Chiemeka Onyeka Okoye, Zhezi Zhang, Dongke Zhang, Centre for Energy (M473), The University of Western Australia,* ***AUSTRALIA***	**39. Enhancing Efficiency of Solid Sorbent based Point Source CO_2 Capture Using Magnetically Stabilized Fluidized Bed Reactor** *Ashin Sunny, Ishani Karki Kudva, Shekhar Shinde, Sudeshna Gun, Pinak Mohapatra, Dawei Wang, Liang-Shih Fan, Distinguished University Professor, The Ohio State University; and Andrew Tong, Susteon Inc.,* ***USA***	**113. A Novel System to Measure the Liquid/Vapor Fraction in A Geothermal Production Well in Real-Time** *Dr. Zhonghua Zhan, Dr. Marc Cremer, Andrew Chiodo, Reaction Engineering International; and Dr. Pengju Xing, Dr. Joseph Moore, and Dr. John McLennan, Energy Geoscience Institute at the University of Utah,* ***USA***	**106. Advanced Membranes for Carbon Capture** *Shiguang Li, Timothy Tamale, Weiwei Xu, Travis Pyrzynski, Mark Stevens, Howard Meyer, Qiaobei Dong, Timothy Tamale, Weiwei Xu, Travis Pyrzynski, Mark Stevens, GTI Energy; Yang Han, Winston Ho, The Ohio State University; Miao Yu, Fan Wang, Dinesh Behera, The Ohio State University; Andrew Sexton, Trimeric Corporation; and Will Morris, Wyoming Integrated Test Center,* ***USA***	
5:20 p.m.	**43. Characteristics of Oxygen-enriched Air Co-gasification of Biomass and Plastics via a Small-scale Auto-thermal Gasifier** *Zhuo Li, Zhiwei Wang, Gaofeng Chen, Huina Zhu, Qun Wang, Jiawei Wu, Ruijie Liu, School of Environmental Engineering, Institute for Carbon Neutrality, Henan University of Technology, Henan University*		**126. Regional Hydrogen Assessment in Intermountain WEST United States** *Prashant Sharan, Manvendra Dubey, and Rajinder Singh, Los Alamos National Lab,* ***USA***	**115. Membrane Development for CO_2 Capture from Steel Manufacturing** *James Tran, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	

	of Technology and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste; Conversion; Zaifeng Li, Shuhua Yang, Mengju Zhang, Henan Academy of Sciences; and Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University, ***CHINA***				
5:40 p.m. Conclusion of the Technical Program					

Clearwater Clean Energy Conference

Wednesday, June 19, 2024

7:30 to to 8:00 a.m. – Breakfast – Island Ballroom

8:00 to 9:40 a.m. – Five Concurrent Sessions

	Session 19 **Cyber-Physical Systems for Control and Controls Development** *Dr. Dave Tucker, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 20** **Systems Studies of Point Source Capture** *Bob Slettehaugh,* Kiewit, and *Tim Fout, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 21** **Carbon Dioxide Removal** *Dr. Ronald W. Breault and Jan Steckel, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 22** **Biomass Conversion to Power and/or Chemicals III** *Josh Stanislowski, UNDEERC and Dr. John Van Osdol, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 23** **sCO_2 Power Cycle Components and Fundamentals** *Matthew Searle, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Andrew Fry, Brigham Young University*
8:00 a.m.	**40. Conceptual Design of a Flexible Carbon Capture Cyber-Physical System for Integrated Energy System Applications** *Nor Farida Harun; Nana Zhou; Biao Zhang (NETL Support Contractors); and Samuel Bayham and David Tucker, National Energy Technology Laboratory,* ***USA***	**79. Investigating the Impact of the Inflation Reduction Act's Section 45Q Tax Credit on the Economics of Industrial CO_2 Capture** *Alex Noring, Arun Iyengar, Sarah Leptinsky, Ivonne Pena-Cabra, Connie Zaremsky, Alex Zoelle, Eric Grol and Amanda Harker Steele, National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	**3. U.S. Department of Energy Office of Fossil Energy and Carbon Management's Carbon Dioxide Removal Program: An Overview** *Andrew Jones, Technology Manager, Carbon Dioxide Removal Program, Rory Jacobson, Acting Director, Carbon Dioxide Removal Division, and Elliot Roth, Federal Project Manager, National Energy Technology Laboratory, U.S. Department of Energy, Jacob Weidman and Henry Long, Senior Engineers, KeyLogic Systems, LLC,* ***USA***	**108. CO_2 Capture from Corn Stover Conversion at Ethanol Plants** *John A. Brunner and Joshua R. Strege, University of North Dakota Energy & Environmental Research Center,* ***USA***	**2. Local Heat Transfer Measurements in Main Cooler for sCO_2 Power Cycles with Dilute Nitrogen and Argon Impurities** *Matthew Searle (NETL Support Contractor) and Doug Straub, National Energy Technology Laboratory,* ***USA***

8:20 a.m.	**7. Study on Energy Optimization and Environmental Assessment based on Smart Farm Integrated with Renewable Energy** *Jiseon Park, HyeonRok Choi, Won Yang, and YongWoon Lee, Carbon Neutral Technology R&D Department, Korea Institute of Industrial Technology,* ***SOUTH KOREA***	**53. Techno-Economic Optimization of Fixed Bed and Moving Bed Contactors for CO_2 Capture from NGCC Plants Using a Functionalized Metal–Organic Framework** *Ryan Hughes, Daison Yancy-Caballero, Miguel Zamarripa-Perez, Michael Matuszewski, NETL Support Contractors and Benjamin Omell, National Energy Technology Laboratory, U.S. Department of Energy; and Debangsu Bhattacharyya, West Virginia University, Morgantown,* ***USA***	**112. Machine-Learned Force Field Modeling of Metal Organic Frameworks for CO_2 Direct Air Capture** *John Findley and Samir Budhathoki (Support Contractors) and Jan Steckel, National Energy Technology Laboratory,* ***USA***	**82. Influence Factors and Products Optimization During Co-pyrolysis of Solid Biomass and Waste Plastics** *Zhiwei Wang, Mengge Wu , Gaofeng Chen, Huina Zhu, Qun Wang, Na Guo, Yan Chen, Shuaihua Guo, School of Environmental Engineering, Henan University of Technology, Institute for Carbon Neutrality, Henan University of Technology, and Zhengzhou International Cooperation Base for Science and Technology on Carbon Neutrality of Organic Solid Waste Conversion; Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University,* ***CHINA****; and Kiran G. Burra, Ashwani K. Gupta, The Combustion Laboratory, Department of Mechanical Engineering, University of Maryland,* ***USA***	**85. Fireside Heat Flux Optimization within Coal-fired Supercritical CO_2 Power Cycles** *Andrew Chiodo, Reaction Engineering International;* Andrew Fry, *Brigham Young University; Michael Johnson, Riley Power; and Jason Miller, Echogen Power Systems (DE), Inc.,* ***USA***

8:40 a.m.	**66. Experimental Methodology for Incorporating SOFC Degradation in Cyber-Physical Systems** *Nor Farida Harun and Nana Zhou (NETL Support Contractor) and David Tucker, National Energy Technology Laboratory, U.S. Department of Energy; and Jose Colon Rodrigues and Edward Sabolsky, West Virginia University,* ***USA***	**NETL Paper on Industrial Capture Analysis** *Sydney Hughes, Eric Grol, etc.*	**23. Design, Fabrication, and Testing of Direct Air Capture Sorbent Modules to Increase Understanding of Trade-offs in Pressure Drop and Capture Efficiency** *Jarrett Riley, Justin Weber, Ronald Breault, Bryan Hughes (LRST Site Support Contractor), Timothy Floyd (LRST Site Support Contractor), and Michael Bobek (LRST Site Support Contractor), National Energy Technology Laboratory, U.S. Department of Energy,* ***USA***	**92. Optimizing Ash Fusion Temperatures in Biomass Combustion: An Investigation of Additive Effects** *Spencer Bandi, Graduate Student, Brigham Young University,* ***USA***	**123. Supercritical CO_2 Equipment Installations at the San Rafael Energy Research Center (SRERC) for the Investigation of Heat Transfer Behavior in Solid Fuel Fired Systems.** *Andrew Fry, Rajarshi Roy, Brian Schooff, Brigham Young University; Jason Miller, Tim Held, Echogen; Andrew Chiodo, Reaction Engineering International; and Arman Arabi, Michael Johnson, Riley Power,* ***USA***
9:00 a.m.	**14. Advanced Decision Support Software for Next Generation Energy Systems** *David Swensen and Martin Denison, Reaction Engineering International; and Jeff Bennett, Nate Holwerda, Jonathan and Ogland-Hand, Carbon Solutions LLC,* ***USA***	**88. The Proof is in the Pilots Pt. 2 - 200 Tonne per Day TCM: Solvent Drop-In for Commercial Scale-Up** *M.A. Lynch, N.A. Fine, R. Kupfer, N.S. Brown, A.E. Brown, E.E.B. Meuleman, ION Clean Energy,* ***USA***	**97. Scale up of Limestone Based Direct Air Capture** *Richard Tamblyn, Origen,* ***USA***		**122. A Supercritical CO_2 Power Cycle Demonstration Unit for the Development of Future Thermal Power Generation Technologies** *Andrew Fry, Brigham Young University,* ***USA***

9:20 a.m.		**94. Front-End Engineering and Design for CO_2 Capture on a 1200-MWE Electric Generating Station** *Jason D. Laumb, University of North Dakota Energy & Environmental Research Center; Takashi Kurioka, Hirotaka Tanaka, Mitsubishi Heavy Industries, Ltd.; Dalton Norton, Conway Nelson Rainbow Energy Center; and Aaron Bennett, Burns & McDonnell, **USA***	**111. Ferryferrohydrosol (FFH) – A New Sorbent for Carbon Dioxide Removal from the Air** *M. Zabochnicka, T. Kamizela, K. Wystalska, U. Kępa, M. Worwąg, M. Kowalczyk, Czestochowa University of Technology, Faculty of Infrastructure and Environment; B. Kuzio, G. Rymarz, S. Kuzio, IGO Sp. z o.o., **POLAND**; and P. Strizhak, L.V. Pisarzhevskii Institute of Physical Chemistry of the National Academy of Sciences of Ukraine, **UKRAINE***		
9:40 a.m.			**16. Advanced Structured Material for Direct Air Capture** *Mustapha Soukri, RTI, **USA***		
10:00 to 10:30 a.m. – Break – Island Ballroom					

10:30 to 12:10 p.m. – Five Concurrent Sessions					
	Session 24 **Recovery of Rare Earth Elements** *Melanie Mackay, Mining Engineering, University of British Columbia, CANADA; Dr. Evan Granite, U.S. Department of Energy*	**Session 25** **PC Fired Units** *J.J. Letcovits, Consultant, and Alan Paschedag, Consultant*	**Session 26** **U.S. Regional Carbon Sequestration Initiatives** *Joshua Stanislowski, Energy and Environmental Research Center, University of North Dakota*	**Session 27** **Systems Studies for CDR** *Sally Homsy, National Energy Technology Laboratory, U.S. Department of* Energy and *Mustapha Soukri, RTI*	**Session 28** **CO_2 Conversion & Low Carbon Products III** *Dr. Aaron Fuller, U.S. Department of Energy and Dr. Michelle K. Kidder, Energy Science and Technology Directorate, Oak Ridge National Lab*
10:30 a.m.	**60. Extractability Indices for Determination of Optimum Coal Combustion Byproduct Feedstocks for Recovery of Metals** *Evan J. Granite, Cheuk Fai Chiu, Ward Burgess, Timothy Cain, Elliot Roth, Murphy Keller, U.S. Department of Energy, Fossil Energy & Carbon Management, Minerals Sustainability Division,* ***USA***	**84. A Novel Dew Point Meter: Application to the Measurement of the Sulfuric Acid Dew Point for Combustion Flue Gas** *Mao Cheng, Zachariah Wargel, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis, Saint Louis,* ***USA***	**31. Midwest Regional Carbon Initiative (MRCI) and CCS Deployment in the Midwestern USA** *Neeraj Gupta, Carbon Management, Battelle,* ***USA***	**59. Techno-economic Analysis of a Direct Air Capture System Utilizing a Looped $CaCO_3/Ca(OH)_2$ Process** *Sarah Leptinsky and Hari Mantripragadaa (Support Contractor) and Sally Homsya, National Energy Technology Laboratory, U.S. Department of Energy; and Timothy Fout, U.S. Department of Energy,* ***USA***	**109. Sequestering CO_2 While Producing Green Building Products** *Bruce C. Folkedahl, University of North Dakota Energy & Environmental Research Center; Walt Sherwood, Ryan Johnson, Ryan Trammel Kaleb Nottke and Bill Easter, Semplastics/X-MAT,* ***USA***
10:50 a.m.	**96. Carbon Ores-Derived Critical Materials for Clean Energy Technology Applications** *Dr. Alexander Azenkeng, Nicholas E. Stanislowski, Jason D. Laumb, Energy & Environmental Research Center, University of North Dakota,* ***USA***	**110. Real-time Fire-side Corrosion Control at a Cycling PC Power Plant Using MPMS and Machine Learning Model** *Hong Shig Shim, Reaction Engineering International,* ***USA***	**44. Permitting Commercial Geologic CO_2 Storage Projects: Lessons Learned** *Kevin C. Connors, Wesley D. Peck, Kyle A. Glazewski, Janelle R. Ensrud, and James A. Sorensen, University of North Dakota Energy & Environmental Research Center,* ***USA***	**86. Overview of the Prairie Compass Direct Air Capture Hub in North Dakota** *Joshua J. Stanislowski, University of North Dakota Energy & Environmental Research Center,* ***USA****; and Rachael Mather, Climeworks GmbH,* ***GERMANY***	
11:10 a.m.	**62. Domestic Wastes and Byproducts: A Resource for Critical Material Supply Chains** *Evan J. Granite, U.S. Department of Energy,*	**114. Model Based Design Optimization of Existing Direct Urea Injection SCR Systems in Coal Fired Boilers**	**101. The Carbon Utilization and Storage Partnership of the Western USA – Regional Industrial**	**128. Modeling and Optimization of a Fixed Bed Direct Air Capture Process Accounting for Varying Process Performance Due to**	

	Fossil Energy & Carbon Management, ***USA***	*Zhonghua Zhan, Marc Cremer, Dave Wang, Reaction Engineering International,* ***USA***	**Decarbonization Support** *Robert Balch, George El-Kaseeh, Jennifer Raney New Mexico Tech, Petroleum Recovery Research Center; and Brian McPherson, University of Utah, Energy and Geoscience Institute,* ***USA***	**Ambient Air Temperature and Humidity Fluctuations at a Candidate Site** *Ryan Hughes, Jinliang Ma, Anca Ostace, and Diason Caberallero (NET Support Contractors) and Benjamin Omell, National Energy Technology Laboratory,* ***USA***	
11:30 a.m.	**55. Deriving Maximum Value from Mineral Waste Delivery Chains Successful** *Dave Osborne, Industry Advisor, Somerset International,* ***AUSTRALIA***	**116. Turning Emissions into Assets: The Financial Benefits of Flue Gas Optimization** *Monica Y. Marin, MSc. Environment/Chem. Eng.,* ***COLOMBIA***		**130. Solid Sorbent for DAC: Advantages and Disadvantages** *Mustapha Soukri, Paban Sitaula, and Dan O'Nolan, RTI International,* ***USA***	
11:50 a.m.	**95. Williston Basin Carbon Ore, Rare Earths and Critical Minerals (CORE-CM) Program** *John P. Kay, Jason D. Laumb, Bruce C. Folkedahl, Ian K. Feole, Charlene R. Crocker, Stacy J. Kouba, Energy Center, Energy & Environmental Research Center, University of North Dakota; and Nolan Theaker, College of Engineering and Mines Research Institute, University of North Dakota Collaborative,* ***USA***	**124. Synthesis and Functionalization of Zeolite-Based Sorbents Derived From Coal Fly Ash and Optimized for Boron Removal From Wastewater** *Patrick Muldoon (NETL Support Contractor) Bret Howard, Ali K. Sekizkardes, Eric Grol and Ping Wang, National Energy Technology Laboratory, U.S. Department of Energy; and Jeffrey S. Summers, U.S. Department of Energy, Fossil Energy & Carbon Management, CO_2 Removal Division,* ***USA***			
12:10 p.m. to 1:30 p.m. – Luncheon – Island Ballroom • Presentation of the Best Student Paper Award • Roundtable/Wrap-up Discussion • Conference Committee Meeting					

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