The 47th International Technical Conference on Clean Energy

July 23 to 27, 2023

Clearwater, Florida, USA

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.

The Clearwater Clean Energy Conference

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CONFERENCE HIGHLIGHTS

**The Keynote Presentations, Short Courses and Technical Sessions
cover all the critical technological issues of the day
as we explore the issues of the day**.

To accommodate international speakers, 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
- Dr. Edmundo Vasquez, Clean Energy Technologies

SHORT COURSES
On Sunday, July 23rd, four extensive Short Courses on topics important to the energy community are offered. These are open to all conference registrants.

BEST STUDENT PAPER AWARD
Due to insufficient participation, there is no competition this year.

IMPORTANT INFORMATION

- **No Unauthorized Photography.**
- **You may not photograph any visuals.**
- **No recording of any sessions.**
- **Wear your badge to every function.**
- **No Cell Phone Use During Sessions:** All cell phones must either be put on vibrate or turned off. No phone calls can be taken or made during the session. This is annoying and distracting for the speakers and attendees. And cell phones may not be used to take pictures in the session rooms or to record speakers.
- **Turn Off Audio Reminders on Computers in Use during Sessions.**

HOTEL INTERNET ACCESS

To access the internet at the Sheraton Sand Key, use **energy23**

SPOUSES INFORMATION

Registered spouses are included in all food functions: The Networking Party, lunches, Continental breakfasts and all breaks. Badges must be worn to all functions; spouses registration fee is $250. Spouses may attend the technical session in which their spouse is speaking.

CONFERENCE ATTIRE

To take advantage of our fabulous locale and to be comfortable during the long conference day, we encourage you (and this includes moderators and speakers) to dress casually, i.e., no jackets and ties, but business casual.

DID YOU KNOW?

The Clearwater Clean Energy Conference has drawn attendees from around the globe to Clearwater, Florida, since 1989. This conference provides essential information to power generators who must meet the pressures of energy utilization in the 21st century.

THE CONFERENCE DESK

Located in Lobby 3, directly outside the Exhibit Center, is the Conference Desk. Staff is on hand before the start of the sessions each morning and through the last session of the day and is ready to assist you with problems or questions.

TECHNICAL SESSIONS Q&A

Q&A is allowed at the end of each paper, if time allows. Speakers will also be available in the morning, at breaks and at lunch.

CONFERENCE REGISTRATION

Your registration fee covers one **Proceedings**, and participation in all short courses, technical sessions and panels, breakfasts, breaks and luncheons, plus all conference materials.

The Spouse's Fee covers participation in the three breakfasts, six breaks and three luncheons throughout the conference.

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: **akgupta@umd.edu.**

Instructions for submission of papers will soon be posted on the Clearwater Clean Energy Conference website: www.ClearwaterCleanEnergyConference.com

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The Agenda
Clearwater Clean Energy Conference
47th International Technical Conference on Clean Energy

Sunday, July 23, 2023

Four Consecutive Short Courses – Bay Room

- **9:00 a.m. to 10:30 a.m. – Combustion Tuning: Why and How**
  J.J. Letcavits, AEP, and Alan Paschedag, Covanta

- **10:45 a.m. to 12:15 p.m. – Introduction to Natural Gas and Processing**
  Dr. Evan Granite, U.S. Department of Energy

- **2:00 p.m. to 3:00 p.m. – Energy from Waste 101**
  Alan Paschedag, Covanta

- **3:15 p.m. to 4:30 p.m. – Overview of Gasification Technologies**
  Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy

Monday, July 24, 2023

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

8:00 a.m. – Keynote Plenary Session – Bay Room

- **Welcome** – *Barbara A. Sakkestad, Clearwater Clean Energy Conference*
- **Overview** – *Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy*
- **Presentation of the Percy Nicholls Award to** *Dr. Dave Osborne, Somerset International Australia,* ***AUSTRALIA***
- **Keynote Address –** *Prof. Yuxin Wu, Dept. of Energy and Power Engineering, Tsinghua University,* ***CHINA***
- **Panel: Future for Computing –** *Dr. Edmundo Vasquez, Clean Energy Technologies*

10:30 a.m. – Break – Island Ballroom

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

- **Session 1 – CO_2 – Direct Air Capture I**
  Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy, and Andrew Hlasko, U.S. Department of Energy
  Beach Room

- **Session 2 – Clean and Secure Energy Driven by AI**
  Assoc. Prof. Dr. Wu Yuxin, and Asst. Prof. Dr. Liu Chao, Dept. of Energy and Power Engineering, Tsinghua University, ***CHINA***
  Gulf Room

- **Session 3 – Hydrogen Combustion I**
  Prof. Ramees Rahman, Center for Advanced Turbomachinery and Energy Research (CATER), and Dr. Marc Cremer, Reaction Engineering
  Palm Room

- **Session 4 – Artificial Intelligence/Machine Learning (AI/ML) for Energy Systems**
  Dr. Rob Hovsapian, National Renewable Energy Network, and Dr. Massood Ramezan, KeyLogic
  Bay Room

- **Session 5 – Deriving More Value from Waste – Maximized Utilization of Mined Materials I**
  Dr. Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy. and Dr. Dave Osborne, Somerset International Australia,
  AUSTRALIA
  Coastal Room

12:20 to 1:45 p.m. – Luncheon – Island Ballroom

1:45 to 3:45 p.m. – Five Concurrent Sessions

- **Session 6 – Biomass Conversion I**
  Joshua Stanislowski, UNDEERC
  Beach Room

- **Session 7 – CO$_2$ Conversion and Low Carbon Products I**
  Dr. Aaron Fuller, U.S. Department of Energy, and Dr. Naomi R. O'Neil,

National Energy Technology Laboratory, U.S. Department of Energy
Gulf Room

- **Session 8 – Combustion R&D I**
  Dr. Ashwani Gupta, University of Maryland, and
  Prof. Larry Baxter, Brigham Young University
  Palm Room

- **Session 9 – Hydrogen Combustion II**
  Prof. Ramees Rahman , Center for Advanced Turbomachinery and Energy
  Research (CATER), and Dr. Marc Cremer, Reaction Engineering International
  Bay Room

- **Session 10 – Modeling & Simulation**
  Dr. Edmundo Vasquez, Clean Energy Technologies
  Coastal Room

3:25 to 3:55 p.m. – Break – Island Ballroom

3:55 to 5:55 p.m. – Five Concurrent Sessions

- **Session 11 – Coal Mine Methane - Measurement and Mitigation**
  Evan Granite, U.S. Department of Energy, and Melanie Mackay, Mining
  Engineering, University of British Columbia, **CANADA**
  Beach Room

- **Session 12 – CO$_2$ Conversion and Low Carbon Products II**
  Dr. Aaron Fuller, U.S. Department of Energy, and
  Dr. Naomi R. O'Neil, National Energy Technology Laboratory, U.S.
  Department of Energy
  Gulf Room

- **Session 13 – Pressurized Oxy-Combustion I**
  Dr. Richard Axelbaum, Washington University in St. Louis, and Prof. Andrew
  Fry, Brigham Young University; and Prof. Xuebin Wang, Xi'an Jiatong
  University, **CHINA**
  Palm Room

- **Session 14 – Emissions, Ecofuels & Ecoenergy**
  Dr. Edmundo Vasquez, Clean Energy Technologies and Byron Burrows,
  Tampa Electric Co.
  Bay Room

- **Session 15 – Municipal Solid Waste Combustion**
  Prof. Lunbo Duan, and Prof. Yueming Wang, Ph.D., Southeast University,
  China and Alan Paschedag, Covanta
  Coastal Room

Tuesday, July 25, 2023

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

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

- **Session 16 – CO_2 Point Sources**
  Andrew Hlasko, U.S. Department of Energy, and David Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy
  Beach Room

- **Session 17 – Biomass Conversion II**
  Joshua Stanislowski, UNDEERC
  Gulf Room

- **Session 18 CO_2 – Direct Air Capture II**
  Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy
  Palm Room

- **Session 19 – Pyrolysis & Gasification**
  *Prof. Weihong Yang, KTH Royal Institute of Technology, **SWEDEN; and** Prof. Ashwani K. Gupta, University of Maryland*
  Bay Room

- **Session 20 – Modular Systems for Conversion of Carbon-Based Solids**
  Jonathan W. Lekse, Dushyant Shekhawat, National Energy Technology Laboratory, U.S. Department of Energy; and Frederick Baddour, NREL
  Coastal Room

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

10:30 a.m. to 11:50 p.m. – Five Concurrent Sessions

- **Session 21 – CO_2 Conversion and Low Carbon Products III**
  Dr. Aaron Fuller, U.S. Department of Energy, and Dr. Naomi R. O'Neil, National Energy Technology Laboratory, U.S. Department of Energy
  Beach Room

- **Session 22 – Net Zero Emissions**
  Dr. Lawrence E. Bool, Linde, and
  Dr. Massood Ramezan, KeyLogic
  Gulf Room

- **Session 23 – NH_3 Combustion**
  Clint Bedick, National Energy Technology Laboratory, U.S. Department of Energy
  Palm Room

- **Session 24 – Hydrogen Production I**
  Howard Meyer, GTI, Dr. Marc Cremer, Reaction Engineering Int'l, and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy
  Bay Room

- **Session 25 – Deriving More Value from Waste – Maximized Utilization of Mined Materials II**
  Dr. Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy, and Dr. Dave Osborne, Somerset International Australia,
  AUSTRALIA
  Coastal Room

11:50 p.m. – Luncheon – Island Ballroom
    Luncheon Address: **The Progress of CFB Combustion in China,**
Professor Guangxi Yue, Dept. of Energy and Power Engineering, Tsinghua University, ***CHINA***

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

- **Session 26 – Hydrogen Production II**
  Howard Meyer, GTI, and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy
  Beach Room

- **Session 27 CO_2 – Novel Approaches**
  Andrew Hlasko, U.S. Department of Energy, and Dr. Ronald Breault,
  National Energy Technology Laboratory, U.S. Department of Energy
  Gulf Room

- **Session 28 – PC Fired Units**
  J.J. Letcavits, Consultant, and Alan Paschedag, Covanta
  Palm Room

- **Session 29 – Pressurized Oxy-Combustion II**
  Dr. Richard Axelbaum, Washington University in St. Louis; and Prof. Andrew
  Fry, Brigham Young University; and Prof. Xuebin Wang, Xi'an Jiatong
  University, CHINA
  Bay Room

- **Session 30 – Machine Learning Approach for Scalability Analysis of Energy Systems**
  Dr. Rob Hovsapian, National Renewable Energy Network
  Coastal Room

Wednesday, July 26, 2023

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

8:00 a.m. – Plenary Session – Bay Room
Panel: Concept to Commercial
Moderator: *Dr. Massood Ramezan, KeyLogic*

10:00 a.m. – Break – Island Ballroom

10:30 a.m. to 11:30 a.m. – Four Concurrent Sessions

- **Session 31 – Energy Technology Maturation**
  Dr. Massood Ramezan, KeyLogic
  Beach Room

- **Session 32 – Combustion R&D II**
  Dr. Ashwani Gupta, University of Maryland, and Prof. Prof. Larry Baxter, Brigham Young University
  Gulf Room

- **Session 33 – Biomass Conversion III**
  Joshua Stanislowski, Energy & Environmental Research Center, University of North Dakota
  Palm Room

- **Session 34 – Thermal Management in Advanced Power Systems**
  Dr. Peter Strakey, National Energy Technology Laboratory, U.S. Department of Energy
  Bay Room

11:50 a.m. – Luncheon – Island Ballroom

- **Roundtable/Wrap-up Discussion**

- **Conference Committee Meeting**

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3:15 p.m. to 4:30 p.m. **Overview of Gasification Technologies**

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8:00 a.m. – Plenary Session – Bay Room

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- **Presentation of the Percy Nicholls Award to Dr. Dave Osborne**
- **Keynote Address: The Role of Data in Conventional Energy for a Green Future**
  Prof. Yuxin Wu, Dept. of Energy and Power Engineering, Tsinghua University, CHINA (Prof. Wu will participate in the panel discussion below)

Panel: Future for Computing
Moderator: Dr. Edmundo R. Vasquez, Clean Energy Technologies

- **Advances in Exa-Scale Computing and MFIX Code Development**
  Dr. Jordan Musser, Research Scientist, Computational Science and Engineering Division, National Energy Technology Laboratory, U.S. Department of Energy

- **VVUQ Research Activities in the CFD Domain**
  Dr. Aytekin Gel, Multiphase Flow Science Team, National Energy Technology Laboratory, U.S. Department of Energy, and ALPEMI Consulting, L.L.C.

- **Development of GPU Based CFD Code and the Use of AI/ML in CFD Calculations**
  Dr. Muhammad Sami, Senior Principal Engineer, ANSYS

- **Quantum Computing and Simulations for Energy Applications**
  Dr. Yuhua Duan, Computational Materials Engineering Team, Computational Science & Engineering Directorate, Research & Innovation Center (R&IC), National Energy Technology Laboratory, U.S. Department of Energy

10:30 to 11:00 a.m. – Break – Island Ballroom

Blue indicates speaker is presenting virtually.

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

	Session 1 **CO₂ – Direct Air Capture I** *Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy and Andrew Hlasko, U.S. Department of Energy*	Session 2 **Clean and Secure Energy Driven by AI** *Assoc. Prof. Dr. Wu Yuxin, and Asst. Prof. Dr. Liu Chao, Dept. of Energy and Power Engineering, Tsinghua University,* **CHINA**	Session 3 **Hydrogen Combustion I** *Dr. Ramees Rahman, Center for Advanced Turbomachinery and Energy Research (CATER); Dr. Marc Cremer, Reaction Engineering International*	Session 4 **Artificial Intelligence/Machine Learning (AI/ML) for Energy Systems** *Dr. Rob Hovsapian, National Renewable Energy Network and Massood Ramezan, KeyLogic*	Session 5 **Deriving More Value from Waste – Maximized Utilization of Mined Materials I** *Dr. Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Dave Osborne, Somerset International Australia,* **AUSTRALIA**
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**	**Coastal Room**
11:00 a.m.	**9. An Overview of the U.S. Department of Energy Office of Fossil Energy and Carbon Management's Carbon Dioxide Removal Program** *Andrew Jones, and Elliot Roth, Carbon Dioxide Removal Program, National Energy Technology Laboratory, U.S. Department of Energy; Ian Rowes, Carbon Dioxide Removal and Conversion Division, U.S. Department of Energy; and Jacob Weidman and Henry Long, KeyLogic Systems, LLC,* **USA**	**150. The Energy Loss Analysis of Different Blade Tips for Vertical Axis Wind Turbine** *Qinghong Tang, Department of Energy and Power Engineering, Yuxin Wu, Institute for Carbon Neutrality, Junfu Lyu, Tsinghua University* **CHINA**	**167. Gas Turbine Safety: Autoignition of Hydrogen-Enriched Natural Gas Mixtures** *Christopher Loving, Garrett Mastantuono, Ramees Rahman, Travis Pigon and Subith S. Vasu, Center for Advanced Turbomachinery and Energy Research (CATER), Department of Mechanical and Aerospace Engineering, University of Central Florida; and Angel Hernandez and Scott Cloyd, Mitsubishi Power, Americas, Inc.,* **USA**	**29. Case Study: Automated Machine Learning and AI Diagnostic & Decision Support Application to Improve Plant Performance at Ameren** *Scott Affelt, Expert Microsystems, Inc.,* **USA**	**7. Rare Earth Elements Extraction, Recovery, and Separation** *Michael L. Free, Professor and Chair, Department of Materials Science and Engineering, and Prashant K. Sarswat, John and Marcia Price College of Engineering, College of Mines and Earth Sciences, University of Utah,* **USA**

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Noon	**49. Electrochemically Regenerated Solvent for Direct Air Capture with Hydrogen Co-Generation** *Jinwen Wang and Ayokunle Omosebi, Center for Applied Energy Research, and Xin Gao and Kunlei Liu, Department of Mechanical Engineering, University of Kentucky, and Aron Patrick, PPL Corporation, USA*	**175. Optimal Configuration Design for a Renewable Energy System Integrated with Gas Turbine** *Keyu Jia, Chao Liu, Suhui Li, Dongxiang Jiang, Department of Energy and Power Engineering, Key Laboratory for Thermal Science and Power Engineering of Ministry of Education, Tsinghua University, CHINA*	**126. The Intricate Transport and Kinetic Structure of Hydrogen Flames** *Jacob Wilde, Prof. Morris Argyle and Prof. Larry Baxter, Brigham Young University, USA*	**164. Federated Inference and Distributed Optimization for Scalable AI** *Dr. Anurag K Srivastava, Raymond J. Lane Professor and Chairperson, West Virginia University, Morgantown, WV, and Senior Scientist, Pacific Northwest National Lab, USA*	**66. Extractability Indices for Determination of Optimum Coal Combustion Byproduct Feedstocks for Recovery of Rare Earth Elements** *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*

12:20 p.m. to 1:45 p.m. – Luncheon – Island Ballroom

1:45 to 3:15 p.m. – Five Concurrent Sessions

	Session 6 Biomass Conversion I *Dr. Joshua Stanislowski, UNDEERC*	**Session 7 CO₂ Conversion and Low Carbon Products I** *Dr. Aaron Fuller, U.S. Department of Energy; and Dr. Naomi R. O'Neil, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 8 Combustion R&D I** *Dr. Ashwani Gupta, University of Maryland, and Prof. Larry Baxter, Brigham Young University*	**Session 9 Hydrogen Combustion II** *Dr. Ramees Rahman, Center for Advanced Turbomachinery and Energy Research (CATER); and Dr. Marc Cremer, Reaction Engineering International*	**Session 10 Modeling & Simulation** *Dr. Edmundo Vasquez, Clean Energy Technologies*
	Beach Room	**Gulf Room**	**Bay Room**	**Palm Room**	**Coastal Room**
1:45 p.m.	**111. Gasification of Coal and Biomass: The Route to Net-Negative Carbon Power and Hydrogen** *Horst Hack, Electric Power Research Institute, USA*	**26. CO₂ Conversion and Low Carbon Products** *Dr. Naomi R. O'Neil, CO₂ Removal and Conversion, National Energy Technology Laboratory, U.S. Department of Energy, USA*	**5. Investigations on the Release of Heavy Metals during the Gasification of Waste Wood** *M. Siepmann, E. Yazhenskikh, and M. Müller, Institute of Energy and Climate Research, IEK-2, GERMANY*	**38. Combustion Emissions and Thermal Performance Impacts When Replacing Hydrocarbon Fuels with Hydrogen in Industrial Furnaces and Power Boilers** *Dr. Marc Cremer and Dr. Dave Wang, Reaction Engineering International, USA*	**50. Numerical Simulations and Validations of Multi-Scale Thermosiphon-Concrete Thermal Energy Storage Battery Operating Performance** *Shuoyu Wang, Julio Bravo, Ahmed Abdulridha, Clay Naito, Spencer Quiel, Muhannad Suleiman, Carlos Romero, Sudhakar Neti, Lehigh University, USA*

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2:05 p.m.	116. Corn Stover Combustion with Carbon Capture and Opportunities for Gasification *Dr. Joshua J. Stanislowski, University of North Dakota Energy & Environmental Research Center, USA*	85. High-Value Products from Produced Water Mineralized via Reaction with Anthropogenic CO_2 *Bruce C. Folkedahl, University of North Dakota Energy & Environmental Research Center; and Walt Sherwood, Ryan Johnson, Ryan Trammell, and William Easter, Semplastics/X-MAT, USA*	32. Application of Biomass Gasification Technologies and Distributed Hydrogen and Electric Power Generation for Renewable Energy and Sustainability for Hawaii *Prof. John P Dooher and Peter J. Dooher, Dooher Institute of Physics and Energy, USA*	31. Experimental Work Related Rotary Kilns *Klas Andersson, Chalmers University, SWEDEN*	18. CFD Modeling of NO_x Formation in a Rotating Detonation Engine *Peter A. Strakey, National Energy Technology Laboratory, U.S. Department of Energy, USA*
2:25 p.m.	123. Biomass Density and Diameter Changes During Char Oxidation *Ruochen Wu and Prof. Larry Baxter, Brigham Young University, USA*	58. Understanding the Dynamic Evolution of Dispersed Cu Catalysts for Electrocatalytic CO_2 Reduction to Ethanol: A Combined Experimental and Computational Studies *Cong Liu, Jiayi Xu, Di-Jia Liu, Argonne National Laboratory; and Prof. Tao Xu, Northern Illinois University, USA*	87. Pyrolysis and CO_2-Assisted Gasification of Polyethylene Terephthalate Using FCC Catalyst *Athienkosi Mavukwana, Hau Yang, Fatih Aktas, Kiran G. Burra, Ashwani K. Gupta, The Combustion Laboratory, University of Maryland, Department of Mechanical Engineering, USA; and Celestin Sempuga, Department of Civil and Chemical Engineering, College of Science, Engineering, and Technology, University of South Africa (UNISA), SOUTH AFRICA*	69. Preparational Work of a Small Rotary Kiln for Cement Production and Plasma Installation – An Experimental Study of the Heat Transfer Conditions for Calcination and Clinkerization Reactions *Adrian Gunnarsson, Klas Andersson, Department of Space, Earth and Environment, Chalmers University of Technology; and Bodil Wilhelmsson, Arvid Stjernberg, Alexander Zether, Heidelberg Materials Cement, SWEDEN*	25. Development of an Algorithm to Evaluate the Performance and Economic Feasibility of Expansion of Solar and Wind Power Generation *Ashley McCullough, Lillian Bischof, Ronald Alexander, Selorme Agbleze and Fernando V. Lima, Department of Chemical and Biomedical Engineering, West Virginia University, USA*
2:45 p.m.	124. Utility Scale Measurements of Biomass-Coal Dispersion in Near Burner Regions of Cofired Boilers *Jacob Beutler and Prof. Larry Baxter, Brigham Young University, USA*	59. Electrochemical Conversion of Captured CO_2 To Low Carbon Products *Luis A. Diaz, Daniel Molina Montes de Oca, John Klaehn, Idaho National Laboratory, USA; Kranthi Manian, Feifei Zhang, TWI; and Shiladitya Paul,*	45. Thermal Analysis and Improvement of Municipal Solid Waste Syngas Combustion Applied on Micro Gas Turbine *A. Kaewpradap and S. Jugjai, Department of Mechanical Engineering, Faculty of Engineering,*	106. A Fast Model for Calculating the Distributed Inlet Pressure Differential in the NETL RDE *Dr. John VanOsdol, National Energy Technology Laboratory, U.S. Department of Energy, USA*	34. Volatile Evolution and Temperature Distribution History Study on Pyrolysis of Large Biomass and Coal Particle *Rui Chen, Jun Cai, Xiaobin Qi and Qinggang Lyu, Institute of Engineering Thermophysics, Chinese*

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		University of Leicester, **UNITED KINGDOM**; *Alexios-Spyridon Kyriakides, Athanasios Papadopoulos , Panos Seferlis (CoCaCO$_2$ Consortium) Chemical Process and Energy Resources Institute, Centre for Research and Technology,* **GREECE**	*King Mongkut's University of Technology Thonburi,* **THAILAND**		*Academy of Sciences,* **CHINA**
3:05 p.m.	**148. Gasification of Biomass-derived Pyoil Using Hot Oxygen Technology** *Bradley Damstedt and Larry Bool, Linde Inc. and Geoff Hopkins,and Barry Freel, Ensyn,* **USA**	**55. Development of Low-Carbon Building Products Using CO$_2$ Sequestered into Chemically Stabilized Soils** *Ashish Bastola and Pavan Akula, Civil and Construction Engineering, Oregon State University; Atolo Tuinukuafe, Geochemistry Department, Sandia National Laboratories; Jessica Rimsza, GTI Energy,* **USA**	**139. Aromatic Hydrocarbon Production from Co-Pyrolysis of Biomass and Plastics** *Mengge Wu, Zhiwei Wang, Qun Wang, Zhimin Du, Yan Chen, Shuaihua Guo, Huina Zhu, School of Environmental Engineering, Henan University of Technology, Institute for Carbon Neutrality, Henan University of Technology; Xiaofei Xin, Henan Academy of Sciences; Gaofeng Chen, College of Energy, Xiamen University; Tingzhou Lei, Mengju Zhang, Xiaofei Xin Institute of Urban and Rural Mining, Changzhou University,* **CHINA**; *Kiran G. Burra and Ashwani K. Gupta, The Combustion Laboratory, Dept. of Mechanical Engineering, University of Maryland,* **USA**	**OPEN DISCUSSION**	**168. Mathematical Optimization of NGCC Solvent-based Carbon Capture Processes to Explore High Capture Designs** *Benjamin P. Omell, Miguel Zamarripa, Brandon Paul, Anuja Deshpande, Daison Yancy Caballero, Anca Ostace, Katherine Hedrick, Joshua C. Morgan, National Energy Technology Laboratory, U.S. Department of Energy,* **USA**
3:25 to 3:55 p.m. – Break – Island Ballroom					

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3:25 to 5:55 p.m. – Five Concurrent Sessions

	Session 11 **Coal Mine Methane - Measurement and Mitigation** *Dr. Evan Granite, U.S. Department of Energy and Melanie Mackay, Mining Engineering, University of British Columbia, CANADA*	Session 12 **CO₂ Conversion and Low Carbon Products II** *Dr. Aaron Fuller, U.S. Department of Energy; and Dr. Naomi R. O'Neil, National Energy Technology Laboratory, U.S. Department of Energy*	Session 13 **Pressurized Oxy-Combustion I** *Dr. Richard Axelbaum, Washington University in St. Louis; Prof. Andrew Fry, Brigham Young University; and Prof. Xuebin Wang, Xi'an Jiatong University, CHINA*	Session 14 **Emissions, Ecofuels & Ecoenergy** *Dr. Edmundo Vasquez, Clean Energy Technologies and Byron Burrows, TECO*	Session 15 **Municipal Solid Waste Combustion** *Prof. Lunbo Duan, and Prof. Yueming Wang, Ph.D., Southeast University, CHINA*
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**	**Coastal Room**
3:55 p.m.	**143. UNECE Group of Experts on Coal Mine Methane and Just Transition; Mandate, Activities, Goals and Achievements** *Ray Pilcher, Chairman Group of Experts on Coal Mine Methane, Sustainable Energy Division, United Nations Economic Commission for Europe and Michal Drabik, Chief of Section Economic Affairs, Sustainable Energy Division, United Nations Economic Commission for Europe*	**54. Process Modeling Guides Operational Variables that Affect CO₂ Utilization During the Accelerated Carbonation of Concrete** *Dr. Dale Prentice, Institute for Carbon Management, UCLA, USA*	**103. Experimental Study on Particle Formation in a Pressurized Oxy-Fuel Combustor Using a Novel *in-situ* Optical Instrument** *Mao Cheng, Duarte Magalhaes, Zachariah Wargel, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis, USA*	**48. Formaldehyde Emissions from Lean-Premix and Diffusion Flame Combustion Turbines** *Robert A. Velasco, P.E., BCEE, QEP, Air & Water Programs, Environmental Services, Peoples Gas System/Tampa Electric Company, USA*	**43. Impacting Ash Particle on Initial Submicron Particle Layer and the Effect on Ash Deposition Behavior** *Yueming Wang, Yuxing Wang, Lunbo Duan, Key Laboratory of Energy Thermal Conversion and Control, Ministry of Education, School of Energy and Environment, Southeast University, CHINA*
4:15 p.m.	**132. Brief Review of Catalytic Oxidative Coupling of Methane to Ethane and Ethene** *Evan J. Granite, United States Department of Energy, Fossil Energy & Carbon Management, USA*	**80. Production of Edible Proteins from Captured CO₂** *D. Karali, A. Kalaitzi, P. Grammelis, Centre for Research & Technology Hellas (CERTH)/Chemical Process & Energy Resources Institute (CPERI); V. Steno, Solmeyea, GREECE*	**83. Numerical Investigation of the Characteristics of Pressurized Biomass-Oxy-Combustion** *Lei Li, V'yacheslav Akkerman, Dept. Mechanical & Aerospace Engineering, West Virginia University, Duarte Magalhães, Richard L. Axelbaum, Environmental and Chemical Engineering,*	**109. Water-Energy-Carbon Nexus under Climate Change: Water Supply Analysis for FEED Design of a Power and Carbon Capture Plant** *Zhenxing Zhang, Illinois State Water Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign, USA*	**41. Potassium Capture Characteristics of Ilmenite Ore as Active Bed Material at High Temperature** *Chun Zhu, Zhen Xu, Yuqi Zhang, Lunbo Duan, Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, CHINA*

*Blue indicates speaker is presenting virtually.

		Consortium for Clean Coal Utilization, Washington University in Saint Louis, USA, Jiaye Zhang, Xuebin Wang, Xi'an Jiaotong University, Xi'an, CHINA		
4:35 p.m.	**134. Finding Best Targets for Methane Emissions Reductions from the Oil and Gas Supply Chain** *Prof. Amy Townsend-Small, Professor, University of Cincinnati, USA*	**11. CO_2 Enhanced Biochar for Acidic Agricultural Land Reclamation** *Nehru Chevanan, John T Kelly and Shawn Hawkins, Altex Technologies Corporation, USA*	**89. Dry Feed Pulverized Coal Pressurized Oxycombustion, Operating Data, Mineral Behavior and Corrosion** *Dr. Andrew Fry, Brigham Young University and Andrew Chiodo, Reaction Engineering International, USA*	**12. Beyond Combustion - Coal in the 21st Century** *Evan J. Granite, United States Department of Energy, Office of Fossil Energy and Carbon Management, USA*	**42. Microwave Heating and Catalytic Activity of Iron/Carbon Materials for H_2 Production from the Decomposition of Plastic Wastes** *Peng Zhang, Cai Liang, Mudi Wu, Xiaoping Chen, Daoyin Liu, Jiliang Ma, Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, CHINA*
4:55 p.m.	**165. Detecting & Quantifying Coal Mine Methane Emissions from Space** *David Wares, GHG SAT, CANADA*	**2. Conversion of CO_2 into Materials: Producing CO_2-Negative Building Composites** *Satish K. Nune, David J. Heldebrant, Nicholas C. Nelson, Keerti S. Kappagantula, Jaelynne A. King, John C. Linehan, Yelin Ni, Jose L. Ramos, Yuan Jiang, Katarzyna Grubel, Francesca Pierobon, Deepika Malhotra, Jotheeswari Kothandaraman and Wontae Joo, Pacific Northwest National Laboratory (PNNL), USA*	**108. Process Design and Techno-Economic Analysis of the Modular Staged Pressurized Oxy-Combustion (SPOC) Power Plant for Biomass** *Duarte Magalhaes, Mao Cheng, Zhiwei Yang, Piyush Verma, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis; Scott Hume, George Booras, and Andrew Maxson, Electric Power Research Institute, Inc. (EPRI); and Gabrielle Farrell, Babul Patel, and*	**127. Energy Storage and Carbon Capture Combined Processes** *Prof. Larry Baxter, Brigham Young University, USA*	**70. Migration and Transformation Characteristics of Trace Elements in Fine Particles during Municipal Solid Waste Combustion** *Wu Yang, Lushi Sun, Ben Wang, State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, CHINA; and Rajender Gupta Department of Chemical and Material Engineering, University of Alberta, CANADA*

*Blue indicates speaker is presenting virtually.

			Eric Bober, NexantECA, **USA**		
5:15 p.m.	**OPEN DISCUSSION**	**51. CO_2 Utilization via Concrete Curing** *Prashant Sharan and Rajesh Pawar, Los Alamos National Laboratory,* **USA**	**160. Interplay of Operating Conditions Dictates the Optimal Performance of Tangentially Fired Entrained Flow Reactors** *Nitesh K. Sahu and Mayank Kumar, IIT Delhi,* **INDIA**	**156. Innovations in Power Generation: The "Units 200+" Project in Poland** *J. Ziaja, J. Lichota, Wrocław University of Technology,* **POLAND**	**44. PM_{10} Emission Characteristics and Mineral Transformations during Co-Combustion of Coal and Municipal Sewage Sludge** *Tianyu Liu, Chang Wen, Dapeng Wang, Bohan Zhang, Minghou Xu, State Key Laboratory of Coal Combustion, Huahzong University of Science and Technology,* **CHINA**
5:35 p.m.	**OPEN DISCUSSION**	**169. Near-critical Fluids Treatment for Liquefaction and Extraction of Bio-Fuels** *Kiran R.G. Burra, M. Sahin and A. K. Gupta, University of Maryland, Dept of Mechanical Engineering,* **USA**	**OPEN DISCUSSION**	**155. Decarbonization Approaches to Conversion of Stranded Energy Resources to Value-Added Products through Microwave Catalysis** *Jianli (John) Hu, West Virginia University,* **USA**	**OPEN DISCUSSION**
5:55 p.m. – Conclusion of the Technical Program					

*Blue indicates speaker is presenting virtually.

Clearwater Clean Energy Conference				
Tuesday, July 25, 2023				
7:30 to to 8:00 a.m. – Breakfast – Island Ballroom				
8:00 to 10:00 a.m. – Five Concurrent Sessions				
	Session 16 **CO_2 – Point Sources** *Andrew Hlasko, U.S. Department of Energy and David Hopkinson, National Energy Technology Laboratory*	**Session 17** **Biomass Conversion II** *Dr. Joshua Stanislowski, UNDEERC*	**Session 18** **CO_2 – Direct Air Capture II** *Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy*	**Session 19** **Pyrolysis & Gasification** *Prof. Weihong Yang, KTH Royal Institute of Technology, **SWEDEN;** and Prof. Ashwani K. Gupta, University of Maryland*	**Session 20** **Modular Systems for Conversion of Carbon-Based Solids** *Jonathan W. Lekse, National Energy Technology Laboratory, U.S. Department of Energy; and Frederick Baddour, NREL*
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**	**Coastal Room**
8:00 a.m.	**53. Modeling and Uncertainty Quantification of CESAR1 Solvent System for Post-Combustion Capture** *Dr. Joshua C. Morgan (Support Contractor), Michael Matuszewski (Support Contractor), Benjamin Omell, National Energy Technology Laboratory, U.S. Department of Energy, **USA**; and Matthew Campbell, Koteswara Rao Putta, and Muhammad Ismail Shah, CO_2 Technology Centre Mongstad, **NORWAY***	**35. Update on Szego Mill Scale-Up for Biomass Processing** *Dr. Olev Trass, Department of Chemical Engineering, University of Toronto, **CANADA***	**75. Amine-functionalized MOFs by Directional Regulation of Deprotonation during Grafting Reaction for Direct Air Capture of CO_2** *Fengsheng Liu, Tao Wang, Muhang He, State Key Laboratory of Clean Energy Utilization, Zhejiang University, **CHINA***	**15. Development of Rotary Kiln-Based Conversion Technology for Hydrogen-Enriched Syngas Production from Coal Waste and Biomass** *Dr. Hong-Shig Shim, Xiaolong Li, and Martin Denison, Reaction Engineering International; and Eric Eddings, and Ignacio Preciado, University of Utah, **USA***	**170. A Vision for the Future of Carbon Conversion** *Jonathan W. Lekse, National Energy Technology Laboratory, U.S. Department of Energy, **USA***

*Blue indicates speaker is presenting virtually.

8:20 a.m.	**67. Low Concentration Carbon Dioxide Capture Using MEEP-Based Membranes** *Birendra Adhikari, Christopher J. Orme, Amit S. Nilkar, Hyeonseok Lee, John R. Klaehn, Joshua S. McNally, Aaron D. Wilson, and Frederick F. Stewart, Idaho National Laboratory (INL), USA*	**4. Process Intensification for Coal and Biomass Gasification for Distributed Power and Hydrogen Production** *John P. Dooher, Ying of Balquhain Fellow, Adelphi University/Dooher Institute of Physics; Marco J. Castaldi, Chemical Engineering Department, City College of New York, City University of New York; and Dean Modroukas, Innoveering LLC, USA*	**72. Design and Costing of an ION Clean Energy CO_2 Capture Plant Retrofitted to an 857 MW Natural Gas Combined Cycle Power Station** *N.A. Fine, A.R. Awtry, J.P. Tomey, B.D. Dinsdale, J.S. Atcheson, E.E.B. Meuleman, A.E. Brown, ION Engineering, USA*	**14. Effect of Ash on Biomass Char Gasification Reactivity by H_2O and CO_2** *Yuxin Wang and Ryo Yoshiie, Department of Mechanical Systems Engineering, and Yasuaki Ueki and Ichiro Naruse, Institute of Materials and Systems for Sustainability, Nagoya University, Tokai National Higher Education and Research, JAPAN*	**64. CFD Modeling Development of Pyrolysis and Gasification of Mixed Feedstocks** *Mehrdad Shahnam*
8:40 a.m.	**73. NETL's Analysis of Carbon Capture Retrofits for Cement Plants** *Sydney Hughes, National Energy Technology Laboratory, U.S. Department of Energy, USA*	**16. Rotary Kiln Approach to Produce Biochar from Invasive Scrub Species for Soil Remediation and Carbon Sequestration** *Dr. Hong-Shig Shim, Xiaolong Li, and Martin Denison, Reaction Engineering International; Clifford Smith, Bay Point Capital Partners; and Eric Eddings and Ignacio Preciado, University of Utah, USA*	**81. Illinois Basin Regional DAC Hub** *Chinmoy Baroi, Kevin C. O'Brien, and Beth Meschewski, Illinois Sustainable Technology Center, USA*	**86. Effect of Spent FCC Catalyst in Pyrolysis and CO_2-Assisted Gasification of Pinewood** *Athienkosi Mavukwana, Hau Yang, Fatih Aktas, Kiran G. Burra, Ashwani K. Gupta, The Combustion Laboratory, University of Maryland, Department of Mechanical Engineering, USA; and Celestin Sempuga, Department of Civil and Chemical Engineering, College of Science, Engineering, and Technology, University of South Africa (UNISA), SOUTH AFRICA*	**142. Products Distribution during Co-pyrolysis of Biomass and Waste Plastics Using a Catalyst** *Shuaihua Guo, Zhiwei Wang, Mengge Wu, Yan Chen, Zhimin Du, School of Environmental Engineering, Henan University of Technology, and Institute for Carbon Neutrality, Henan University of Technology; Mengju Zhang, Zaifeng Li, Xiaofei Xin, Henan Academy of Sciences; Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University, CHINA; Kiran G. Burra, Ashwani K. Gupta, The Combustion Laboratory, Department of Mechanical Engineering, University of Maryland, USA*

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9:00 a.m.	74. NETL's Carbon Capture Retrofit Databases *Sydney Hughes, Alex Zoelle, Mark Woods, Samuel Henry, Sally Homsy, Sandeep Pidaparti, Norma Kuehn, Hannah Hoffman, Katie Forrest, Timothy Fout, William Summers, Steve Herron, Eric Grol, National Energy Technology Laboratory, U.S. Department of Energy,* **USA**	94. The Effect of Biomass/Coal Blend Combustion on the Fate of Sulfur *Rajarshi Roy, Brigham Young University,* **USA**	79. Effects of Additives on the Corrosivity of Fine Particles during Municipal Solid Waste Combustion *Wu Yang, Ben Wang, Lushi Sun, State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, Wuhan,* **CHINA**; *and Rajender Gupta, Department of Chemical and Material Engineering, University of Alberta,* **CANADA**	**144. Co-pyrolysis Characteristics of Different Agroforestry Residues and Polyethylene Terephthalate** *Yan Chen, Zhiwei Wang, Zhimin, Shuaihua Guo, Mengge Wu, School of Environmental Engineering, Henan University of Technology, and Institute for Carbon Neutrality, Henan University of Technology; Gaofeng Chen, College of Energy, Xiamen University; Tingzhou Lei, Institute of Urban and Rural Mining, Changzhou University, Mengju Zhang, Xiaofei Xin, Shuhua Yang, Qun Wang Henan Academy of Sciences,* **CHINA**; *and Kiran G. Burra, Ashwani K. Gupta, The Combustion Laboratory, Department of Mechanical Engineering, University of Maryland,* **USA**	63. Graphite for Lithium-Ion Batteries from Biomass Pyrolysis Oil *Mark R. Nimlos, Steven M. Rowland, Bertrand J. Tremolet de Villers, Sang-Don Han, National Renewable Energy Laboratory; Michael Regula, Zachary Combs, Birla Carbon; Cara Fagerholm, Battery Innovation Center; Shaikat Chandra Dey, Lilian Lower, William Joe Sagues, Stephen S. Kelley, Sunkyu Park, North Carolina State University,* **USA**; *, Barry Freel, Geoff Hopkins, Ensyn Technologies Inc.,* **CANADA**; *and Tijmen Vries, Ton Vries, BioBTX,* **THE NETHERLANDS**
9:20 a.m.	**76. An Industrial Demonstration Study on CO$_2$ Mineralization Curing for Concrete** *Tao Wang, Zhenwei Yi, State Key Laboratory of Clean Energy Utilization,iang University,* **CHINA**	30. Using Chemical Looping and Oxygen Combustion with Biomass or Waste Fuels to Produce Negative Carbon-Intensity Hydrogen or Steam *Will Latta, Babcock & Wilcox,* **USA**	131. Timeline for Implementation of Full-Scale Carbon Capture Projects *Jason D. Laumb, University of North Dakota Energy & Environmental Research Center,* **USA**	84. Performances of Hollow ZSM-5 Catalyst with Encapsulated Highly Dispersed Ni for Catalytic Biomass Tar Cracking *Lei Shi, Yuanquan Xiong, School of Energy and Environment, Southeast University,* **CHINA**	**57. Microwave-Assisted Gasification: Opportunities and Challenges** *Pranjali Muley, Abedin, Ashraf, and Xinwei Bai (Support Contractors), and Mark Smith, National Energy Technology Laboratory, U.S. Department of Energy,* **USA**

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9:40 a.m.	101. Integration of CO_2 Capture in Natural Gas Combined Cycle Power Plants – Comparison of Pre- vs. Post-Combustion Carbon Capture *Justin Tiedeman and Jim Keane, Wood PLC, USA*	96. Biomass to Syngas: Advancements in the OSU's Moving Bed Reducer Technology for Biomass Gasification *Rushikesh K. Joshi, Cody Park, Yaswanth Pottimurthy, Eric Falascino, Dikai Xu, Dawei Wang, Anuj Joshi, Pinak Mohapatra, Sonu Kumar, Ashin Sunny, Soohwan Hwang, Vedant, Shah, Qichang Meng, Qiaochau Zhang, Andrew Tong, and Liang-Shih Fan, Department of Chemical and Biomolecular Engineering, The Ohio State University, USA*	125. Cost-effective Direct Air Capture Options *Prof. Larry Baxter, Brigham Young University, USA*	OPEN DISCUSSION	OPEN DISCUSSION
10:00 to 10:30 a.m. – Break – Island Ballroom					

*Blue indicates speaker is presenting virtually.

10:30 to 11:50 a.m. – Five Concurrent Sessions

	Session 21 **CO$_2$ Conversion and Low Carbon Products III** *Dr. Aaron Fuller, U.S. Department of Energy; and Dr. Naomi R. O'Neil, National Energy Technology Laboratory, U.S. Department of Energy*	Session 22 **Net Zero Emissions** *Dr. Lawrence E. Bool, Linde and Massood Ramezan, KeyLogic*	Session 23 **NH$_3$ Combustion** *Clint Bedick, National Energy Technology Laboratory, U.S. Department of Energy*	Session 24 **Hydrogen Production I** *Howard Meyer, GTI Energy; and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy*	Session 25 **Deriving More Value from Waste – Maximized Utilization of Mined Materials II** *Dr. Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy and Dr. Dave Osborne, Somerset International Australia, AUSTRALIA*
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**	**Coastal Room**
10:30 a.m.	**162. Efficient CO$_2$ to Methanol Production, A Commercially Available, Scalable and Proven Process** *Dr. Cathy Tway, Johnson Matthey, USA*	**118. Technologies in Support of Clean Hydrogen Production and Net-Zero Carbon Emissions Energy Systems** *Dave Lyons, National Energy Technology Laboratory and Jay-Woh Kim, U.S. Department of Energy, USA*	**61. Ammonia as a Fuel for Aviation** *Brandon Cotto, Marcel Otto, Ladislav Vesely, Jayanta Kapat, University of Central Florida, USA*	**151. R-GAS Partial-Oxidation (POX) Reactor for Blue Hydrogen Production from Natural Gas and Bio-mass Feedstocks – A Techno Economic Analysis** *Zach El Zahab, GTI Energy, USA*	**39. Domestic Wastes and Byproducts – A Potential Resource for Critical Material Supply Chains** *Evan J. Granite, Grant Bromhal, Jennifer Wilcox, Anna Wendt, Savannah Rice, and Mary Anne Alvin, U.S. Department of Energy, USA*
10:50 a.m.	**56. Molten Salt Mediated CO$_2$ Conversion for Co-production of CO and Ethylene** *Kyle Vogt-Lowell, Junchen Liu, Dennis Chacko, Luke M. Neal and Fanxing Li, NC State University, USA*	**129. Hydrogen Mid-Century Net-Zero Scenario for the State of Wyoming and its Economic Impacts** *Eugene Holubnyak, Haibo Zhai, Timothy Considine, Manish Maurya, Casey Dschaak, Hydrogen Energy Research Center, School of Energy Resources, University of Wyoming, USA*	**8. Ammonia and Cracked Ammonia Laminar Flame Speed Measurements Using the Burner Heat Flux Method and IR Thermometry** *Wesley Boyette, Clinton Bedick, Peter Strakey, National Energy Technology Laboratory, U.S. Department of Energy, USA*	**23. Clean Hydrogen Production by Decarbonizing Natural Gas by Carbon-Catalyzed Thermal Decomposition** *Mpila Nkiawete, Randy Vander Wal, The EMS Energy Institute and the John and Willie Leone Family Department of Energy and Mineral Engineering, Pennsylvania State University, USA*	**114. Upgrading of Raw Coal and Coal Waste for Coal-Derived Graphene Process** *Nicholas E. Stanislowski, Alexander Azenkeng, and Jason D. Laumb, University of North Dakota Energy & Environmental Research Center, USA*

*Blue indicates speaker is presenting virtually.

11:10 a.m.	**10. Challenges and Opportunities of Commercial CO$_2$ Electrolysis** *Dr. Sichao Ma, Twelve Benefit Corporation dba Twelve, USA*	**130. Conceptual Design Study on Gasification of Coal and Biomass to Generate Carbon-Free Electric Power and Hydrogen** *Horst Hack, Electric Power Research Institute, USA*	**117. Investigation of Combustion, Heat Transfer, and Emissions Impacts of co-firing Ammonia with Coal in Pulverized Coal Boilers** *Zhonghua Zhan, Marc Cremer, Dave Wang, Hong-Shig Shim, Reaction Engineering International, USA*	**98. Subsurface Hydrogen Production: Technology Overview and Techno-Economic Analysis** *Dr. Shadi Salahshoor, GTI Energy, USA*	**133. Using Coal Tailings-Based Aggregates for Road Construction** *D. G. Osborne, Somerset International Australia; Z. Tao, Z. Chen, A. Khazaie and S. Jahandan, Western Sydney University; M Rahme, Nu-Rock Technology Pty Ltd.; and A Harriman, Altonx, AUSTRALIA*
11:30 p.m.	**173. High Efficiency Electrochemical Conversion of Carbon Dioxide to Ethylene – Electrode Development and Technoeconomic Analysis** *Xiao-Dong Zhou, University of Connecticut and UL Lafayette, and Jingjie Wu, University of Cincinnati, USA*	**71. Overview of DOE/FECM Gasification Systems Program** *Jai-woh Kim, Hydrogen with Carbon Management, U.S. Department of Energy, and Dr. Dave Lyons, Gasification Systems, National Energy Technology Laboratory, U.S. Department of Energy*	**128. Ammonia Co-firing in Coal Based Power Generation from EU Perspective** *Jarosław Zuwała Professor, Ph.D., D. Sc., Eng., Institute for Energy and Fuel Processing Technology, POLAND*	**OPEN DISCUSSION**	**68. Full Scale Demonstration of Somerset Sub325® Technologies for Value Recovery and Dewatering: Discussion of Testing Procedures and Results from Multiple Locations, Applications, and Industries** *D.G. Osborne and J. Fisher; Somerset International Australia, AUSTRALIA*

11:50 to 1:30 p.m. – Luncheon – Island Ballroom
Luncheon Speaker: *Professor Yue Guangxi, Dept. of Energy and Power Engineering, Tsinghua University, China*

The Progress of CFB Combustion in China

*Blue indicates speaker is presenting virtually.

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

	Session 26 Hydrogen Production II *Howard Meyer, GTI Energy, and Dr. Pete Strakey, National Energy Technology Laboratory, U.S. Department of Energy*	Session 27 CO₂ – Novel Approaches *Andrew Hlasko, U.S. Department of Energy; and Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy; and Prof. Larry Baxter, Brigham Young University*	Session 28 PC Fired Units *J.J. Letcavits, AEP and Alan Paschedag, Covanta*	Session 29 Pressurized Oxy-Combustion II *Dr. Richard Axelbaum, Washington University in St. Louis, and Prof. Andrew Fry, Brigham Young University; and Prof. Xuebin Wang, Xi'an Jiatong University, CHINA*	Session 30 Machine Learning Approach for Scalability Analysis of Energy Systems *Dr. Rob Hovsapian, National Renewable Energy Network*
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**	**Coastal Room**
1:30 p.m.	**171. Overview of Natural Gas as a Feedstock for Hydrogen Production** *Howard Meyer, and Michael Bradford GTI Energy; and Des Dillon, EPRI,* **USA**	**24. U.S. DOE Office of Fossil Energy and Carbon Management, CCS Research and Technology Development Program Update** *Andrew M. Hlasko, P.Eng. U.S. Department of Energy, Office of Fossil Energy & Carbon Management, Senior Program Manager, Point Source Carbon Capture,* **USA**	**19. Combustion Optimization at Longview Power Reduces Emissions While Achieving Improved Heat Rate and Efficiency** *Jeremy A. Brown and Timothy Fuller, Babcock & Wilcox,* **USA**	**102. Modular Staged Pressurized Oxy-Combustion (SPOC) Power Plant for Coal and Biomass – Integration of Combustor Boiler and DCC** *Duarte Magalhaes, Mao Cheng, Anand Sankaranarayanan, Zachariah Wargel, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal Utilization, Washington University in Saint Louis,* **USA**	**36. Scanning Electron Microscopy Phase Mapping Using Artificial Intelligence** *Shuchita Patwardhan, David Stadem, Dr. Steven Benson, Hannah Huffman and Seth Thoelke, Microbeam Technologies Inc.,* **USA**
1:50 p.m.	**13. Performance Testing of a Moving-Bed Gasifier Using Coal, Biomass, and Waste Plastic Blends to Generate Hydrogen** *George Booras, Electric Power Research Institute; Rolf E. Maurer, and David P. Thimsen, Hamilton Maurer International, Inc.;* **USA**; *and Alberto Pettinau,*	**6. Design and Operation of 150Kt/y Coal Fired Flue Gas CO₂ Chemical Absorption Demonstration Project with Low Energy Consumption** *Prof. Mengxiang Fang, Prof. Tao Wang, Qingshanhu Energy Research Center, Zhejiang University; Dr. Rui Zhao and Dr. Dong Xu, New*	**46. Full-scale Single Burner Testing and CFD Modeling of a High Temperature Oxy-Coal Burner** *Andrew Chiodo and Brydger Van Otten, Reaction Engineering International, and Steve Krimsky, Jupiter Oxygen Corporation,* **USA**	**78. Nitrogen Transformation during Pressurized Oxy-Combustion of Biomass** *Gaofeng Dai, Xuebin Wang, Jiaye Zhang, Houzhang Tan, MOE Key Laboratory of Thermo-Fluid Science and Engineering, Xi'an Jiaotong University, CHINA*	**152. Dynamic Modeling and Validation of Heavy-Duty Gas Turbines Using Machine Learning** *Mayank Panwar, Julian D. Osorio, and Rob Hovsapian, NREL,* **USA**

*Blue indicates speaker is presenting virtually.

	and Simone Meloni, Sotacarbo – Società Tecnologie Avanzate Low Carbon S.p.A., **ITALY**	*Energy Research Technology Institute, China Energy Investment; and Yan Huang, Guoneng Jinjie Energy Co., Ltd., CHINA*			
2:10 p.m.	**97. Next-Generation Technology Integration Platform for Low- and Zero-Carbon Ammonia Production and Utilization** *Dr. Sameer Parvathikar, RTI International,* **USA**	**99. Transformational Membranes for Carbon Capture and Utilization** *Shiguang Li, and Howard Meyer, GTI Energy; Yang Han, Winston Ho, The Ohio State University; Miao Yu, University at Buffalo; and Xinhua Liang, Washington University in St. Louis, USA*	**95. Neural Net Power Plant Control – Developing Real-Time Assessment of Net Unit Heat Rate Through Load Swings in a Coal-Fired Power Plant for Dynamic NN Control** *Keane Stewart, Brigham Young University,* **USA**	**90. Impacts of Pressure on Metals Partitioning on Ash Aerosols in Oxy-coal Combustion** *Andrew Chiodo, Zhonghua Zhan, and Xiaolong Li, Reaction Engineering International, and Jost O.L. Wendt, University of Utah,* **USA**	**135. Performance Evaluation of Solar Thermal Energy Conversion Systems Using Data Driven Machine Learning** *Julian D. Osorio, Center for Energy Conversion & Storage Systems, Mayank Panwar, Power Systems Engineering Center, and Rob Hovsapian, Energy Systems Integration, National Renewable Energy Laboratory; George Karniadakis and Shengze Cai, Division of Applied Mathematics & School of Engineering, Brown University; Chrys Chryssostomidis, Department of Mechanical, Massachusetts Institute of Technology,* **USA***; and Zhicheng Wang, Laboratory of Ocean Energy Utilization of Ministry of Education, Dalian University of Technology,* **CHINA**
2:30 p.m.	**52. Hydrogen Production from Produced Water** *Prashant Sharan, Michael Dugas, Robert Currier and Alp Findikoglu Los Alamos National Laboratory,* **USA**	**120. Cryogenic Carbon Capture – Cost Effective and Energy Efficient Path to Climate Change Mitigation** *Prof. Larry Baxter, Brigham Young University,* **USA**	**110. Big Rivers Coal to Gas Conversion: CFD and Thermal Performance Model-Based Evaluation of Combustion, Heat Transfer, and Emissions** *Marc Cremer, Dave Wang Reaction Engineering International; and Brian*	**104. In-situ Measurement of Moist Flue Gas under High Pressure Using a Nafion Dryer and FTIR** *Mao Cheng, Duarte Magalhaes, and Richard L. Axelbaum, Energy, Environmental and Chemical Engineering, Consortium for Clean Coal*	**107. DNN Power Grid Classifier as a Surrogate for Graph-Search Algorithms for the Survivability Analysis** *Juampablo E. Heras Rivera, Dr. Svetlana V. Poroseva, Department of Mechanical Engineering, University of New Mexico,* **USA**

*Blue indicates speaker is presenting virtually.

		King Burns and McDonnell, **USA**	*Utilization, Washington University in Saint Louis,* **USA**	
2:50 p.m.	**OPEN DISCUSSION**	**161. University of Kentucky CO_2 Capture for Coal-fired Flue Gas** *Associate Professor Kunlei Liu, Department of Mechanical Engineering, and Brad Irvin, Reynolds Frimpong and Heather Nikolic, Institute of Decarbonization and Energy Advancement, College of Engineering,* **USA**	**113. Particulate from Lignite Coal Combustion and Impact on Carbon Capture Aerosol Emissions** *Joshua R. Strege, Energy & Environmental Research Center,* **USA**	**92. Shakedown and Operation of a 1.5 MWth Coal-fired sCO_2 Power Cycle** *Andrew Fry, Brigham Young University,* **USA**	**OPEN DISCUSSION**
0 p.m.	**OPEN DISCUSSION**	**157. Dual Function Materials for Direct Air Capture and Catalytic Conversion of CO_2 into Renewable Natural Gas** *Jonathan E. Peters, Andrew Tong, Vasudev Haribal, Jian-Ping Shen, S. James Zhou, Raghubir Gupta, Susteon; and Monica Abdallah, Chae Jeong-Potter, Robert Farrauto, Columbia University,* **USA**	**OPEN DISCUSSION**	**91. Modeling of Experimental Parameters That Will Impact Heat Flux and Tube Metal Temperatures** *Andrew Chiodo, Reaction Engineering International, and Dr. Andrew Fry, Brigham Young University,* **USA**	**OPEN DISCUSSION**
3:30 p.m. Conclusion of the Technical Program and Break – Island Ballroom				

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Clearwater Clean Energy Conference
Wednesday, July 26, 2023

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

8:00 a.m. – Plenary Session – Panel: Concept to Commercial – Bay Room

Moderator: *Dr. Massood Ramezan, KeyLogic*

- *Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy*

- *Dr. Lawrence Bool, Linde, Inc.*

- *David Lyons, National Energy Technology Laboratory, U.S. Department of Energy*

- *Joshua Stanislowski, Energy& Environmental Center, University of North Dakota*

- *Dr. Zach El Zahab, GTI Energy*

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

10:30 to 11:50 a.m. – Four Consecutive Sessions

	Session 31 **Energy Technology Maturation** *Massood Ramezan, KeyLogic*	Session 32 **Combustion R&D II** *Prof. Ashwani K. Gupta, University of Maryland and Prof. Larry Baxter, Brigham Young University*	Session 33 **Biomass Conversion III** *Joshua Stanislowski, UNDEERC*	Session 34 **Thermal Management in Advanced Power Systems** *Dr. Peter Strakey, National Energy Technology Laboratory, U.S. Department of Energy*
	Beach Room	**Gulf Room**	**Palm Room**	**Bay Room**
10:30 a.m.	**149. Maintaining Microstructure – The Path to Successful Technology Maturation in Fluidized Systems** *Dr. Ronald W. Breault, National Energy Technology Laboratory, U.S. Department of Energy,* **USA**	**119. Ash Effects on Char Reactivity – Definitive Experimental and Theoretical Indications of Late-Stage Burnout Reactivity Changes** *Ruochen Wu and Prof. Larry Baxter, Brigham Young University,* **USA**	**77. Emission and Distribution of Dioxin in a Coal-Fired Power Plant Coupled with Garbage and Biomass** *Yili Zhang, Ao Zhou, Su Zhang, Xuebin Wang, MOE Key Laboratory of Thermo-Fluid Science and Engineering, Xi'an Jiaotong University,* **CHINA**	**47. Investigating the Nature of Pilot-Assisted Premixed Ammonia/Methane/Air Blends as an Alternative Fuel in a Swirl Stabilized Gas Turbine Combustor: Flame Stability and Wall Heat Transfer Study** *Meghna Das Chaudhury, Abinash Sahoo, Srinath V. Ekkad, Venkateswaran Narayanaswamy, Depart-ment of Mechanical and Aerospace Engineering, North Carolina State University,* **USA**

*Blue indicates speaker is presenting virtually.

10:50 a.m.	153. An Overview of DOE/NETL's Successes in Technology Maturation and Readiness for Market *David Lyons, National Energy Technology Laboratory, U.S. Department of Energy, USA*	122. Statistical Analysis of Arrhenius Data *Prof. Larry Baxter, Brigham Young University, USA*	3. Steam Reforming of Biomass Pyrolysis Volatiles Using an Electrified 3D-Printed Catalyst *José Juan Bolívar Caballero, Tong Han, Rikard Svanberg, Ilman Nuran Zaini, Pengcheng Cao, Thomas Lewin, Pär G. Jönsson, Weihong Yang, Department of Materials Science and Engineering, KTH Royal Institute of Technology, SWEDEN*	137. High-Speed Turbine Aero Thermal Developments for Clean Power Generation *Guillermo Paniagua, Purdue University, Zucrow Laboratories, USA*
11:10 a.m.	154. Carbon Molecular Sieve Membranes for Gas Separations – Materials to Industrial Platform Development *Rajinder P. Singh, Los Alamos National Laboratory, New Mexico, USA*	112. Front End Engineering Design for CO_2 Capture at Coal Creek Station *Jason Laumb, Energy & Environmental Research Center, University of North Dakota, USA*	138. Plasma Gasification of Raw Waste Biomass After Preliminary Pretreatment *Halina Pawlak Kruczek, Michał Ostrycharczyk, Marcin Baranowski, Mateusz Wnukowski, Krystian Krochmalny, Piotr Bojarski, Mateusz Kowal, Michał Czerep, Jakub Mularski, and Monika Serafin-Tkaczuk, Wrocław University of Science and Technology; and Tadeusz Mączka and Bartłomiej Borkowski, IASE Institute of Power Systems Automation, POLAND*	60. Evaluation of Waste Heat Recovery Systems for Industrial Decarbonization *Ladislav Vesely and Jayanta Kapat University of Central Florida, Center for Advanced Turbomachinery and Energy Research; and Logan Rapp, Sandia National Laboratories, USA*
11:30 a.m.	163. Ceramic Bilayer Structure Technology for a Pressure Driven Oxygen Separation from Air *David Reed, Josef Matyáš, Gregory Coffey, Jon Helgeland, Pacific Northwest National Laboratory, USA*	OPEN DISCUSSION	140. Combined Heat and Power Study for North Dakota Ethanol Plants *Joshua R. Strege, Kerryanne M. Leroux, Janet L. Crossland, John P. Kay, and Christopher J. Beddoe, Energy & Environmental Research Center, USA*	93. Predictive Model Control of Heat Flux to the Primary Heat Exchanger in a Coal Fired sCO_2 System *Brian Schoof, Brigham Young University, USA*

11:50 a.m. – Luncheon – Island Ballroom

- Roundtable/Wrap-up Discussion
- Conference Committee Meeting

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