

**The 44th International Technical Conference on
Clean Energy**

The Clearwater Clean Energy Conference

June 16 to 21, 2019

Clearwater, Florida, USA

**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 Six
Continents, Then You Must Attend**

The Clearwater Clean Energy Conference



THE CLEARWATER CLEAN ENERGY CONFERENCE

The Agenda

Sunday, June 16th

9:00 – 11:00 a.m. – **Fundamental Experiments and Modeling for Direct-Fired Supercritical CO₂ Combustion**

Prof. Subith Vasu, Center for Advanced Turbomachinery and Energy Research (CATER), University of Central Florida

11:15 a.m. – 1:15 p.m. – **Combustion Tuning: Why and How**

Alan Paschedag, Covanta, Inc., and J.J. Letcavits, American Electric Power

1:30 p.m. – 3:30 p.m. – **Catalysts and Sorbents for Pollution Control**

Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy

3:45 p.m. – 5:45 p.m. – **Course 4**

Monday, June 17th

8:30 a.m.—**Continental Breakfast in the Exhibit Center – Exhibit Center**

9:00 a.m. – **Morning Keynote Address & Panel:**

Dr. Randy Gentry, Chief Research Officer and Deputy Director, Science & Technology, National Energy Technology Laboratory, U.S. Department of Energy

Panel: Commercialization of R&D Technologies

Chair: Massood Ramezan, KeyLogic

11:30 a.m. – **Lunch in the Exhibit Center**

12:45 p.m. – **Afternoon Keynote Address & Panel:**

Industrial Boiler Dispatched during Energy Emergencies

Robert Bessette, Council of Industrial Boiler Operators

Panel: Impact of Renewables on Grid Stabilization

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

3:15 p.m. **Break in the Exhibit Center**

3:45 p.m. – **Four Concurrent Technical Sessions**

Session 1 - Sand Key CO₂ Capture, Storage & Reuse I

Dave Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, and Victor Kusuma, Battelle

Session 2 - Gulf Room Grid Stability

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

Session 3 - Palm Room Oxy-Combustion I

Prof. Terry Wall, University of Newcastle, Australia & Klas Andersson, Chalmers University, Sweden

Session 4 - Beach Room Coal Upgrading for Value Added Products

Gerardine Botte, Ohio University

5:30 p.m. **Beach Party (Poolside, Weather Permitting)**

Tuesday, June 18th

7:30 a.m. **Continental Breakfast in the Exhibit Center**

8:00 a.m. **Four Concurrent Technical Sessions**

Session 5 - Sand Key Room
Advances in Analytical and Testing Techniques
Dave Osborne, Somerset

Session 6 - Modeling
Dr. Edmundo Vasquez, Clean Energy Technologies

Session 7 - Palm Room
Data Analytics and Advanced Control Strategies I
Larry Shadle, National Energy Technology Laboratory, U.S. Department of Energy

Session 8 - Bay Room
Gasification for Power & Chemicals I
Massood Ramezan, KeyLogic and Kunlei Liu, University of Kentucky

10:00 a.m. Break – Exhibit Center

10:30 a.m. – Plenary: The Legacy of Prof. Janos M. Beer, Massachusetts Institute of Technology
Dr. Ashwani Gupta, University of Maryland

12:10 p.m. – Lunch – Exhibit Center

1:30 p.m. – Panel: Waste To Energy
Chair: Dr. Ashwani Gupta, University of Maryland

3:30 p.m. – Break – Exhibit Center

4:00 p.m. Four Concurrent Technical Sessions

Session 9 - Sand Key Room
Radiation
Brad Adams, Brigham Young University

Session 10 - Gulf Room
CO₂ Capture, Storage & Reuse II
Dave Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, and Victor Kusuma, Battelle

Session 11 - Palm Room
Advanced Cycles for Power Generation
Horst Hack, EPRI

Session 12 - Bay Room
Data Analytics and Advanced Control Strategies II
Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy

6:00 p.m. – Pizza Night for the Students

Wednesday, June 19th

7:30 a.m. **Continental Breakfast in the Exhibit Center**

8:00 a.m. **Four Concurrent Technical Sessions**

Session 13 - Sand Key Room
Recovery of Rare Earth Minerals
Eric Eddings, University of Utah

Session 14 - Gulf Room
Biomass & Biomass Cofiring I
Les Marshall, Ontario Power Generation, Canada

Session 15 - Palm Room
Chemical Looping I
JoAnn Lighty, Boise State University

Session 16 - Bay Room
Combustion & Gasification I
Ashwani Gupta, University of Maryland and Weihong Yang, KTH Royal Institute of Technology, Sweden

10:00a.m. – Break – Exhibit Center

Wednesday, June 19th (cont'd)

10:30 a.m. **Four Concurrent Technical Sessions**

**Session 17 - Sand Key Room
Energy From Waste**

Alan Paschedag, Covanta

**Session 18 - Gulf Room
Combustion Emissions**

Dr. Edmundo Vasquez, Clean Energy Technologies and Byron Burrows, TECO

**Session 19 - Palm Room
Chemical Looping II**

Robert Stevens, National Energy Technology Laboratory, U.S. Department of Energy and Andrew Tong, Ohio State

**Session 20 - Beach Room
PC Fired Units**

J.J. Letcavits, AEP

12:10 p.m. – **Lunch in the Exhibit Center**

1:30 p.m. **Two Concurrent Panels –**

Treating and Recovering Value from Mineral Residues

Dave Osborne, Somerset

Emissions: The Current Status

Chair: Dr. Edmundo Vasquez, Clean Energy Technologies

3:30 p.m. – **Break in the Exhibit Center**

4:00 p.m. – **Four Concurrent Technical Sessions**

**Session 21 - Sand Key Room
Oxy-Combustion II**

Prof. Terry Wall, University of Newcastle, Australia and Klas Andersson, Chalmers University, Sweden

**Session 22 - Gulf Room
Supercritical CO₂**

Suhyeon Park, University of Central Florida and Josh Stanislawski, UNDEERC

**Session 23 - Palm Room
Fuels Production**

Dushyant Shekhawat, National Energy Technology Laboratory, U.S. Department of Energy

**Session 24 - Bay Room
Combustion & Gasification II**

J.J. Letcavits, AEP & Alan Paschedag, Covanta

5:45 p.m. – **Conference Committee Meeting – Sand Key Room**

Thursday, June 20th

7:30 a.m. – **Continental Breakfast in the Island Ballroom**

8:00 a.m. – **Four Concurrent Technical Sessions**

**Session 25 - Sand Key Room
Advanced Benefication**

Dave Osborne, Somerset Coal, Australia

**Session 26 - Gulf Room
Fluid Particle Fundamentals**

Dr. Ron Breault, National Energy Technology Laboratory, U.S. Department of Energy

**Session 27 - Palm Room
Alternative Fuels for Gas Turbines**

Dr. Ashwani Gupta, University of Maryland

**Session 28 - Bay Room
Gasification for Power & Chemicals II**

Massood Ramezan, KeyLogic and Kunlei Liu, University of Kentucky

9:40 a.m. – **Break – Island Ballroom**

Thursday, June 20th (cont'd)

**10:10 a.m. – Four Concurrent
Technical Sessions**

**Session 29 - Sand Key Room
Biomass & Biomass Cofiring II**

*Les Marshall, Ontario Power Generation,
Canada*

**Session 30 - Gulf Room
Novel Reactor Design**

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

**Session 31 - Palm Room
Upgrading Natural Gas**

*Evan Granite, National Energy Technology
Laboratory, U.S. Department of Energy*

**Session 32 - Bay Room
Fluidized Bed Units**

Fredrik Lind, Chalmers University, Sweden

**11:30 a.m. – Lunch in the Island
Ballroom – Presentation of the Best
Student Paper Award and Roundtable
Wrap-up Discussion – *Bring your ideas
and suggestions for next year's conference.***

Friday, June 21st

**6:30 a.m. Continental Breakfast in
Lobby 2 for Polk Power Plant and
Covanta Tour Participants**

**7:00 a.m. – Departure of Polk and
Covanta Tours**

**7:30 a.m. – Conference Committee
Chairs Meeting**

THE CLEARWATER CLEAN ENERGY CONFERENCE

SUNDAY - June 16, 2019

Short Courses - To provide our attendees the latest in technological advances, we've invited industry experts to offer two-hour Short Courses intended to give an overview or specific details on topics of greatest interest to the industry. This year we are pleased to offer:

9:00 - 11:00 a.m. - **Fundamental Experiments and Modeling for Direct-Fired Supercritical CO₂ Combustion**

Prof. Subith Vasu, Center for Advanced Turbomachinery and Energy Research (CATER), University of Central Florida

This short course will present fundamentals and review of recent efforts in the development and validation of a combustion chemical kinetic mechanism for sCO₂ oxy-methane/syngas combustion that can be used for computational fluid dynamic code (CFD) simulations in sCO₂ oxy-combustion development. Typical gas-phase combustion models for fuels (methane, syngas, etc.) have been validated for gas turbine conditions - pressures below 40 atm and in fuel/air combustion - and cannot be extended to the operating conditions of sCO₂ combustors such as, those used in Allam cycle. Recent sCO₂ models are created by incorporating real gas and solvent effects on combustion process using quantum chemical and molecular dynamic investigations. Validation is carried out using unique experiments conducted in CO₂ diluted methane/syngas mixtures and for pressures up to 300 bar. Acquiring experimental data is critical in the development of a sCO₂ detailed kinetic mechanism as there was previously none available for methane at very high pressures near 300 bar (for Allam cycle) and for CO₂ diluted methane mixtures even at normal pressures. Challenges with coupling the mechanism to combustion CFD codes will be discussed. Such codes enable us to study a variety of topics regarding direct-fired sCO₂ oxy-methane/syngas combustors and will be highly valuable and accurate tool for computer design optimization of next generation sCO₂ combustors.

11:15 a.m. - 1:15 p.m. - **Combustion Tuning: Why and How**

Alan Paschedag, Covanta, Inc., and J.J. Letcavits, American Electric Power

The process of combustion tuning is on the surface very simple. However, without an understanding of what makes combustion tick and what preparations must be made in advance, the results will not be ideal. A tour through combustion principles and what settings, adjustments, pre-planning, and fuel sourcing can do to optimize burner tuning.

1:30 p.m. - 3:30 p.m. - **Catalysts and Sorbents for Pollution Control**

Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy

3:45 p.m. - 5:45 p.m. - **Course 4 TBA**

3:00 p.m. – Exhibit Center Setup in the Island Ballroom

MONDAY - June 17, 2019

8:30 a.m.	Continental Breakfast in the Exhibit Center - Exhibit Center
9:00 a.m.	Morning Keynote Address & Panel Keynote Speaker: <i>Dr. Randy Gentry, Chief Research Officer and Deputy Director, Science & Technology, National Energy Technology Laboratory, U.S. Department of Energy</i> Panel: Commercialization of R&D Technologies <i>Chair: Massood Ramezan, KeyLogic</i>
11:30 a.m.	Lunch in the Exhibit Center
12:45 p.m.	Afternoon Keynote Address & Panel Keynote Speaker: <i>Robert Bessette, Council of Industrial Boil Operators</i> Panel: Impact of Renewables on Grid Stabilization <i>Chair: Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy</i> <ul style="list-style-type: none">• <i>Robert Hovsopian, Idaho National Laboratory, U.S. Department of Energy</i>• <i>Tom Tarka, National Energy Technology Laboratory, U.S. Department of Energy</i>• <i>Andrew Maxon, Electric Power Research Institute</i>• <i>Rick Kephart, Emerson</i>• <i>Martin Gascon, Intertek</i>• <i>Kevin Toupin, Babcock Power, Inc.</i>
3:15 p.m.	Break in the Exhibit Center

3:45 p.m.	Four Concurrent Technical Sessions			
	Session 1 Palm Room CO₂ Capture, Storage & Reuse I <i>Dave Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, and Victor Kusuma, Battelle</i>	Session 2 Gulf Room Grid Stability <i>Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy</i>	Session 3 Palm Room Oxy-Combustion I <i>Prof. Terry Wall, University of Newcastle, Australia & Klas Andersson, Chalmers University, Sweden</i>	Session 4 Beach Room Coal Upgrading for Value Added Products <i>Gerardine Botte, Ohio University</i>
3:45 p.m.	108. Pilot Testing of Amine-Based Solvent at a Low-Rank Coal-Fired Power System <i>Jason D. Laumb, John P. Kay, David J. Dunham, Bruce C. Folkedahl, University of North Dakota, Energy & Environmental Research Center; Tim Thomas, Mike Fowler, and Osamu Miyamoto, Mitsubishi Heavy Industries America Inc. USA; and Keisuke Iwakura, Tatsuya Tsujiuchi, Takashi Kamijo, Mitsubishi Heavy Industries, Ltd., JAPAN</i>	97. Leveraging National Laboratory Assets to Address Stability Challenges due to Declining Grid Inertia Using Geographically Distributed Electrical-Thermal Co-Emulation <i>R. Hovsopian, M. Panwar, J. D. Osorio, M. Mohanpurkar, Idaho National Laboratory; and D. Maloney, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	34. Investigation on Combustion Characteristics of 0.1MWth Pressurized Oxy-fuel Combustion System Using Gaseous Fuel <i>Donghee Kim (Department of Mechanical Engineering, Pohang University of Science and Technology), Hyungjun Ahn, Won Yang, and Youngjae Lee, Thermochemical Energy System, Korea Institute of Industrial Technology, KOREA</i>	33. Z-path Moving Bed Pyrolysis for Low-Rank Coal Upgrading <i>Qi Zhou, Yu Zhang, Xiaoyan Bai, Xianfeng Pei, Yang Zhang, Yan Wang, Beijing Research Institute of Coal Chemistry, China Coal Research Institute, State Key Laboratory of Coal Mining and Clean Utilization, National Energy Technology and Equipment Laboratory of Coal Utilization and Emission Control, CHINA</i>
4:05 p.m.	119. Status of Technology Development at the National Carbon Capture Center <i>Doug McCarty, NCCC Process and Design Engineering Manager, Southern Company, USA</i>	124. Addressing Challenges of Flexible Operations through Controls and Automation Research <i>Steven Seachman (EPRI), Don Parker (Provecta Process Automation), and Susan Maley (EPRI), USA</i>	36. Analytical Study of Pressurized Oxy-combustion Power Plant for Efficiency Increase and Heat Recovery <i>Geun Yeong Park, Yong Woon Lee, Won Yang, Korea Institute of Industrial Technology, and Chemical and Biomolecular Engineering, Yonsei</i>	106. U.S. Commercial Service – Exports of Coal and Coal Related Products – A Detailed “How To” <i>William S. Lawton, U.S. Export Assistance Center, U.S. Commercial Service, International Trade Administration, U.S. Department of Commerce, USA</i>

			<i>University, KOREA</i>	
4:25 p.m.	<p>120. Automated Lab-Scale Membrane Testing at the National Carbon Capture Center: An Update <i>Victor A Kusuma, Sameh Elsaidi, Ali K Sekizkardes, Lingxiang Zhu, and David Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	<p>125. Predicting Power Plant Lifespan using Machine Learning <i>Martin Gascon, Nikhil Kumar and Rana Ghosh, Intertek USA</i></p>	<p>75. Advancing Pressurized Oxy-Coal Combustion for Power Generation: BYU Program Update <i>Andrew Fry, Brigham Young University, USA</i></p>	<p>40. Preparing Metallurgical Coal for Use in the Manufacture of Carbon Fibres <i>Rohan Stanger, Quang Anh Tran, John Lucas, Minoo Naebe, Graeme Jamison, and Terry Wall, Department of Chemical Engineering, University of Newcastle, AUSTRALIA</i></p>
4:45p.m.	<p>123. Pilot scale Testing of Four Physical Solvents for Precombustion CO₂ Capture <i>Nicholas Siefert, Michael Swanson, Joshua Stanislawski, Wei Shi, Robert Thompson, and David Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	<p>126. TBA <i>Tom Tarka, National Energy Technology Laboratory, USA</i></p>	<p>73. Integrated SO_x and NO_x Removal from Flue Gas with Simultaneous Moisture Latent Heat Recovery in Pressurized Oxy-Combustion Processes <i>Piyush Verma, David Stokie, Benjamin Kumfer, Young-shin Jun, Gregory Yablonsky, Richard L. Axelbaum, Washington University in St. Louis, USA</i></p>	<p>90. Production of Mesophase Pitch from Coal for Carbon Fiber Production <i>Joshua Malzahn, Ignacio Preciado, Ding Wang, and Eric Eddings, Department of Chemical Engineering, University of Utah; and Matt Weisenberger, Center for Applied Energy Research, University of Kentucky, USA</i></p>
5:05 p.m.	<p>107. Developing Tandem Catalysts for CO₂ Hydrogenation to Olefins <i>Marc D. Porosoff, University of Rochester, USA</i></p>	<p>127. Machine Learning and Data Analytics Applications for Enhancing Operator and Control System <i>Rick Kephart, Emerson, USA</i></p>	<p>144. Sub-micron Ash Aerosol Formation in Oxy-coal Combustion at Atmospheric and Elevated Pressures <i>Andrew Chiodo, Reaction Engineering International; and Jost O. L. Wendt, Yueming Wang and Xiaolong Li, University of Utah, USA</i></p>	<p>110. Preparation of Activated Carbon Nanofibers by Degradative Solvent Extraction Product from Low-rank Coal and the Utilization for Supercapacitors <i>Weixiang Qian, Chao Wu, Xu Zhang, Xianqing Zhu, Guangqian Luo, Huan Liu, Hongyun Hu, Hong Yao, Xian Li (Key Laboratory of Coal Clean Conversion and Chemical Process</i></p>

				<i>Autonomous Region, College of Chemistry and Chemical Engineering, Xinjiang University), State Key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, CHINA</i>
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5:30 p.m. Beach Party - Weather Permitting: Poolside (or in the Exhibit Center)

TUESDAY Morning - June 18, 2019

7:30 a.m. **Continental Breakfast in the Exhibit Center**

8:00 a.m. **Four Concurrent Technical Sessions**

	Session 5 Sand Key Room Advances in Analytical and Testing Techniques <i>Dave Osborne, Somerset Coal, Australia</i>	Session 6 Modeling <i>Dr. Edmundo Vasquez</i> <i>Clean Energy Technologies</i>	Session 7 Palm Room Data Analytics and Advanced Control Strategies I <i>Larry Shadle, National Energy Technology Laboratory, U.S. Department of Energy</i>	Session 8 Bay Room Gasification for Power & Chemicals I <i>Massood Ramezan, KeyLogic and Kunlei Liu, University of Kentucky</i>
8:00 a.m.	41. Understanding Coal Thermoplasticity Using High Range Molecular Spectrometry <i>Rohan Stanger, Quang Anh Tran, John Lucas, and Terry Wall, Department of Chemical Engineering, University of Newcastle, AUSTRALIA</i>	113. Overview of DOE's Institute for the Design of Advanced Energy Systems <i>D.C. Miller and A. Burgard, National Energy Technology Laboratory, U.S. Department of Energy; J. Sirola, Sandia National Laboratory; D. Agarwal, Lawrence Berkeley National Laboratory; L. Biegler, Carnegie Mellon University; and D. Bhattacharyya, West Virginia University, USA</i>	9. Optimizing Homogenization to Reduce Negative Environmental Impact of Coal Processing <i>Michael P. Cipold (Karlsruhe Institute of Technology and J&C Bachmann GmbH), Dr. Pradyumn K. Shukla, Karlsruhe Institute of Technology; Dr. Claus C. Bachmann, J&C Bachmann GmbH, GERMANY</i>	26. Economic Viability and Optimal Scheduling of Polygeneration Plants in Germany <i>Sebastian Miehling, Alexander Buttler, Hartmut Spliethoff (Bavarian Center for Applied Energy Research), Institute for Energy Systems, Technical University of Munich, GERMANY</i>
8:20 a.m.	42. Development of a Low Cost Optical Method for Inline Washability Monitoring of Fine Coal <i>Rohan Stanger, Quang Anh Tran, Terry Wall, Dave Osbourne, Peter Stepien, Clint Bruin, Department of Chemical Engineering, University of Newcastle,</i>	114. Advanced Modeling and Optimization to Support the Existing Fleet <i>M. Zamarripa, T. Burgard, and J. Eslick, National Energy Technology Laboratory, U.S. Department of Energy; D. Bhattacharyya, West Virginia University; and B. Nicholson, and J. Sirola, Sandia National</i>	50. Development of Real Time System Identification to Characterize Changes in a Gas Turbine during Transient Operations <i>Paolo Pezzini, Harry Bonilla, Lawrence Shadle, David Tucker, National Energy Technology Laboratory, U.S. Department of Energy; and</i>	14. Field Test of a Poison Resistant Sour Water Gas Shift Catalyst <i>Girish Srinivas, Steve Schwab, Brian B. Gebhard, and Steven C. Gebhard, P.E., TDA Research Inc., USA</i>

	AUSTRALIA	Laboratory, USA	Kenneth M. Bryden, Iowa State University, USA	
8:40 a.m.	135. Robust Online Temperature Estimation of a Membrane-Wall Gasifier <i>Jianliang Xu, Guangsuo Yu, Haifeng Liu, Key Laboratory of Coal Gasification and Energy Chemical Engineering of Ministry of Education, East China University of Science and Technology, and Shanghai Engineering Research Center of Coal Gasification, East China University of Science and Technology, CHINA</i>	115. Design and Optimization of Coal Plants of the Future <i>J. Ghouse, C. Okoli, and M. Zamarripa, National Energy Technology Laboratory, U.S. Department of Energy; C. Laird and J. Siirola, Sandia National Laboratory; I. Grossmann, and L. Biegler, Carnegie Mellon University; and D. Bhattacharyya, West Virginia University, USA</i>	51. Dynamic Real-time Optimization of a Coal Fired Power Plant Using an Artificial Neural Network Model <i>Kody Powell, University of Utah; and Seyed Mostafa Safdarnejad, USA</i>	7. Dry Solids Pump - Full-scale Testing at 500 psi and Techno-Economic Evaluation when Installed in a Quench Gasifier <i>Timothy Saunders and Joseph Caravella, Gas Technology Institute; Greg Weber, Energy & Environmental Research Center, University of North Dakota, USA; and Christopher Higman, Higman Consulting, UNITED KINGDOM</i>
9:00 a.m.	131. New 3D Analytical Approach for Coal Characterisation <i>Prof Anh Nguyen and Majid Ejtemaei, The University of Queensland, AUSTRALIA</i>	134. Computation Accelerated Design of Advanced Materials for Novel Energy Applications <i>Yifei Mo, Department of Materials Science and Engineering, University of Maryland, USA</i>	52. Testing of Hybrid Renewable Energy System Load Cycling in a Recuperated Gas Turbine <i>Harry Bonilla, Taylor Meyer, Daniel J. Maloney, David A. Tucker, National Energy Technology Laboratory, U.S. Department of Energy; and Kenneth M. Bryden, Iowa State University, USA</i>	5. Study on Coal Ash/Slag Transformation and Elemental Migration in a Staged-OMB Gasifier <i>Zhongjie Shen, Andrew Placido, Zachary Moore, and Kunlei Liu, University of Kentucky Center for Applied Energy Research, USA</i>
9:20 a.m.	TBA	145. Modeling of the Coal Particle Behavior in an Ultra-Supercritical Boiler with Large Eddy Simulation <i>Haoshu Shen, Yuxin Wu, Hai Zhang, Yang Zhang, Guangxi Yue, Key Laboratory for Thermal Science and Power Engineering of Ministry</i>	53. Development of a Reinforcement Learning-Based Control Strategy for Load Following in Supercritical Pulverized Coal (SCPC) Power Plants <i>Elijah Hedrick, Katherine Reynolds, Parikshit Sarda, Stephen E. Zitney, and Benjamin Omell, National</i>	44. Effect of High Temperature Process on the Morphology Structure Evolution of Coal Char Particles under N₂ or CO₂ Atmosphere <i>QinghuaGuo, ZhiqingZhang, Yan Gong, Guangsuo Yu, Yifei Wang, and Fuchen Wang, East China University of</i>

		<i>Education, Department of Energy and Power Engineering, Tsinghua University, CHINA</i>	<i>Energy Technology Laboratory, U.S. Department of Energy; and Debangsu Bhattacharyya, West Virginia University, USA</i>	<i>Science and Technology, CHINA</i>
9:40 a.m.	TBA	TBA	54. Condition Based Monitoring and Predicting Ash Behavior in Coal Fired Boilers - II - Coal Properties Optimization <i>Shuchita Patwardhan, David Stadem, Matt Fuka, and Steve Benson, Microbeam, USA</i>	
10:00 a.m. Break in the Exhibit Center				

10:30 a.m. – Plenary Presentation: The Legacy of Prof. Janos M. Beer, Massachusetts Institute of Technology

Chair: *Prof. Ashwani Gupta, University of Maryland*

Prof.-Dr.-Ing. Klaus R. G. Hein

Prof. Hai Zhang, Department of Thermal Engineering, Tsinghua University, China

On December 8, 2018, one of the most distinguished leaders in the industry and in our conference passed away peacefully. Prof. Beer was instrumental in keeping our conference in the forefront of energy issues and in guiding us in the best way to proceed and the topics that we needed to cover. Prof. Beer's life had him participating in the major events in world history: he fought the Nazis (As a brave young man, he worked extensively with the Swedish humanitarian Raoul Wallenberg in November and December of 1944 that protected many Hungarian Jews from being deported to the Auschwitz-Birkenau death camp). He studied the violin at the famous Franz Liszt Academy of Music. After the war instead of pursuing a career in music, he studied engineering at the Technical University of Budapest. While there he became a world class rower. He was a Hungarian Freedom Fighter, and he and Marta had to flee Hungary in 1956. He first worked as an engineer at Babcock & Wilcox in U.K. where Prof. Meredith Thring of Sheffield University noticed him and convinced him to come to Sheffield. From there his career thrived. We plan to review his work and hear from colleagues and students from all over the world.

TUESDAY Afternoon – June 18, 2019

12:10 p.m.	Lunch – Exhibit Center			
1:30 p.m.	Plenary Session Panel			
Waste To Energy				
Chair: <i>Dr. Ashwani Gupta, University of Maryland</i>				
<ul style="list-style-type: none"> • <i>Alan Paschedag, Covanta</i> • <i>Dr. Marco Castaldi, The City College of New York</i> • <i>Dr. Hang Seok Choi and Dr. Yong-Chil Seo, Yonsei University, Korea</i> • <i>Dr. Timothy G. Townsend, University of Florida</i> • <i>Dr. Halina Pawlak-Kruczek Wroclaw University of Technology, Poland</i> • <i>Pramodh Nijhawan, Industrial Accessories Company</i> • <i>Prof. Yuxin Wu, Department of Thermal Engineering, Tsinghua University, China</i> 				
3:30 p.m. Four Concurrent Technical Sessions				
4:00 p.m.	Session 9 Sand Key Room Radiation <i>Brad Adams</i> <i>Brigham Young University</i>	Session 10 Gulf Room CO₂ Capture, Storage & Reuse II <i>Dave Hopkinson, National Energy Technology Laboratory, U.S. Department of Energy, and Victor Kusuma, Battelle</i>	Session 11 Palm Room Advanced Cycles for Power Generation <i>Horst Hack</i> <i>Electric Power Research Institute</i>	Session 12 Bay Room Data Analytics and Advanced Control Strategies II <i>Dr. Ronald Breault, National Energy Technology Laboratory, U.S. Department of Energy</i>
4:00 p.m.	23. Predicting Ash Deposition and Radiative Heat Transfer during Pulverized Fuel Combustion <i>Gautham Krishnamoorthy, Department of Chemical Engineering, University of North Dakota, USA</i>	15. CO₂ as a Geological Working Fluid: Enhancing Oil Recovery from Unconventional Resources <i>Jared P. Ciferno, Technology Manager, Onshore Oil & Gas, U.S. Department of Energy, National Energy Technology Laboratory (NETL), USA</i>	55. Advanced Ultra-supercritical (AUSC) Component Testing <i>Horst Hack, Electric Power Research Institute, USA</i>	117. Dynamic Model-Based Digital Twin Technology for Flexible Power Plant Operations and Control <i>Stephen E. Zitney, National Energy Technology Laboratory, U.S. Department of Energy, and Debangsu Bhattacharyya, Department of Chemical and Biomedical Engineering, West Virginia University, USA</i>
4:20 p.m.	77. Radiation Calculations	25. Developing a High	56. Evaluation of Steam	129. Early Detection of

	<p>with a Dimensionally Adaptive Mesh <i>Bradley R. Adams, and Todd A. Williams, Dept. of Mechanical Engineering, Brigham Young University, USA</i></p>	<p>Fidelity Computational Fluid Dynamics Model for CO₂ Separation by Adsorption on 13X Zeolite <i>Subhdeep Banerjee, Rupendranath Panday, Gregory Breault, Cheng Li, William A. Rogers, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	<p>Cycle Upgrades to Improve the Competitiveness of U.S. Coal Power Plants <i>Horst Hack, Electric Power Research Institute, Inc., USA</i></p>	<p>Vertical Pit Pump Failure Using Advanced Pattern Recognition Modeling and Condition Monitoring Techniques <i>Kelly Whittenberg, Black and Veatch and Jeremy Cole, Wisconsin Public Service, USA</i></p>
4:40 p.m.	<p>78. A Comparison of Heat Transfer Measurements between Pulverized-coal and 85% coal/15% Biomass Co-firing Combustion in a 1.5 MW Pilot-scale Furnace <i>Teri Draper, Kaitlyn Scheib, Eric Eddings, and Terry Ring, Department of Chemical Engineering, University of Utah; Stan Harding, Michal Hradisky, Marc Backman, and Jennifer Spinti, Institute for Clean and Secure Energy, University of Utah; Andrew Fry, Department of Chemical Engineering, Brigham Young University, USA; Adrian Gunnarsson, and Klas Andersson, Department of Space, Earth and Environment, Energy Technology, Chalmers University, SWEDEN</i></p>	<p>57. CCUS Research and Technology Demonstration Projects Program Update <i>Andrew Hlasko, U.S. Department of Energy, USA</i></p>	<p>96. Hydrogen Enrichment for a Solid Oxide Fuel Cell/Gas Turbine (SOFC/GT) Hybrid Power Generation System Using Mechanical Gas Separation <i>John VanOsdol, Dave Tucker, and Larry Shadle, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	<p>130. Remote Monitoring & Diagnostic Successes at Merom Generating Station <i>Mike Merwald, Black & Veatch, and Gary Burris, Merom Generating Station, USA</i></p>
5:00 p.m.	<p>Radiometer Paper from Andrew Fry, Brigham</p>	<p>91. Effect of Temperature on the Geological</p>	<p>128. Evaluating AUSC New Build and Retrofit Options</p>	<p>143. Process Failure Detection via Recurrence</p>

	Young University	Sequestration of CO₂ in a Layered Carbonate Formation <i>R. Kumar, S. W. Campbell, Department of Chemical and Biomedical Engineering, and J. A. Cunningham, Department of Civil and Environmental Engineering, University of South Florida, USA</i>	for Existing Coal Plants <i>Travis Shultz, Walther Shelton, National Energy Technology Laboratory, U.S. Department of Energy; Eric Lewis, and Dale Keairns, Deloitte Consulting; Mark Woods, Richard Newby, and Charles White, Key Logic; Marc Turner, David Gray and John Plunkett (Retired), Leidos, USA</i>	Quantification Analysis <i>Steven L. Rowan, ORISE, USA, Ronald W. Breault, National Energy Technology Laboratory; and Narasimhan Soundarrajan, REM Engineering Services LLC, USA</i>
5:20 p.m.	TBA	109. Integration of a Full Scale Carbon Capture System with a 470 MW Lignite Fired Power Plant <i>Josh Stanislowski, University of North Dakota, Energy & Environmental Research Center, USA</i>	133. Thermodynamic Analysis of A Novel Solar Hybrid System Incorporating Methane steam Reforming and A Recuperative Direct-fired Supercritical Carbon Dioxide Cycle <i>Tuantuan Xin, Cheng Xu, Shaokui Li, Wenyi Liu, Heng Chen and Yongping Yang, National Thermal Power Engineering and Technology Research Center, North China Electric Power University, CHINA</i>	TBA
6:00 p.m.	Pizza Night for students in the Sand Key Room – The Conference has encouraged student participation from its inception. To offer students guidance on what the world has to offer once they graduate, the Conference Committee will offer a “Pizza Night” for them where representatives from government, academia and industry will offer perspectives on what these areas have to offer them upon graduation. This event is open to all students.			

WEDNESDAY MORNING – June 19, 2019

7:30 a.m. **Continental Breakfast in the Exhibit Center**

8:00 a.m. **Four Concurrent Technical Sessions**

	Session 13 Sand Key Room Recovery of Rare Earth Minerals <i>Eric Eddings, University of Utah</i>	Session 14 Gulf Room Biomass & Biomass Cofiring I <i>Les Marshall, Ontario Power Generation, Canada</i>	Session 15 Palm Room Chemical Looping I <i>JoAnn Lighty, Boise State University</i>	Session 16 Bay Room Combustion & Gasification I <i>Ashwani Gupta, University of Maryland and Weihong Yang, KTH Royal Institute of Technology, Sweden</i>
8:00 a.m.	61. Electrochemical Extraction of Rare Earth Metals from Coal and Coal By-Products <i>Behnaz Jafari, Alamgir M. Haque, Xiang Lyu, and Gerardine G. Botte, Center for Electrochemical Engineering Research, Department of Chemical and Biomolecular Engineering, Russ College of Engineering and Technology, Ohio University, USA</i>	17. The Influence of Alkali, Chlorine and Sulfur on Aerosol Formation <i>Thomas Allgurén, Dan Gall, Klas Andersson, Department of Space Earth & Environment, Chalmers University of Technology, SWEDEN; and Yueming Wang, Xiaolong Li, Jost O. L. Went, Department of Chemical Engineering, University of Utah, USA</i>	13. Application of 50 kWth Coal-Fueled Chemical Looping Combustion System using Multi-Functional Bauxite Oxygen Carriers <i>Liang Kong, Zhen Fan, Jonathan Pelgen, Heather S. Nikolic, and Kunlei Liu (Department of Mechanical Engineering), Center for Applied Energy Research, University of Kentucky, USA</i>	31. Lean Combustion of Methane on Pd/Co₃O₄-ZrO₂/SiC Open Cell Foams <i>Carmen W. Moncada Quintero and Stefania Specchia, Department of Applied Science and Technology, Politecnico di Torino, ITALY</i>
8:20 a.m.	112. Determination and Recovery of Rare Earths from Coal Combustion By-Products <i>Evan Granite, Elliot Roth, National Energy Technology Laboratory, U.S. Department of Energy; and Ken Ludwig, Electric Power Research Institute, USA</i>	18. NO Formation during Co-Combustion of Coal with Two Thermally Treated Biomasses <i>Thomas Allgurén, Rikard Edland, Klas Andersson, Fredrik Normann, Department of Space Earth & Environment, Chalmers University of Technology, SWEDEN; Andrew Fry, Department of Chemical Engineering, Brigham Young</i>	37. An Overview of Microstructural Changes Occurring in a NETL Developed Cu/Fe Spinel Oxygen Carrier During Chemical Looping Redox Cycling Using a Real Time CSLM Technique <i>Anna Nakano, Jinichiro Nakano (Leidos Research Support Team), and James Bennett, U.S. Department of</i>	28. Determination of the Intrinsic Gasification Kinetics of Bituminous Coal including Product Inhibition and Char Deactivation under Entrained Flow Conditions <i>Tobias Netter, Andreas Geißler, Prof. H. Spliethoff (Bavarian Center for Applied Energy Research), Institute for Energy Systems, Technical University of Munich,</i>

		<i>University, USA</i>	<i>Energy National Energy Technology Laboratory, USA</i>	GERMANY
8:40 a.m.	Dan Landau Paper	35. Development of Measuring Method of Grindability by Mixing Ratio with Coal and Biomass <i>YongWoon Lee, and Won Yang, Thermochemical Energy System R&D Group, Korea Institute of Industrial Technology, KOREA</i>	58. Effects of Fuel Type and Temperature on the Attrition of Hematite Ore for Chemical Looping <i>Nathan Galinsky (Oak Ridge Institute for Science and Education), Samuel Bayham, and Ronald Breault, National Energy Technology Laboratory, USA</i>	29. A Reduced Order Model for Simulating Entrained Flow Gasifiers and Its Extended Utilization for Pre- and Post-Processing <i>M. Hartwich and B. Meyer, Energy Process Engineering and Thermal Waste Treatment, TU Bergakademie Freiberg; and A. Richter, CIC Virtuhcon, TU Bergakademie Freiberg, GERMANY</i>
9:00 a.m.	TBA	71. Moisture Uptake and Mechanical Stability of Upgraded Biomass for Use in Pulverized Coal Co-firing <i>Cristina Jaramillo and Eric Eddings, Department of Chemical Engineering, University of Utah, USA</i>	24. Chemical Looping Combustion: An Oxygen Carrier Production Cost Study <i>Robert Stevens, U.S. Department of Energy, National Energy Technology Laboratory; Richard Newby, KeyLogic Systems, Inc.; and Dale Keairns, Deloitte Consulting, LLP, USA</i>	22. Co-Gasification Characteristics of Waste Tire and Corn Stalk Blends <i>Zhiwei Wang, K. G. Burra, A. K. Gupta, The Combustion Laboratory, Department of Mechanical Engineering, University of Maryland, USA</i>
9:20 a.m.	TBA	74. Comparison of Combustion Performance and Fouling Behavior While Firing a 15 wt% Blend of Prepared Woody Biomass with Coal and Pure Coal in a 1.5 MW Pilot-scale Furnace <i>Andrew Fry, Brigham Young University, USA</i>	16. Prediction of Performance of a Pilot-Scale Dual Fluidized Bed System for Chemical Looping with Oxygen Uncoupling <i>Zachary Reinking, and Kevin J. Whitty, Department of Chemical Engineering, University of Utah; Hong-Shig Shim, Reaction Engineering International; and JoAnn S.</i>	47. Innovative Fluidized Bed Technologies in Coal to Chemical Processes <i>Mao Ye, Tao Zhang, Jinling Zhang, Jibin Zhou, Jing Wang, and Zhongmin Liu, National Engineering Laboratory for MTO, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, CHINA</i>

			<i>Lighty, College of Mechanical Biomedical Engineering, Boise State University, USA</i>	
9:40 a.m.	TBA	86. Valorization of Coal and Biomass Co-firing Fly Ash for CO₂ Capture Application <i>Prof. Chuanwen Zhao, Dr. Yafei Guo, Dr. Jian Sun, Prof. Ping Lu, Jiangsu Provincial Key Laboratory of Materials Cycling and Pollution Control; School of Energy and Mechanical Engineering, Nanjing Normal University, Bancang Street, Nanjing, Jiangsu, CHINA</i>	79. Design and Implementation of a Solid Fuel Fluidized Bed Reactor for Chemical Looping Combustion Studies <i>Michael Bobek (Oak Ridge Institute for Science and Education), Samuel Bayham, Ronald Breault, National Energy Technology Laboratory, USA</i>	80. Praxair Oxygen Transport Membranes for Economical Syngas Production for Chemical Synthesis Applications <i>Dr. Lawrence E. Bool, Praxair, Inc., USA</i>
10:00 a.m. – Break in the Exhibit Center				

WEDNESDAY MORNING – June 19, 2019

10:30 a.m. – Four Concurrent Technical Sessions

	Session 17 Sand Key Room Energy From Waste <i>Alan Paschedag, Covanta</i>	Session 18 Gulf Room Combustion Emissions <i>Dr. Edmundo Vasquez, Clean Energy Technologies and Byron Burrows, TECO</i>	Session 19 Palm Room Chemical Looping II <i>Robert Stevens, National Energy Technology Laboratory, U.S. Department of Energy</i> <i>Andrew Tong, Ohio State</i>	Session 20 Beach Room PC Fired Units <i>J.J. Letcavits, AEP</i>
10:30 a.m.	8. Conversion of Waste from Gasification Facilities, Refineries, and Steelmaking Plants to H₂ and/or CO <i>Jinichiro Nakano, Anna Nakano (AECOM), and James Bennett, U.S. Department of Energy National Energy Technology Laboratory, USA</i>	21. Impact of Flowfield on Pollutants Emission from a Swirl Assisted Distributed Combustor <i>Joseph S. Feser, Serhat Karyeyen (Gazi University Department of Energy Systems Engineering, Ankara, TURKEY) and Ashwani K. Gupta, University of Maryland Department of Mechanical Engineering, USA</i>	27. Sustainable Conversion of Carbon Dioxide and Shale Gas to Green Chemicals via Chemical Looping <i>Prof. Luke M. Neal, and Professor Fanxing Li, NC State University, USA</i>	6. Single Solution That Reduces Power Plants Heat Rates, Emissions, and Operating Costs <i>A. Kravets, A. Favale, J. Barba, Veritask Energy Systems, Inc., USA</i>
10:50 a.m.	111. Cofiring of RDF with Coal, Slurry and Biomass in Modern, Flexible and Sustainable CHP on an Example of Fortum Zabrze Project – 203 Mwth CFB with CFB Scrubber <i>Michael Gadnor, Sumitomi SHI FW Energiaa Polska, POLAND</i>	85. Selenium Migration Characteristics in the Wet Flue Gas Desulfurization Slurry: A Lab-Scale Study <i>Renjie Zou, Guangqian Luo, Haoyu Zhang, Mingyu Yu, Yongda Huang), Hongyun Hu, Xian Li, and Hong Yao, State key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, CHINA</i>	94. 250 kWt Pilot Testing in Support of a 10 MWe Coal-Direct Chemical Looping Demonstration Feasibility Study <i>Thomas J. Flynn, Luis G. Velazquez-Vargas, and Jinhua Bao, The Babcock & Wilcox Company, USA</i>	65. Continuous Boiler CO Monitoring for Combustion Optimization and Boiler Efficiency Improvement <i>Dave Earley, EES Combustion Technologies and Services, Inc., USA</i>
11:10 a.m.	121. Novel Installation for the Recovery of the	136. Techno-Economic Analysis of FGD	TBA	66. Using Coal Additives for a Fuel Flexibility

	<p>Agricultural Water from the Digestate <i>Halina P. Kruczek, Wrocław University of Technology, POLAND</i></p>	<p>Wastewater Treatment Process Options at Existing Plants <i>Marc Turner, Leidos; Jessica VanWagoner, KeyLogic; and Mitch Mueller, Danny Rellergert, and Mike Preston, Black & Veatch; Eric Grol, Department of Energy, National Energy Technology Laboratory, USA</i></p>		<p>Program: Getting an Edge in Today's Competitive Market <i>Dave Earley, EES Combustion Technologies and Services, Inc., USA</i></p>
11:30 a.m.	<p>122. Energy From Waste: The Path to Power <i>Alan Paschedag, Manager, Process Engineering, Covanta, USA</i></p>	<p>69. Treating Effluent Streams at Coal Power Plants Using Membranes <i>Nicholas Siefert, Timothy Bartholomew, Jake Weidmann, Sara Osipi, and Meagan Mauter, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	TBA	<p>105. Consideration of Combustion-related Issues Faced in the Retrofit of an Existing Pulverized Coal Fired Boiler Utilizing Oxy-coal Technology <i>Kevin Davis, Brydger Van Otten, and Andrew Chiodo Reaction Engineering International; and Steven Krinsky, Jupiter Oxygen Corporation, USA</i></p>
11:50 a.m.	TBA	TBA	TBA	TBA

WEDNESDAY AFTERNOON - June 19, 2019

12:10 p.m. - Themed Lunch in the Exhibit Center

Advanced Cycles for Power Generation, *Horst Hack, Electric Power Research Institute*

sCO₂, *Josh Stanislawski, Energy & Environmental Research Center, University of North Dakota*

1:30 p.m. Two Concurrent Panels -

Panel: Treating and Recovering Value from Mineral Residues

Chair: *Dave Osborne, Somerset Coal, Australia*

- *William Lawton, U.S. Department of Commerce*
- *Michael O'Brien, Team Leader, Enhanced Coal Processing, Mining and Processing Technologies/Coal Mining Program, Queensland Centre for Advanced Technologies (QCAT), CSIRO, Australia*

Panel: Emissions: The Current Status

Chair: *Dr. Edmundo Vasquez, Clean Energy Technologies*

- *Profs. Hai Zhang and Yuxin Wu, Department of Thermal Engineering, Tsinghua University, China*
- *Prof. Jörg Maier of University Stuttgart, GERMANY*

3:30 p.m. - Break in the Exhibit Center

4:00 p.m. - Four Concurrent Technical Sessions

	Session 21 Sand Key Room Oxy-Combustion II <i>Prof. Terry Wall, University of Newcastle, Australia and Klas Andersson, Chalmers University, Sweden</i>	Session 22 Gulf Room Supercritical CO₂ <i>Suhyeon Park, University of Central Florida and Josh Stanislawski, UNDEERC</i>	Session 23 Palm Room Fuels Production <i>Dushyant Shekhawat, National Energy Technology Laboratory, U.S. Department of Energy</i>	Session 24 Bay Room Combustion & Gasification II <i>J.J. Letcavits, AEP & Alan Paschedag, Covanta</i>
4:00 p.m.	87. Characteristics of Pressurized Oxy-Coal Combustion in a 100 kW_{th}, 15 bar Combustor <i>Zhiwei Yang, Dishant Khatri, Tianxiang Li, and Richard. L. Axelbaum, Department of Energy, Environmental & Chemical Engineering, Washington University in St. Louis, USA</i>	68. Experimental Ignition Studies of Supercritical CO₂ Oxy-Fuel Mixtures <i>Suhyeon Park, Gihun Kim, Anthony Terracciano, Samuel Barak, Subith Vasu, Center for Advanced Turbomachinery and Energy Research (CATER), University of Central Florida, USA</i>	4. Pyrolysis of Hydrothermal Carbonization- treated Pulp and Paper Mill Sludge <i>Shule Wang, Henry Persson, Pär Jönsson, and Weihong Yang, Royal Institute of Technology, School of Industrial Engineering and Management, Department of Materials Science and</i>	12. Torrefaction of Agricultural Residues: Effect of Temperature, Residence Time and Biomass Composition on Process Products Properties <i>Katarzyna Jagodzińska, Marek Pronobis, and Edyta Kudlek, Silesian University of Technology, Institute of</i>

			<p><i>Engineering, Group of Energy and Furnace Technology; SWEDEN</i></p>	<p><i>Power Engineering and Turbomachinery; Michał Czerep and Mateusz Wnukowski, Wroclaw University of Science and Technology, Institute of Heat Engineering and Fluid Mechanics, POLAND; and Weihong Yang, KTH Royal Institute of Technology, Department of Material Sciences and Engineering, SWEDEN</i></p>
4:20 p.m.	<p>138. Design, Construction, and Assessment of Dry Coal Feeding in a High Pressure Oxy-coal System <i>Andrew Chiodo and Kevin Davis, Reaction Engineering International; and Kevin Whitty, Jost O. L. Wendt, and Xiaolong Li, University of Utah, USA</i></p>	<p>82. Design of a Coal-Based Allam Cycle Large Pilot Plant <i>Josh Stanislawski, Energy & Environmental Research Center, University of North Dakota, USA</i></p>	<p>10. Energy Efficient Synthesis of Methanol from Biodiesel Waste Glycerol: Introducing a New Sustainable Reaction Process <i>Shalini Kandasamy, Shanthi Priya Samudrala, and Sankar Bhattacharya, Department of Chemical Engineering, Monash University, AUSTRALIA</i></p>	<p>19. On the Nitrogen Chemistry in Jet and Swirled Pilot-Scale PF Flames <i>Rikard Edland, Thomas Allgurén, Klas Andersson, Fredrik Normann, Jost O. L. Went (Department of Chemical Engineering, University of Utah), Department of Space Earth & Environment, Chalmers University of Technology, SWEDEN; Andrew Fry, Department of Chemical Engineering, Brigham Young University, USA</i></p>
4:40 p.m.	<p>139. Novel Dry High Pressure Coal Feed System for Advanced Oxy-combustion <i>Brad Adams, Jacob Tuia, Taylor Schroedter, Andrew Fry, Brigham Young University, USA</i></p>	<p>89. Measurement of Convective Heat Transfer Coefficients with Supercritical CO₂ Using the Wilson Plot Technique <i>Jim Black, Doug Straub, Joe Yip, and Matthew Searle, National Energy Technology</i></p>	<p>67. High Solids Anaerobic Digestion of Aquatic Weed, Banana Waste and Moringa Leaves for Enhanced Methane Production <i>R. Z. Gaur, P. Bittencourt, X. Yang, E. Lee, S. J. Ergas, Department of Civil &</i></p>	<p>20. Influence of Process Conditions on Fast Pyrolysis of Waste Tire in a Conical Spouted Bed Reactor <i>Hoon Chae Park, Byeong Kyu Lee, Hang Seok Choi, Department of Environmental Engineering, Yonsei</i></p>

		<i>Laboratory, U.S. Department of Energy; Ed Robey, Leidos; and Sridharan Ramesh, and Arnab Roy, West Virginia University Research Corporation, USA</i>	<i>Environmental Engineering, University of South Florida, USA</i>	<i>University, REPUBLIC OF KOREA</i>
5:00 p.m.	95. Ash Formation under High Pressure Oxy-combustion Systems <i>Dishant Khatri, Zhiwei Yang, Tainxiang Li, Richard Axebaum, Washington University in St. Louis, USA</i>	83. Andrew Maxson, EPRI paper, in Josh's session	101. Microwave-assisted Coal Conversion to Fuels and Chemicals <i>Dushyant Shekhawat, Mark W. Smith, Christina Wildfire, Victor Abdelsayed, and Candice Ellison, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	63. Investigation of Gaseous Potassium Adsorption Process and Sodium-Potassium Competitive Adsorption by Modified Kaolinite during the Combustion of Biomass <i>Xiuju Zhang, Huan Liu, Haoxuan Xing, Geyi Wang, Haiyan Liu, Xian Li, and Hong Yao, State Key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, CHINA</i>
5:20 p.m.	146. Full Scale Experiments in Oxy-fired Aluminum Recovery Smelters to Tackle the Challenge with Batch Process Dynamics <i>Thomas Allgurén, Department of Space Earth & Environment, Chalmers University of Technology, SWEDEN</i>	118. Dynamic Modeling and Control of a 10 MWe Supercritical CO₂ Recompression Closed Brayton Cycle <i>Stephen E. Zitney and Eric A. Liese, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	TBA	70. Integration of Algal Biosolid Processing with Coal in Gasified Spout-Bed <i>John P Dooher, Adelphi University/Dooher Institute of Physics and Energy, Garden City, Devan Cole and Joseph Cilio, Department of Physics, Adelphi University, USA</i>
5:45 p.m. – Conference Committee Meeting – Sand Key Room				

THURSDAY Morning - June 20, 2019

8:00 a.m. - Four Concurrent Sessions

8:00 a.m.	<p>Session 25 Sand Key Room Advanced Coal Beneficiation <i>Dave Osborne, Somerset Coal, Australia</i></p>	<p>Session 26 Gulf Room Fluid Particle Fundamentals <i>Ron Breault, National Energy Technology Laboratory, U.S. Department of Energy</i></p>	<p>Session 27 Palm Room Alternative Fuels for Gas Turbines <i>Prof. Ashwani Gupta, University of Maryland</i></p>	<p>Session 28 Bay Room Gasification for Power & Chemicals II <i>Massood Ramezan, KeyLogic and Kunlei Liu, University of Kentucky</i></p>
8:00 a.m.	<p>72. Coal Beneficiation Program Overview - Expanding the U.S. Coal Value Chain: An Overview of the U.S. DOE Coal Beneficiation Program <i>John Rockey, Perry Bissell, Justin Strock, and Anthony Zinn, National Energy Technology Laboratory, U.S. Department of Energy, USA</i></p>	<p>39. Investigations on Crystallisation Processes of Three Oxidic Gasifier Slag Systems <i>Jan Peter Schupsky, and Michael Müller, Institute of Energy and Climate Research - IEK 2, Forschungszentrum Jülich GmbH, GERMANY</i></p>	<p>98. Experimental Investigation on Impact of Alternative Fuels on Gas Turbine Vibrations and Instability <i>Charith Wijesinghe, Bhupendra Khandelwal, Low Carbon Combustion Centre, The University of Sheffield, UNITED KINGDOM</i></p>	<p>142. Sustainable Utilization of the Sewage Sludge Using Combined Drying, Torrefaction and Gasification Technologies <i>Halina P. Kruczek, Wrocław University of Technology, POLAND</i></p>
8:20 a.m.	<p>132. Improving Solid-bowl Centrifuge Performance with Coal Tailings <i>Majid Ejtemaei, Anh Nguyen and Dave Osborne The University of Queensland, AUSTRALIA</i></p>	<p>59. Effect of Scale on CFB Riser Dynamics <i>Ronald Breault and Justin Weber, National Energy Technology Laboratory, U.S. Department of Energy; and Steve Rowan and Jingsi Yang, ORISE, USA</i></p>	<p>100. Assessment of Legislative Methods USA EPA 5B/202 and US EPA 5I/202 When Used for Ultra-low PM Level Measurement Produced by Gas Turbine Engine <i>Ihab Ahmed, Bob Pearce, Roger Brown, Bhupendra Khandelwal, Low Carbon Combustion Centre, The University of Sheffield, UNITED KINGDOM</i></p>	<p>46. Refractory Failure in Entrained-Flow Gasifier: Investigation of Partitioned Erosion Characteristics in an Industrial Opposed Multi-Burner Gasifier <i>Yan Gong, QinghuaGuo, Huiwen Zhu, and Guangsuo Yu, East China University of Science and Technology, CHINA</i></p>
8:40 a.m.		<p>60. Experimental Investigation on Fountain Characteristics in a Rectangular Spouted Bed Based on Image Processing</p>	<p>99. Effect of Particulate Density Factor on PM Mass Concentration Measurements of Alternative Fuels</p>	<p>45. Progress on Opposed Multi-Burner (OMB) Coal-Water Slurry Gasification Technology and Its Industrial Applications</p>

		<i>Ronald Breault and Justin Weber, National Energy Technology Laboratory, U.S. Department of Energy; and Steve Rowan and Jingsi Yang, ORISE, USA</i>	<i>Marcus N Kauffmann, Ihab Ahmed, James Cronly, Bhupendra Khandelwal, Low Carbon Combustion Centre, The University of Sheffield, UNITED KINGDOM</i>	<i>Guangshuo Yu, Qinghua Guo, Yan Gong, Jianliang Xu, Yifei Wang, Xueli Chen and Fuchen Wang, East China University of Science and Technology, CHINA</i>
9:00 a.m.	TBA	TBA	TBA	141. Gasification of Torrefied Sewage Sludge with the Addition of Calcium Oxide <i>Halina P. Kruczek, Wrocław University of Technology, POLAND</i>
9:20 a.m.	TBA	TBA	TBA	81. Hot Oxygen Technology for Tar and Methane Reforming from Syngas Streams <i>Dr. Lawrence E. Larry Bool, Praxair, Inc., USA</i>

THURSDAY Morning - June 20, 2019

9:40 a.m. - Break in the Island Ballroom

10:10 a.m.	Four Concurrent Technical Sessions			
	Session 29 Sand Key Room Biomass & Biomass Cofiring II <i>Les Marshall, Ontario Power Generation, Canada</i>	Session 30 Gulf Room Novel Reactor Design <i>Dave Lyons, National Energy Technology Laboratory, U.S. Department of Energy</i>	Session 31 Palm Room Upgrading Natural Gas <i>Evan Granite, National Energy Technology Laboratory, U.S. Department of Energy</i>	Session 32 Bay Room Fluidized Bed Units <i>Fredrik Lind, Chalmers University, Sweden</i>
10:10 a.m.	88. Parametric Study of Hydrothermal Treatment of Biomass to Produce Biofuels <i>Ankit Mathanker, Deepak Pudasainee, Rajender Gupta, Department of Chemical & Materials Engineering, and Amit Kumar (Department of Mechanical Engineering), University of Alberta, CANADA</i>	49. An Overview of Novel Reactor Development <i>Dave Lyons, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	1. Brief Review of Catalytic Oxidative Coupling of Methane to Ethane and Ethene <i>Evan J. Granite, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	30. Investigating the Leaching Capacity of Potassium from Rock Ilmenite Used as a Bed Material in Fluidized Bed Boiler When Acidic, Neutral and Alkaline Conditions Are Applied <i>Ewa Krymarys, Angelica Gyllén, Fredrik Lind, Magnus Rydén, Department of Space, Earth and Environment and Pavleta Knutsson, Department of Chemistry and Chemical Engineering, Chalmers University of Technology, SWEDEN</i>
10:30 a.m.	93. Numerical Investigation of Pre-mixed and Non-premixed Wood Volatile Injection in an Industrial Biochar Plant <i>Hassan Khodaei, Chris Olson (Innovative Reduction Strategies Inc. (IRSI), and Petr Nikrityuk, Department of Chemical and Materials Engineering, Donadeo</i>	TBA	43. Dehydroaromatization of Ethane Using Microwave Catalytic Reactor <i>John Hu, Department of Chemical & Biomedical Engineering, Center for Innovation in Gas Research & Utilization, West Virginia University, USA</i>	32. Sulfur Interactions with Rock Ilmenite during Combustion of Biomass in a 12MW_{th} CFB Boiler <i>Mariane Vigoureux (Department of Chemistry and Chemical Engineering) Frederik Lind, and Pavleta Knutsson, Department of Space, Earth and</i>

	<i>Innovation Centre for Engineering University of Alberta, CANADA</i>			<i>Environment, Chalmers University of Technology, SWEDEN</i>
10:50 a.m.	140. Integrated Thermo-Catalytic Reforming of Forest and Agricultural Residues <i>Manjot Gill, Rajender Gupta, Department of Chemical & Materials Engineering; and Vinoj Kurian, Madhumita Patel, Amit Kumar, Department of Mechanical Engineering, University of Alberta, CANADA</i>	TBA	48. New Advances in Air Separation for Fossil Energy Plants <i>Dave Lyons, National Energy Technology Laboratory, U.S. Department of Energy, USA</i>	38. Distribution of O₂ and CO in the Cross Section of a Circulating Fluidized Bed Furnace during Operating with Inert and Oxygen Active Bed Materials <i>Fredrik Lind, Chalmers University of Technology, Department of Space, Earth and Environment, SWEDEN</i>
11:10 a.m.	TBA	TBA	92. Upgrading of Natural Gas Liquids via Chemical Looping Oxidative Dehydrogenation (ODH) <i>Luke M. Neal, Vasudev Haribal, Fanxing Li, NC State University, USA</i>	103. Minimizing NO_x Emissions from a Fluidized Bed Boiler <i>Janusz Lichota, Wrocław University of Technology, POLAND</i>
11:30 a.m.	Lunch in the Island Ballroom – Presentation of the Best Student Paper Award and Roundtable Wrap-up Discussion – Bring your ideas and suggestions for next year’s conference.			

FRIDAY MORNING – June 21, 2019

6:30 a.m. Continental Breakfast in Lobby 2 for Polk Power Plant and Covanta Tour Participants

7:00 a.m. – Departure of Polk Power Plant and Covanta Tours

7:30 a.m. – Conference Committee Chairs Meeting

THE CLEARWATER CLEAN ENERGY CONFERENCE HIGHLIGHTS

Endorsing Organizations:

- American Institute of Chemical Engineers
- American Public Power Association
- CANMET Natural Resources, Canada
- China Coal Research Institute
Ministry of Coal, People's Republic of China
- Edison Electric Institute
- Export Assistance Center, U.S. Commercial Service
- International Energy Agency: Coal Research
- Japan Coal Energy Center (JCOAL)
- National Mining Association
- National Rural Electric Cooperative Association
- Ohio Coal Development Office
- U. S. Geological Survey

MISSION STATEMENT – Increased demand – coupled with energy security issues, uncertainty in the oil sector, and changing environmental regulations – **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.

The **current Administration** brings in many more challenges and opportunities for the energy sector.

The Panels, Short Courses and Technical Sessions offer information on all of the major topics of the day.

Technical Sessions The conference presents topics of the greatest interest to the industry in 32 technical sessions.

Panels To provide our attendees with the most comprehensive and up-to-date information from the world's energy leaders, we offer panel presentations covering an overview of emerging, evolving, and innovative technologies, fuels, policy and/or equipment in the power generation industry. In addition, we will honor the life and legacy of the

We plan to cover all the proposed programs and policies. As changes and additions occur, we will cover them.

Through the Technical Sessions, Short Courses, and Panels, 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 seek papers from all countries worldwide.

The **Clearwater Clean Energy Conference** offers participants about 150 technical presentations in four days. Buffet style luncheons in the Exhibit Center (an area dedicated for the use of attendees all day), refreshment breaks and a fabulous beach reception offer numerous networking opportunities.

late Prof. Janos M. Beer.

Short Courses On Sunday, June 16th, we offer Short Courses on a wide variety of topics important to the energy community. **Participation is optional; is included in the registration fee; and open to all conference registrants.**

Themed Luncheon – A conference favorite is the Themed Luncheon. Industry leaders host tables of 8 where a specific topic is chosen by the host for discussion during lunch.

Advanced Cycles for Power Generation, Horst Hack, Electric Power Research Institute

Supercritical CO₂, Josh Stanislawski, Energy & Environmental Research Center, University of North Dakota

Exhibit Center showcasing 24 booths also provides opportunities to highlight accomplishments and achievements. We also offer tables for Information Display. Those signing are included in the write-ups and could include an ad in the Official Program.

Best Student Paper Award – Over the years the conference has benefitted from the many excellent papers given by students. To give these exceptional students well-deserved recognition, the Conference Committee now presents the **Clearwater Clean Energy Conference Best Student Paper Award**. All full time students are eligible for participation.

Field Trips – Friday, June 21, 2019

BACKGROUND

At the direction of the Conference Committee, it was decided to broaden the scope of the conference to include some new and exciting technologies currently on the horizon. Industry professionals representing nearly all the major players in the electric utility industry were in Clearwater, Florida, USA for the **43rd Clearwater Clean Energy Conference.**

This conference has earned a reputation for excellence as one of the premiere conferences on coal technologies as it grows in size and scope since its inception in 1975.

HEADQUARTERS – Sand Key is one of the 20 Best Beaches, according to many travel and tourism organizations. **Sheraton Sand Key**, 1160 Gulf Boulevard, Clearwater, Florida – Phone: 727-595-1611 FAX: 727-596-8488 offers the conference \$193/night for Single or Double accommodations. Identify as a conference participant and use code: CL1143.
<http://www.beachsand.com> for information about the Sheraton Sand Key

Covanta Pasco, Inc. – Energy-from-Waste Facility

The Pasco County Solid Waste Resource Recovery Facility in Spring Hill, FL, operating as Covanta Pasco, Inc., began commercial operation in May 1991, serving the residents of Pasco County. The facility processes up to 1,050 tons per day of municipal solid waste, generating 31.2 megawatts of renewable energy that is sold to Duke Energy. The facility uses secondary sewer treatment effluent from a nearby wastewater treatment plant for part of its process water make-up. In addition, as part of the Energy-from-Waste facility, there is a public drop-off center where local residents can bring non-hazardous household items for disposal.

Polk Power Plant Field Trip:

Tampa Electric Company planned, engineered, built, and operates the Polk Power Plant Unit #1 Integrated Gasification Combined Cycle (IGCC) Power Plant. The project was partially funded under the Department of Energy's Clean Coal Technology Program pursuant to a Round III award.

The 44th International Technical Conference on Clean Energy

June 16 to 21, 2019

Sheraton Sand Key, Clearwater, Florida, USA

Visit

www.ClearwaterCleanEnergyConference.com
for complete conference details



44th International Technical Conference on Clean Energy

**June 16 to 21, 2019
Sheraton Sand Key
Clearwater, Florida, USA**

\$795 Now to March 31st

\$895 April 1st to May 1st

\$995 May 2nd to the conference.

\$395 Full Time Students to May 1st –

\$495 May 2nd to Conference

REGISTRATION FORM -- (Return with payment) – or call with credit card information to avoid filling out the form

Name _____

First Name for
Badge _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Country _____

Phone _____

Mobile _____

Email _____

Registration
Fee: \$ _____

Spouse's Fee: \$150.00

Spouse's
Name _____

Polk Power Plant Tour: \$150.00

Covanta/Hillsborough Tour: \$150.00

GRAND TOTAL:
\$ _____

*The registration fee covers one **Proceedings**, all conference events (Sunday through Thursday), the Exhibit Center, 4 luncheons, evening events, all breaks, all Continental breakfasts, and all conference materials.*

CTA reserves the right to modify the Conference Program at any time

Method of Payment; Check One:

Check enclosed (payable to CTA; remit to Post Office Box 1130, Louisa, VA 23093); or call 540-603- 2022 or 240-751-0900 with the information below or email to barbarasak@aol.com

VISA No.

MasterCard No.

American Express No.

Discover No.

Card Expiration Date:

Signature: _____

Spouses Registration *With so much to see and do in the Clearwater area; we don't plan specific activities for spouses. However, the \$150 fee covers the Welcome Party, four luncheons, beach party, Continental breakfasts and all refreshment breaks. **Keep in mind, the on-site spouse's registration is \$175.***

Student Registration *To encourage participation by full-time students currently enrolled in a college or university, the Conference Committee is offering a registration fee of \$395 to May 1st; \$495 after that date.*

The Clearwater Clean Energy Conference

*Barbara Sakkestad
Post Office Box 1130
Louisa, VA 23093
240/751-0900
540/603-2022
barbarasak@aol.com*

www.ClearwaterCleanEnergyConference.com