

# Forty-First Annual International Pittsburgh Energy and Carbon Management Conference (PECMC) (Virtual)

**October 07-09, 2024**

## Technical Program

**"Technology Innovation and Transition to Cleaner Energy"**

### Participating Organizations

*Ajou University, SOUTH KOREA  
Commonwealth Scientific and Industrial  
Research Organisation (CSIRO),  
AUSTRALIA  
CONSOL Energy Inc., USA  
Freiberg University of Mining &  
Technology, GERMANY  
Gas Technology Institute (GTI), USA  
Hamilton Maurer International, USA  
HTI, USA  
Institute for Chemical Processing of Coal,  
POLAND  
Istanbul Technical University, TURKEY  
KeyLogic Systems, Inc., USA  
Longbridge Energy Consulting, USA  
MIE University, JAPAN*

*National Institute of Clean and Low-  
Carbon Energy (NICE), CHINA  
Osaka University, JAPAN  
Penn State University, USA  
Sotacarbo S.p.A., ITALY  
Southern University of Science and  
Technology, CHINA  
The Ohio State University, USA  
U.S. DOE/NETL, USA  
U.S. Geological Survey, USA  
University of Houston, USA  
University of Kentucky, USA  
University of New Orleans, USA  
University of Pittsburgh, USA  
University of Wyoming, USA  
West Virginia University, USA*



**Hosted by:**



## WELCOME!

On behalf of the Conference Advisory Board, Conference Committees, and the University of Pittsburgh, we welcome you to the Forty-first [Annual International Pittsburgh Energy and Carbon Management Conference \(PECMC-2024\)](#), which will be held October 7-9, 2024 online via Zoom. The Conference is hosted by the University of Pittsburgh, USA.

The theme of this year's conference "Technology Innovation and Transition to Cleaner Energy" covers wide a spectrum of important topics on energy and environmental issues and technologies, which are directly related to secure transition to clean energy. This year's Technical Program includes two parallel oral tracks on Monday (10/7/2024), two parallel oral tracks on Tuesday (10/8/2024), and two parallel oral tracks on Wednesday (10/9/2024). All tracks begin at 10:00 and end at 15:00 each day. Detailed information about the technical sessions are available in page 8 of the Technical Program.

This year's invited Plenary Speakers are: (1) The Honorable Brad Crabtree, Assistant Secretary for Fossil Energy and Carbon Management; (2) Dr. Marianne Walck, Director of the National Energy Technology Laboratory (NETL) US-DOE; (3) The Honorable Charles McConnell, Assistant Secretary of Energy (2011-13) US-DOE, Energy Officer UH Energy, Executive Director, Carbon Management and Energy Sustainability Chancellor/President's Division, University of Houston; (4) Dr. Ahmed Aboudheir, Chief Executive Officer of Aboudheir Consulting Ltd; (5) Dr. Evan Granite, Program Manager, Carbon Ore, Senior Technical Advisor, U.S. DOE - Fossil Energy & Carbon Management; and (6) Dr. Omar Basha, Managing Director, ONB Engineering Research and Technical Services LLC.

We express our sincere gratitude to the Plenary Speakers and Moderators for their support and involvement, to all the authors and co-authors of the technical papers and to all the members of the Technical Program Committee. Special thanks go to the topic coordinators, co-chairs and speakers for their invaluable contributions to the 2024 technical program.

As the chair of the Advisory Board of the Conference, I deeply appreciate your participation and interest in this year's Conference and we invite you to join us next year for the Forty-second Annual International Pittsburgh Energy and Carbon Management Conference (PECMC-2024), hopefully in-person, at the Westin Convention Center Hotel in Pittsburgh, PA, USA .

Sincerely,

Massood Ramezan, Chair



Senior Technical Advisor at Key Logic Systems, USA

## The International Pittsburgh Energy and Carbon Management Conference

### **EXECUTIVE DIRECTOR:**

Dr. Badie I. Morsi

### **CONFERENCE OFFICE:**

University of Pittsburgh, Swanson School of Engineering  
Pittsburgh Coal Conference

3700 O'Hara Street, 940 Benedum Hall, Pittsburgh, PA 15261 USA  
Tel: +1-412-624-7440 Email: [ipcc@pitt.edu](mailto:ipcc@pitt.edu) [www.pccpitt.org](http://www.pccpitt.org)

## CONFERENCE OVERVIEW

### MONDAY, OCTOBER 7, 2024

PLENARY SESSION I	08:00 - 10:00
CONCURRENT TECH. SESSIONS	10:00 - 12:00
LUNCH	12:00 - 13:00
CONCURRENT TECH. SESSIONS	13:00 - 15:00

### TUESDAY, OCTOBER 8, 2024

PLENARY SESSION II	08:00 - 10:00
CONCURRENT TECH. SESSIONS	10:00 - 12:00
LUNCH	12:00 - 13:00
CONCURRENT TECH. SESSIONS	13:00 - 15:00

### WEDNESDAY, OCTOBER 9, 2024

PLENARY SESSION IIII	08:00 - 10:00
CONCURRENT TECH. SESSIONS	10:00 - 12:00
LUNCH	12:00 - 13:00
CONCURRENT TECH. SESSIONS	13:00 - 15:00

*Times listed are Eastern Daylight Savings Time USA (Local Pittsburgh, PA, USA)*

## ZOOM INVITATIONS

	Track 1 (8:00-14:30)	Track 2 (10:00-15:00)
<b>Monday 10/7/2024</b>	<p style="text-align: center;"><b>Plenary Session I and Sessions 1 &amp; 3</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/92309437229">https://pitt.zoom.us/j/92309437229</a></p> <p style="text-align: center;">Meeting ID: 923 0943 7229 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,92309437229# US (Philadelphia) 8778535247,,92309437229# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/acik1aWEzE">https://pitt.zoom.us/u/acik1aWEzE</a></p>	<p style="text-align: center;"><b>Sessions 2 &amp; 4</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/96932055493">https://pitt.zoom.us/j/96932055493</a></p> <p style="text-align: center;">Meeting ID: 969 3205 5493 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,96932055493# US (Philadelphia) 8778535247,,96932055493# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/aee50qZqBg">https://pitt.zoom.us/u/aee50qZqBg</a></p>
	<b>Track 1 (8:00-15:00)</b>	<b>Track 2 (10:00-14:30)</b>
<b>Tuesday 10/8/2024</b>	<p style="text-align: center;"><b>Plenary Session II and Sessions 5 &amp; 7</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/98781954319">https://pitt.zoom.us/j/98781954319</a></p> <p style="text-align: center;">Meeting ID: 987 8195 4319 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,98781954319# US (Philadelphia) 8778535247,,98781954319# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/almUsy7qA">https://pitt.zoom.us/u/almUsy7qA</a></p>	<p style="text-align: center;"><b>Sessions 6 &amp; 8</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/92512980106">https://pitt.zoom.us/j/92512980106</a></p> <p style="text-align: center;">Meeting ID: 925 1298 0106 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,92512980106# US (Philadelphia) 8778535247,,92512980106# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/acDmBabPbf">https://pitt.zoom.us/u/acDmBabPbf</a></p>
	<b>Track 1 (8:00-14:30)</b>	<b>Track 2 (10:00-15:00)</b>
<b>Wednesday 10/9/2024</b>	<p style="text-align: center;"><b>Plenary Session III and Sessions 9 &amp; 11</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/91903279767">https://pitt.zoom.us/j/91903279767</a></p> <p style="text-align: center;">Meeting ID: 919 0327 9767 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,91903279767# US (Philadelphia) 8778535247,,91903279767# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/apGSAPFb4">https://pitt.zoom.us/u/apGSAPFb4</a></p>	<p style="text-align: center;"><b>Sessions 10 &amp; 12</b> Join Zoom Meeting <a href="https://pitt.zoom.us/j/96038226849">https://pitt.zoom.us/j/96038226849</a></p> <p style="text-align: center;">Meeting ID: 960 3822 6849 Passcode: PECMC2024</p> <p style="text-align: center;">One tap mobile +12678310333,,96038226849# US (Philadelphia) 8778535247,,96038226849# US Toll-free Find your local number: <a href="https://pitt.zoom.us/u/adQMIB6DLD">https://pitt.zoom.us/u/adQMIB6DLD</a></p>

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## Plenary Sessions

**MONDAY, October 7, 2024**

**8:00-10:00 - PLENARY SESSION I**

**Moderator: Dr. Massood Ramezan**

**8:00-9:00 - The Honorable Brad Crabtree**

Assistant Secretary for Fossil Energy and Carbon Management

**"Carbon Management: Progress to Date and Challenges Going Forward"**

**9:00 - 10:00 - Dr. Omar Basha**

Managing Director, ONB Engineering Research and Technical Services LLC

**"Highlighting Critical Barriers in the CCUS Value Chain to Develop technically and Economically Feasible Solutions"**

**TUESDAY, October 8, 2024**

**8:00-10:00 - PLENARY SESSION II**

**Moderator: Mr. Thomas Sarkus**

**8:00 – 9:00 - Dr. Ahmed Aboudheir**

Chief Executive Officer of Aboudheir Consulting Ltd

**"Design and Deployment of Large Scale CCUS Projects that Work Towards Net Zero by 2050"**

**9:00 - 10:00 - Dr. Marianne Walck**

Director of the National Energy Technology Laboratory (NETL) US-DOE

**"Driving Clean Energy: NETL's Role, Integrated Systems, and the Path to Carbon Management"**

**WEDNESDAY, October 9, 2024**

**8:00-10:00 - PLENARY SESSION III**

**Moderator: Mr. Richard Winschel**

**8:00 – 9:00 - The Honorable Charles McConnell**

Assistant Secretary of Energy (2011-13) US-DOE Energy Officer UH Energy

Executive Director, Carbon Management and Energy Sustainability Chancellor/President's Division  
University of Houston

**"The Energy Transition Requires CCUS for Transformation"**

**9:00 - 10:00 - Dr. Evan Granite**

Program Manager, Carbon Ore

Senior Technical Advisor, U.S. DOE - Fossil Energy & Carbon Management

**"Domestic Wastes and Byproducts: A Resource for Critical Material Supply Chains"**

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## Virtual Conference FAQ's

All participants are expected to conduct themselves in a professional and respectful manner during the conference and abide by all applicable University policies and procedures. While this conference is a public discussion, participants may not record any session.

How do I join a session?

Conference staff will email the Zoom meeting details to all paid conference attendees the day before the conference. It is recommended that you test Zoom before the conference.

How do I ask a question during a session?

To submit a question to the speaker, type it into the Zoom chat box. The session co-chair will read questions from the chat to the speaker.

I am giving an oral presentation, what do I need to do during my session?

Please sign in to the Zoom session 10-15 minutes before your scheduled presentation time. At the start of your scheduled presentation time the session co-chair will announce your presentation and conference staff will play your pre-recorded video presentation or you will present live for 25 min. Following the talk there will be 5 minutes of live question and answer. The session co-chair will read you any questions submitted in the chat

## Oral Presentation Sessions

Monday (10/7/2024)		
	Track 1	Track 2
8:00 - 9:00	Plenary Session I	
9:00 - 10:00		
10:00 - 10:30	Carbon Management - 1 (Session 1)	Value-Added Products from Coal - 1 (Session 2)
10:30 - 11:00		
11:00 - 11:30		
11:30 - 12:00		
12:00- 13:00	Lunch	
13:00 - 13:30	Carbon Management - 2 (Session 3)	Value-Added Products from Coal - 2 (Session 4)
13:30 - 14:00		
14:00 - 14:30		
14:30 - 15:00		
Tuesday (10/8/2024)		
	Track 1	Track 2
8:00 - 9:00	Plenary Session II	
9:00 - 10:00		
10:00 - 10:30	Coal Science/Clean Coal and Gas to Fuels (Session 5)	Gasification Technologies (Session 6)
10:30 - 11:00		
11:00 - 11:30		
11:30 - 12:00		
12:00- 13:00	Lunch	
13:00 - 13:30	Carbon Management -3 (Session 7)	Clean Coal Demonstration and Commercial Projects (Session 8)
13:30 - 14:00		
14:00 - 14:30		
14:30 - 15:00		
Wednesday (10/9/2024)		
	Track 1	Track 2
8:00 - 9:00	Plenary Session III	
9:00 - 10:00		
10:00 - 10:30	Clean Hydrogen (Session 9)	Coal Bed Methane and Shale Gas/Sustainability & Environment (Session 10)
10:30 - 11:00		
11:00 - 11:30		
11:30 - 12:00		
12:00- 13:00	Lunch	
13:00 - 13:30	Rare Earth Elements/Energy Storage (Session 11)	Combustion Technologies (Session 12)
13:30 - 14:00		
14:00 - 14:30		
14:30 - 15:00		

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# TECHNICAL PROGRAM—ORAL PRESENTATIONS

## ORAL SESSIONS

Monday, October 7

10:00 — 15:00

### SESSION 1

#### CARBON MANAGEMENT — 1

*Bingyun Li*

**10:00 Photothermal reduction of CO<sub>2</sub> to formic acid over Pd/P25 composite catalyst**, Fangyuan Zhang, Jieying Jing, Wen-Ying Li, Taiyuan University of Technology, Taiyuan, CHINA

**10:30 Characteristic of hydrogen production from various of feed gases in sorption enhanced water gas shift reactions**, Jinpeng Zhang, Yanxin Jia, Jieying Jing, Wenying Li, Taiyuan University of Technology, Taiyuan, CHINA

**11:00 Adsorption and desorption kinetics of dry sorbents for CO<sub>2</sub> capture**, Gregory N. Okolo, Juan Williams, Raymond C. Everson, John R. Bunt, Paola Ammendola, Federica Raganati, North-West University, SOUTH AFRICA

**11:30 Lessons Learned from Canadian CCUS Projects**, Laura Westover, Puttipong Tantikhajorngosol, The International CCS Knowledge Centre, Regina, SK, CANADA

### SESSION 2

#### VALUE-ADDED PRODUCTS FROM COAL — 1

*Richard Bajura*

**10:00 Comparing ashes of some thermal power plants and metallurgical factory in Vietnam and their utilization**, Nguyen Viet Quang Hung, Centre of Severe Materials and Environment, Hanoi, Vietnam; Masakatsu Nomura, Osaka University, Osaka, Japan; Chu Thi Thanh, TMD Group, Vinh City, Nghe An, Vietnam; Tadanori Hashimoto, Atsushi Ishihara, Mie University, Tsu - City, Mie, Japan

**10:30 Application of composite external donor technology in coal-based polypropylene production**, Peiqian Yu, Yufei Bian, Liuha Feng, Yue Yu, Rongjuan Cong Lin feng, Chen, National institute of Clean-and-Low-Carbon, Beijing, CHINA

**11:00 Molecular design and performance modulation of anthracene-based solar thermal fuels**, Chonghua Li, Xingtang Xu, Jieying Jing, Wen-Ying Li, Taiyuan University of Technology, Taiyuan, CHINA

**11:30 Efficient separation of monoaromatics from direct coal liquefaction**,

Xiao-Long Shi, Yun-Cai Song, Jie Feng, Wen-Ying Li, Taiyuan University of Technology, Taiyuan, CHINA

### SESSION 3

#### CARBON MANAGEMENT — 2

*Omar Basha*

**13:00 Converting CO<sub>2</sub> into Nano-Minerals via Amino Acids**, Bingyun Li, Qingyang Li, Department of Orthopaedics, West Virginia University, Morgantown, WV, USA

**13:30 Carbon Management Driven by Wafer Scale Engines**, Vyacheslav Romanov, National Energy Technology Laboratory (NETL), Pittsburgh, PA, USA

**14:00 Direct Air Capture Deployment Assessment in Deep Mitigation Pathways Toward 2075 in the U.S.: MARKAL-NETL Modeling Results**, Christopher Nichols, Nadejda Victor, National Energy Technology Laboratory, USA

### SESSION 4

#### VALUE-ADDED PRODUCTS FROM COAL - 2

*Richard Winschel*

**13:00 NOVEL PRB COAL BASED ASPHALT**, L.C. Muller, Cheng-Yen Pan, T.I. Pfeiffer, P. Behrens, J.J. Adams, Y. Kumbargeri, J.-P. Planche, J. Martin, L. Hazard, Md I. Haque, University of Wyoming - School for Energy Resources, Western Research Institute, Laramie, WY, USA

**13:30 A Novel Approach to Manufacturing Lignite Composites with High-Filler Content**, Md. Reza-E-Rabby, Keerti Kappagantula, Jose Ramos, Raveen John, Aditya Nittala, Yelin Li, Nathan Canfield, Adam Denny, Ethan Nickerson, Satish Nune, David J Heldebrant, Pacific Northwest National Laboratory, Richland, WA, USA

**14:00 ROCK WOOL SPUN FROM VITRIFIED COAL FLY ASH/SLAG IS VERY PROFITABLE**, Howard McClintic, Concurrent Technologies Corporation, Washington, DC, USA

**14:30 Critical Elements for the Construction of a sustainable Closure\* for CCR Impoundment**, Mark Keck, Cristine Zubrow, Al Briggs, Key Environmental, Inc., Carnegie, PA, USA

## ORAL SESSIONS

Tuesday, October 8

10:00 — 15:00

### SESSION 5

#### COAL SCIENCE/CLEAN COAL AND GAS TO FUELS

*Isaac Gamwo*

**10:00 Evaluation of temporal variations in the chemistry of exposed coal heaps**, Jyoti Sharma, Ashok K Singh, Arnold L Usham, Priya Kumari, CSIR-Central Institute of Mining and Fuel Research, Dhanbad (DC), Jharkhand, INDIA; Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, INDIA

**10:30 Preparation And Catalytic Cracking Reactivity of Zsm-5 Zeolite from Vietnamese Quang Ninh Coal Ash**, Atsushi Ishihara, Hung Viet Nguyen, Koki Kunieda, Shinya Matsuura, Tadanori Hashimoto, Mie University, Tsu City, Mie Pref., JAPAN

**11:00 Enhanced Phenanthrene Hydrogenation Saturation Performance over Nickel-Based Catalyst via Adjusting the Interaction Between Ni and Support**, Tao Tian, Zemin Zhao, Jieying Jing, Wenying Li, State Key Laboratory of Clean and Efficient Coal Utilization, Taiyuan University of Technology, CHINA

**11:30 Blue Ammonia and Urea Production via Coal-Gasification**, Ravi Ravikumar, Sunil Kumar Singhal, Ben Vivier, Fluor Enterprises, Aliso Viejo, CA, USA

### SESSION 6

#### GASIFICATION TECHNOLOGIES

*Massood Ramezan*

**10:00 The formation and evolution of pores during the pyrolysis of low-rank coal and its influence on products mass transfer**, Yi Cui, Yun-Cai Song, Jie Feng, Wen-Ying Li, State Key Laboratory of Clean and Efficient Coal Utilization, Taiyuan University of Technology, Taiyuan, CHINA

**10:30 Building an Energy System Based on Thar Coal**, Farid A. Malik, Abid Aziz, FCC University, Lahore, Pakistan; Pak Motors (Pvt) Ltd, PAKISTAN

**11:00 U.S. Department of Energy/ National Energy Technology Laboratory Gasification Systems Program Overview**, Jonathan W. Lekse, U.S. DOE, National Energy Technology Laboratory, Pittsburgh, PA, USA

**11:30 Machine Learning Enhanced LIBS to Measure and Process Biofuels and Waste Coal for Gasifier Improved Operation**, Ozan Karadut, Zheng Yao, Carlos Romero, Robert De Saro, Joe Craparo, Larry Mulligan, Johan Van Dyk, Asmara Soomro, Alexander Koutsostamatis, Lehigh University, Energy Research Center; GTI Energy, Energy Research Company, USA



# TECHNICAL PROGRAM—ORAL PRESENTATIONS

## SESSION 7

### CARBON MANAGEMENT — 3

*Omar Basha*

**13:00** **Advancements in Methane-to-Methanol Conversion Technologies: A Review**, Omar M. Basha, Rui Wang, Isaac Gamwo, Badie I. Morsi, ONB Engineering Research and Technical Services LLC, Delaware, USA; U.S. DOE NETL, Pittsburgh, PA, USA; University of Pittsburgh, Pittsburgh, PA, USA

**13:30** **TEA of the SMR-CCS Process for Blue Hydrogen Production Using Thirty-Six Physical Absorbents**, Rui Wang, Husain E. Ashkanani, Nicholas S. Siefert, Robert L. Thompson, Jeffrey Culp, Kathryn Smith, Janice A. Steckel, Wei Shi, Isaac K. Gamwo, David Hopkinson, Victor Kasuma, Badie I. Morsi, U.S. DOE National Energy Technology Laboratory, Pittsburgh, PA, USA; Kuwait University, Kuwait; University of Pittsburgh, Pittsburgh, PA, USA.

**14:00** **Performance of Anthracite Coal-Derived Activated Carbon in Adsorbing CO<sub>2</sub> across Different Gas Concentrations**, Zeyuan Tian, Gabriel Bonsall, Zheng Yao, Carlos Romero, Tom Lowe, Greg Driscoll, Boyd Kreglow, Harold Schobert, Lehigh University - Energy Research Center, Blaschak Anthracite Corporation, USA

**14:30** **Impact of a bluff-body on pressurized oxy-combustion**, Lei Li, V'yacheslav Akkerman, WVU, Morgantown, West Virginia, USA; Richard L. Axelbaum, Duarte Magalhaes, Mao Cheng, Washington University in Saint Louis, MO, USA

## SESSION 8

### CLEAN COAL DEMONSTRATION AND COMMERCIAL PROJECTS

*Thomas Sarkus*

**13:00** **A Random Walk Through...NETL's Commercial Success Stories**, Thomas A. Sarkus, National Energy Technology Laboratory, USA

**13:30** **Planned Unit Will Produce REE Alloys for Permanent Magnets**, Howard McClintic, Concurrent Technologies Corporation, Washington, DC, USA

**14:00** **Status of DOE Carbon Management Demonstration and Large Pilot Plant Projects**, Thomas Sarkus, National Energy Technology Laboratory, U.S. Department of Energy, USA

**ORAL SESSIONS**  
**Wednesday, October 9**  
**10:00 — 15:00**

## SESSION 9

### CLEAN HYDROGEN

*Thomas Sarkus*

**10:00** **Design of Non-Fluorinated Proton Exchange Membranes from Poly(Terphenyl Isatin) with Fluorene-Linked Sulfonate Groups and Microblock Structures**, Chaoyi Ba, Shu Xu, Meltem Urgun-Demirtas, Argonne National Laboratory, Lemont, IL, USA

**10:30** **Thermal-catalytic Decomposition of Natural Gas for Clean Hydrogen and premium Carbon Using Electric Fields**, Randy Vander Wal, James Heim, II, Mpila Nkiawete, Penn State University, University Park, USA

**11:00** **Performance Testing of a Moving-Bed Gasifier Using Coal Biomass and Waste Plastic Blends with Washed and Unwashed Legacy Coals**, Horst Hack, George Booras, Rolf E. Maurer, David P. Thimsen, Elijah Thimsen, Alberto Pettinau, Simone Meloni, Gabriele Calli, Hang Zhou, Yupeng Xu, Mehrdad Shahnam, Electric Power Research Institute (EPRI), USA, Hamilton Maurer International, Inc. Hudson, IL, USA, Sotacarbo Sotacarbo Società Tecnologie Avanzate Low Carbon S.p.A., Carbonia, ITALY, National Energy Technology Laboratory (NETL), Morgantown, WV, USA

**11:30** **Halo: Hydrogen-Recovery Using an Ai-Arc-Plasma Learning Operational System For Produced Water**, Glen Nakafuji, Oceanit, Honolulu, HI, USA

## SESSION 10

### COAL BED METHANE AND SHALE GAS/ SUSTAINABILITY & ENVIRONMENT

*Richard Bajura*

**10:00** **Analyzing Thanh Hoa, Ha Tinh and Nghe An coal samples of Vietnam**, Nguyen Viet Quang Hung, Centre of Severe Materials and Environment, Hanoi, Vietnam; Masakatsu Nomura, Osaka University, Osaka, Japan; Chu Thi Thanh, TMD Group, Vinh City, Nghe An, Vietnam; Tadanori Hashimoto, Atsushi Ishihara, Mie University, Tsu - City, Mie, Japan

**10:30** **Research Progress and Key Scientific Issues of Unconventional Natural Gas**, Dameng Liu, China University of Geosciences, Beijing, CHINA

**11:00** **Understanding the Regional Variations in Pay Thickness of Unconventional Reservoirs in the Powder River Basin by Incorporating Learnings from a Site-Specific, Core-Calibrated, Geologic Model**, Luke Fritz, Richard Ness, Ben Roth, Nick Jones, Advanced Resources International, Advanced Resources International, TN; Enhanced Oil Recovery Institute, WY, USA

**11:30** **Road Traffic Density Analysis and Multi-Objective Optimization of Coal Hauling Trucks Selection by Considering Cost and CO<sub>2</sub> Emissions towards Cleaner Mining Production: Case Study of PT ABC**, Irfan Aji Ramadan, Firly Rachmaditya Baskoro, Tri Karian, Fadhila Achmadi Rosyid, Arjo Prawoto Wibowo, Institut Teknologi Bandung, INDONESIA

## SESSION 11

### RARE EARTH ELEMENTS/ENERGY STORAGE

*Richard Winschel*

**13:00** **Photoelectrocatalytic Hydrogen Production from Seawater Using Element-Doped TiO<sub>2</sub> Nanorods**, Chen-Hang HuangFu, Yun-Cai Song, Jie Feng, Wen-Ying Li, State Key Laboratory of Clean and Efficient Coal Utilization, Taiyuan University of Technology, Taiyuan, CHINA

**13:30** **Beyond Combustion – Coal in the 21st Century – Carbon Products from Coal**, Evan J. Granite, U.S. DOE, USA

**14:00** **Critical Mineral Supplies and Market Sector Demands for LIBs and EVs**, Randy Vander Wal, James Heim, Penn State University, University Park, PA, USA

## SESSION 12

### COMBUSTION TECHNOLOGIES

*Evan Granite*

**13:00** **Life Cycle Greenhouse Gas Emissions of Coal-Biomass Co-firing Power Plants with Carbon Capture and Storage**, Wanying Wu, Haibo Zhao, University of Wyoming, Laramie, WY, USA

**13:30** **Thermogravimetric Analysis Combustion Characteristics of Coal Microlithotype Particle Types**, Lesigen Moodley, Frikkie Conradie, Walter Schmitz, Hein Neomagus, Bonny Nyangwa, Olifant Sinthumule, Eskom Research, Testing and Development, Johannesburg; North-West University; University of Witwatersrand, SOUTH AFRICA

**14:00** **The effect of dry salt conditioning on the resistivity of South African fly ashes**, Gregory N. Okolo, Barend Mienie, Burgert B. Hattingh, Hein W.J.P. Neomagus, North-West University, SOUTH AFRICA

**14:30** **Drop Tube Furnace Combustion Characteristics and Computation Fluid Dynamics Modelling Of Coal Char Microlithotype Particle Types**, Lesigen Moodley, Frikkie Conradie, Walter Schmitz, Hein Neomagus, Bonny Nyangwa, Kganuwi Kekana, Eskom Research, Testing and Development, Johannesburg; North-West University; University of Witwatersrand, SOUTH AFRICA

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