ASME ES 2023

17th International Conference on Energy Sustainability

CONFERENCE
July 10–12, 2023

The Madison DC Hotel
Washington DC, USA

Program

https://event.asme.org/ES

The American Society of Mechanical Engineers®
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SETTING THE STANDARD

Welcome from the conference chairs

DEAR COLLEAGUES,

On behalf of the ASME's Advanced Energy System Division and Solar Energy Division, we are delighted to welcome you to the ASME 2023 Energy Sustainability Conference in Washington, DC!

Our conference theme this year, "A Just Transition to a Sustainable Future," emphasizes the critical importance of not only transitioning away from carbon intensive fossil fuels towards sustainable energy, but also the necessity of doing so in a way that is fair, inclusive, and just. This conference brings together a community of scholars dedicated to developing better technologies to reduce the amount of energy we use and to produce that energy renewably. The work highlighted here this week demonstrates the breadth of ideas and depth of knowledge needed to move sustainability forward. As we gather in the capital city of the United States, we also recognize the critical role that public policy plays in this endeavor.

The conference is a leading forum in which experts and researchers from academia, industry, national labs, and other key organizations gather to exchange ideas, research achievements, and technical developments in various research areas related to energy and sustainability. The conference technical tracks cover a wide range of topics, including Sustainable Buildings and Communities, Concentrating Solar Power, Solar Chemistry, Photovoltaics, Wind Energy, Energy Storage, Sustainable Manufacturing, Alternative Fuels, Geothermal Energy, Hydrogen Energy, Carbon Capture, Education and Policy for Clean Energy Transition, and more. The Energy Sustainability Conference is co-located with the Summer Heat Transfer Conference to provide an excellent opportunity for the attendees to expand their network and participate in technical sessions on a broader list of topics. We are pleased to announce that we have a full schedule, including expert technical presentations, keynote and plenary speakers, and networking events.

This year's conference organizers have prioritized encouraging participation of new voices through the introduction of two new registration discount awards. The first is a deep discount on student registration fees, and it demonstrates how important the next generation of scholars is to the goals of a just transition to a sustainable future. The second award supports attendance of scholars early in their careers and scholars from institutions that are often underrepresented in engineering spaces, including minority-serving institutions, undergraduate institutions, and institutions from the global south. This award affirms our strong belief that a diverse scholarly community will develop better, more durable, and more just paths to a sustainable future.

The Organizing Committee would like to express its deep gratitude to the volunteer session chairs, reviewers, track organizers, and Executive Advisory Committee who have spent countless hours putting together a high-quality technical program. We would also like to thank ASME staff members for their support of the program, and we especially express our gratitude to our authors and presenters for sharing their latest research results with us. We sincerely hope you enjoy the conference!

2023 Energy Sustainability Conference Organizing Committee

Hamidreza Najafi, Ph.D., Conference General Chair, AESD, Florida Institute of Technology
Julia Nicodemus, Ph.D., Conference General Chair, SED, Lafayette College
Luke J. Venstrom, Ph.D., Technical Program Chair, SED, Valparaiso University
Ben Xu, Ph.D., Technical Program Chair, AESD, University of Houston
Rohini Bala Chandran, Ph.D., Technical Program Co-Chair, SED, University of Michigan
Pei-Dong, Ph.D., Technical Program Co-Chair, AESD, George Mason University

Contents

Conference Information

REGISTRATION INFORMATION

Dolley Madison Foyer, Second Floor

Registration Hours:

Sunday, July 9, 3:00PM–6:00PMPM

Monday, July 10, 7:00AM–5:00PM

Tuesday, July 11, 7:00AM–5:00PM

Wednesday, July 12, 8:00AM–4:00PM

EXHIBIT INFORMATION

Dolley Madison Ballroom Foyer, Second Floor

Hours

Monday, July 10, 10:00AM–4:00PM

Tuesday, July 11, 10:00AM–4:00PM

Wednesday, July 12, 10:00AM–4:00PM

AUDIOVISUAL EQUIPMENT IN SESSION ROOMS

All technical sessions are equipped with one LCD projector and one screen. Laptops will NOT be provided in the sessions. Presenters should coordinate with their session chairs regarding the presentation laptop. Please plan to bring your presentation on a thumb drive 15–20 minutes prior to the session start time and/or arrange logistics directly with your session chair.

BADGE REQUIRED FOR ADMISSION

All conference attendees must always wear the official ASME 2023 ES badge to gain admission to technical sessions, exhibits, and other conference events. Without a badge, you will NOT be allowed to attend any conference activities.

CONFERENCE AWARD LUNCHEON (TICKET REQUIRED FOR GUESTS ONLY)

The Awards Luncheon will take place during the conference to recognize and celebrate a select group of individuals for their contributions and achievements in energy sustainability.

Solar Energy Division (SED) and Advanced Energy Systems Division (AESD) Awards Luncheon is on **Tuesday, July 11, 12:15PM–1:45PM in Potomac A on the Lobby Floor**.

CONFERENCE LUNCHES

Conference lunches will be held from **12:15PM to 1:45PM on Monday and Wednesday in Dolley Madison/Montpelier A&B located on the Second Floor**. Please join your fellow attendees for a good meal and a great networking opportunity.

Underrepresented in STEM Lunch Discussion
Monday, July 10
12:30 PM – 1:45 PM
Room: Constitution A

Grab lunch from the main dining room and join us for networking and guided discussions around our experiences as members of underrepresented groups in STEM.

We welcome anyone who is part of an underrepresented group in STEM, including, but not limited to, underrepresentation based on gender, sexuality, race, ethnicity, or (dis)ability.

Guided group discussions over lunch will give us a chance to meet and get to know each other as well as share experiences and learn from each other about both the common and unique experiences we face as members of underrepresented groups.

CONFERENCE APP

SHTC/ES 2023 is utilizing a mobile event app in place of a printed program to enhance the conference experience for all attendees.

- Connect with Attendees
- View Speaker Profiles
- Access Session Information
- Watch On-Demand Content
- Download Final Papers
- And More!

*All features may not be available at all events.

CONFERENCE PROCEEDINGS

Each attendee will receive an email with a unique code to access digital copies of all the papers accepted for presentation at the conference. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings are registered with the Library of Congress and are submitted for abstracting and indexing. The proceedings are published in the ASME Digital Library. You will be provided with an individual link to the online papers via email. In the event you do not receive the email, send a request to toolboxhelp@asme.org.

CONFERENCE REFRESHMENT BREAKS

Morning and afternoon breaks will be provided in the Dolley Madison Foyer, Second Floor. Come and meet our exhibitors, Carrier Corporation, Boeing and FluxTeq, and join your fellow attendees for a few minutes of networking and discussion. The schedule is as follows:

Monday–Wednesday, July 10–12
10:30AM–11:30AM and 3:30PM–4:00PM

EMERGENCY INFORMATION

If you are experiencing a health emergency, please dial 911. If you are able or someone else is able, please dial zero and inform the operator so that the hotel can be on the alert for the emergency response team. The hotel also has 24-hour security and officers trained in first aid, CPR, & AED service.

INTERNET ACCESS

Complimentary basic internet is provided in sleeping rooms if you are staying at the Madison and in the hotel's public space and in the meeting space.

Wi-Fi Network: Madison Conference
No Password is required

MEMBERSHIP TO ASME (4 MONTHS FREE)

Registrants who paid the non-member conference registration fees will receive a four-month complimentary ASME Membership. ASME will automatically activate this complimentary membership for qualified attendees. Please allow approximately four weeks after the conclusion of the conference for your membership to become active.

Visit www.asme.org/membership for more information about the benefits of ASME Membership.

PRESENTER ATTENDANCE POLICY

According to ASME's Presenter Attendance Policy, if a paper is not presented at the conference, the paper will not be published in the official Archival Proceedings, which are registered with the Library of Congress and are abstracted and indexed. The paper also will not be published in the ASME Digital Collection and may not be cited as a published paper.

Schedule at a Glance

TIME	EVENT	ROOM
SUNDAY, JULY 9, 2023		
3:00PM-6:00PM	Registration	Dolley Madison Foyer
MONDAY, JULY 10, 202		
7:00AM-5:15PM	Mothers' Room	Office
7:00AM-5:00PM	Registration	Dolley Madison Foyer
8:00AM-9:00AM	Yellott Award Plenary: Solar Reactor-Based Utility-Scale Power Generation System Using Hydrogen and Carbon Fuel Cells	Potomac A
9:00AM-10:30AM	05-01 - Thermochemical Energy Storage for CSP Applications	Potomac A
9:00AM-10:30AM	02-01 - Heat Pump and Building Waste Heat Utilization	Dolley Madison Ballroom
9:00AM-10:30AM	01-01 - A Just Transition to a Sustainable Future	Potomac C
9:00AM-10:30AM	06-01 - Thermochemical Redox Cycles: Demonstration and Operation	Adams A
10:30AM-11:00AM	AM Coffee Break Student Hackathon Meet & Greet	Dolley Madison Foyer Dolley Madison Ballroom
11:00AM-12:30PM	05-02 - Metrology in CSP	Potomac A
11:00AM-12:30PM	05-03 - Solar Receiver Design 1	Dolley Madison Ballroom
11:00AM-12:30PM	03-01 - Thermochemical Energy Storage	Potomac C
11:00AM-12:30PM	08-01 - Thermal Energy Conversion Techniques	Adams A
12:30PM-1:45PM	Lunch	Dolley Madison Ballroom & Montpelier A & B
12:30PM-1:45PM	Underrepresented in STEM Lunch Discussion	Constitution A
1:45PM-3:15PM	05-04 - Solar Receiver Design 2	Potomac A
1:45PM-3:15PM	02-02 - Fluid Mechanics and Heat Transfer in Building Applications	Dolley Madison Ballroom
1:45PM-3:15PM	03-02 - Phase Change Thermal Energy Storage	Potomac C
1:45PM-3:15PM	11-01 - Carbon Capture and Sequestration	Adams A
3:15PM-3:45PM	PM Coffee Break	Dolley Madison Foyer
3:15PM-3:45PM	Poster Session	Dolley Madison Foyer
3:45PM-5:15PM	Open Lightning Talks/Elevator Pitches	Potomac A
6:00PM-8:00PM	Student Networking Event	Hamilton B
TUESDAY, JULY 11, 2023		
7:00AM-5:00PM	Registration	Dolley Madison Foyer
7:00AM-5:15PM	Mothers' Room	Office
8:00 AM-9:00AM	Plenary Session: Energy Storage for Sustainable Buildings, Judith Vidal, Ph.D., National Renewable Energy Laboratory	Dolley Madison Ballroom
9:00AM-10:30AM	05-05 - Solar Receiver Design 3	Potomac A
9:00AM-10:30AM	05-06 - Other CSP Technologies	Montpelier B
9:00AM-10:30AM	02-03 - Building Management and Control	Potomac C
9:00AM-10:30AM	09-01 - Industrial Process Heat and Waste Heat	Adams A
9:00AM-10:30AM	04-01 - Research for the Clean Energy Transition (Socio-Technical, Education and Policy)	Adams B
10:30AM-11:00AM	AM Coffee Break	Dolley Madison Foyer

Schedule at a Glance

TIME	EVENT	ROOM
11:00AM-12:30PM	10-01 - Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels	Montpelier B
11:00AM-12:30PM	05-11 - Heliostat Consortium 1	Montpelier A
11:00AM-12:30PM	05-08 - Particles for Thermal Energy Storage in CSP 1	Potomac C
11:00AM-12:30PM	06-02 - Materials and Fundamentals	Adams A
11:00AM-12:30PM	03-03 - Pumped Thermal Energy Storage	Adams B
12:30PM-1:45PM	Solar Energy Division (SED) and Advanced Energy Systems Division (AESD) Awards Luncheon	Potomac A
1:45PM-3:15PM	Panel - Funding Opportunities	Mount Vernon B
1:45PM-3:15PM	Panel: Thermal Energy Storage for Electricity and Industrial Heat Applications	Mount Vernon A
1:45PM-3:15PM	05-07 - CSP System Analysis, Controls, and Standards	Montpelier B
1:45PM-3:15PM	02-04 - Building Envelope, Building Energy, and Data Centers	Montpelier A
1:45PM-3:15PM	08-02 - Alternative Energy Conversion Techniques	Adams A
3:15PM-3:45PM	PM Coffee Break	Dolley Madison Foyer
3:45PM-5:15PM	Program Directors 1-1 Appointments	Montpelier B
3:45PM-5:15PM	SED Committees Meeting: Conservation and Solar Buildings	Potomac A
3:45PM-5:15PM	SED Committees Meetings: Solar Chemistry & Bio Conversion	Adams B
3:45PM-5:15PM	SED Committees Meetings: Solar Thermal Power	Potomac C
3:45PM-5:15PM	AESD Committees Meetings: Renewable Energy and Energy Conversion (REEC)	Adams A
5:15PM-8:00PM	Student Hackathon Presentations	Hamilton A
5:30PM-7:00PM	Solar Energy Division Executive Committee Meeting	Adams A
6:30PM-8:00PM	J. V. Beck Symposium Committee Meeting	Potomac C
WEDNESDAY, JULY 12, 2023		
8:00AM-4:00PM	Registration	Dolley Madison Foyer
7:00AM-5:15PM	Mothers' Room	Office
8:00AM-9:00AM	Plenary: Harnessing the Power of Sunlight in Two-step Solar Thermochemical Cycles Utilizing Redox-active Mixed Ionic-electronic Conducting Materials	Potomac A
9:00AM-10:30AM	05-12 - Heliostat Consortium 2	Potomac A
9:00AM-10:30AM	05-09 -Particles for Thermal Energy Storage in CSP 2	Mount Vernon A
9:00AM-10:30AM	09-02 - Solar Desalination	Montpelier A
9:00AM-10:30AM	06-03 - Novel Reactors and Processes	Adams A
9:00AM-10:30AM	07-01 - Photovoltaic & Electrochemical Technologies	Adams B
10:30AM-11:00AM	AM Coffee Break	Dolley Madison Foyer
11:00AM-12:30PM	05-13 - Heliostat Consortium 3	Potomac A
11:00AM-12:30PM	05-10 - Particles for Thermal Energy Storage in CSP 3	Mount Vernon A
11:00AM-12:30PM	02-05 - Innovations for Sustainably Built Environments	Montpelier A
11:00AM-12:30PM	03-04 - Sensible Energy Storage	Adams A
12:30PM-1:45PM	Lunch	Dolley Madison Ballrom & Monteplier A & B
Conference Ends		

Plenary Sessions, Panel Session, and Committee Meetings

PLENARY SESSIONS	DATE	TIME	ROOM
Yellot Award Plenary: "Solar Reactor-Based Utility-Scale Power Generation System Using Hydrogen and Carbon Fuel Cells"	Monday, July 10	8:00AM–9:00AM	Potomac A
Plenary: "Energy Storage for Sustainable Buildings"	Tuesday, July 11	8:00AM–9:00AM	Dolley Madison Ballroom
Plenary: Harnessing the Power of Sunlight in Two-step Solar Thermochemical Cycles Utilizing Redox-active Mixed Ionic-electronic Conducting Materials	Wednesday, July 12	8:00AM–9:00AM	Potomac A

PANEL	DATE	START TIME	ROOM
"Thermal Energy Storage for Electricity and Industrial Heat Applications"	Tuesday, July 11	1:45PM–3:15PM	Adams B

COMMITTEES	DATE	START TIME	ROOM
SED: Conservation and Solar Buildings Chair: Jian Zhang, Ph.D. (2023-2025)	Tuesday, July 11	3:45PM–5:15PM	Potomac A
SED: Solar Chemistry & Bio Conversion Chair: Dr.-Ing. Johannes Grobbel (2023-2025)	Tuesday, July 11	3:45PM–5:15PM	Adams B
SED: Solar Thermal Power Chair: Jeremy Sment (2023-2025)	Tuesday, July 11	3:45PM–5:15PM	Potomac C
AESD: Renewable Energy and Energy Conversion (REEC)	Tuesday, July 11	3:45PM–5:15PM	Adams A
Solar Energy Division Executive Committee Meeting	Tuesday, July 11	5:30PM–7:00PM	Adams A

YELLOTT AWARD PLENARY

MONDAY, JULY 10 | 8:00AM–9:00AM

Nesrin Ozalp, Ph.D., ASME Fellow
Professor
Purdue University Northwest

Solar Reactor-Based Utility-Scale Power Generation System Using Hydrogen and Carbon Fuel Cells Solar Reactor-Based Utility-Scale Power Generation System Using Hydrogen and Carbon Fuel Cells

ABSTRACT: Solar thermal cracking of methane coupled with hydrogen production and HFC eliminates the need for thermal energy storage required by competing thermal cracking technologies. With the combined use of HFC and CFC, solar cracking of natural gas has the potential to offer a promising alternative to present power generation cycles. Solar cracking of methane to generate electricity via both HFC and CFC has a much higher well-to-wheel efficiency compared with solar reforming or solar thermochemical cycles to produce syngas, followed by conventional internal combustion engines. Hydrogen is used in a HFC to generate electricity for the grid and the carbon is easily segregated for use in a continuously operating CFC with excess carbon used for energy storage during low demand. As the only gas released from this FC, practically pure CO_2 discharged from the CFC can be readily captured for storage or used as a feedstock for syngas production via dry reforming of natural gas. Because carbon constitutes 75% by mass of the natural gas cracking product stream, the natural gas cracking process powered by the CFC has the potential to maintain full production during long term unavailability of solar energy. Such a system offers an alternative to the current state of the art of thermal storage and would change the perception of solar energy. The proposed system also offers options for continuous or intermittent operation as economics dictate. The combined solar reactor with fuel cells has the flexibility of working strictly as an electricity production unit by keeping both fuel cells explicitly for power generation and excluding the reactor when sufficient carbon and hydrogen are produced. An efficiency analysis of this hybrid system yields an optimal efficiency of 68% via perfect natural gas decomposition when accounting for compressor losses and lower heating value of natural gas. The preliminary calculations also reveal that the degree of conversion in the solar reactor significantly influences the overall system performance. Most of the CSP plants implement the Rankine cycle to convert heat to electricity with typical efficiencies of 35–40%. However, higher efficiencies may be reached via solar cracking of the natural gas coupled with HFC and CFC for a combined efficiency of 60–70%. This presentation discusses the technical details and advantages of this proposed innovative system, and its potential applications in distributed power generation and replacement of existing low-efficiency peaker plants.

BIOGRAPHY: Dr. Nesrin Ozalp is a Professor of Mechanical Engineering at Purdue University Northwest and a Full Professor by Courtesy at the School of Mechanical Engineering of Purdue University West Lafayette. Dr. Ozalp specializes in the areas of experimental and numerical study of thermal transport processes. Her research focuses on multiphase convective and radiative heat transfer analysis of solar thermochemical processes with non-linear temperature patterns and turbulent flow dynamics. She is the Lead Principal Investigator of research projects totaling $5M+, the corresponding author of 130+ peer reviewed publications, and Co-PI of completed Phase I of Solar Carbon Black commercialization with Fraunhofer. She is the past chair of ASME Solar Energy Executive Committee, chair of the ASME Heat Transfer and Thermal Sciences Education technical committee, Inaugural Executive Committee member of the American Society of Thermal Fluids Engineers, General Chair and/or Technical Program Chair of several ASME and ASTFE conferences, and the recipient of many research, teaching, and service awards. Dr. Ozalp is an ASME Fellow and an ASTFE Fellow.

PLENARY SESSION

TUESDAY, JULY 11 | 8:00AM–9:00AM

Judith C. Vidal, Ph.D.
Distinguished Member of Research Staff
Manager of Building Energy Science Group
Leader of Buildings Emerging Technologies Program
Buildings Technologies and Science Center
National Renewable Energy Laboratory (NREL)

Energy Storage for Sustainable Buildings

ABSTRACT: Alongside expansion in intermittent renewable power generation, electrification of building end uses like heating, water-heating, and cooking can transition residential and commercial buildings to net-zero CO_2 emissions. Widespread electrification, however, has the potential to increase annual heating electricity use by over 250% and will also be a major driver of peak period electricity demand growth, particularly in colder regions. Cost-effectively decarbonizing the electricity and building sectors in parallel will require the ability to shift electricity demand to match variable and intermittent renewable generation as well as to satisfy distribution constraints. Behind-the-meter storage (BTMS) in buildings for both thermal energy storage (TES) and battery or electrical energy store (EES) can significantly increase a building's ability to manage and shift electricity demand and is a key enabler of a net-zero CO_2 energy system in the United States. NREL and other National Laboratory partners such as LBNL and ORNL are co-leading an energy storage consortium for buildings—Stor4Build—that will focus on developing and advancing integrated/packaged and stand-alone/modular energy storage systems that will accelerate the growth, optimization, deployment, and adoption of simplified and novel technologies that can be easily adopted by all Americans. Stor4Build's 5-year outcome is a community-scale demonstration of technologies to showcase the initial achievements of the consortium, which will serve to lay a foundation for large-scale deployments of TES along with EES and systems capable of satisfying both the heating and cooling needs in buildings and thus validate the transition toward needed market transformation.

BIOGRAPHY: Dr. Judith Vidal from the National Renewable Energy Laboratory (NREL) is the Manager of Building Thermal Energy Science

Group, the Sub-Program Lead of Buildings Emerging Technologies, and a Distinguished Member of Research Staff. Dr. Vidal is also a joint faculty member at the Colorado School of Mines (CSM). She has established an international reputation for her cutting-edge work on thermal systems and has published many journal articles on her work in journals such as Nature Materials Degradation. Dr. Vidal has received prestigious awards such as the NREL Distinguished Member of Research Staff in February 2021 and the NREL Chairman's Award in 2017.

In the area of thermal systems, optimization of thermal materials, thermomechanical evaluations of wrought alloys, their weldments, and advanced manufacturing, Dr. Vidal is currently leading several R&D efforts evaluating systems to extend the lifetime thermal components. Dr. Vidal has diversified her expertise and capabilities in other technologies such as building emerging technologies, water splitting electrolysis, fuel cells, thermoelectric, and biofuels. Her collaborative efforts, domestically and internationally, cover several technologies and leverage the R&D activities for early-stage research to create efficient and interactive buildings to help decrease energy consumption.

PLENARY SESSION

WEDNESDAY, JULY 12 | 8:00AM–9:00AM

Peter Loutzenhiser, Ph.D., ASME Fellow
Associate Professor
Woodruff School of Mechanical Engineering at the Georgia Institute of Technology (GIT)

Harnessing the Power of Sunlight in Two-step Solar Thermochemical Cycles Utilizing Redox-active Mixed Ionic-electronic Conducting Materials

ABSTRACT: Effectively harnessing the power of sunlight is integral for driving the transition from fossil fuels to renewable energy technologies. Research endeavors focused on coupling concentrated solar thermal technologies to thermochemical processes and cycles are offering new, promising pathways towards effectively capturing and storing sunlight to accelerate the transition. Of particular interest are two-step solar thermochemical cycles based on metal oxide reduction/oxidation (redox) reactions aimed at H_2O and CO_2-splitting, solar thermochemical storage, and air separation. The first step of the cycles is the thermal reduction of the metal oxide to a lower valence metal oxide or a metal and O_2 driven by concentrated solar irradiation. Three different oxidation pathways are used in the second step to recover the metal oxide: (1) oxidation with H2O and/or CO_2 to produce H2 and/or CO, (2) oxidation with O_2 at elevated temperatures to release sensible and chemical heat for electricity generation, and (3) oxidation with O_2 in air to produce N_2. Redox-active mixed ionic electronic conducting (MIEC) materials are promising materials that are being investigated for integration into different solar thermochemical cycles due to attractive properties, including tunability via cation selection and substitution for different operating conditions, reactions in the absence of crystal structure changes, and thermal stability over a large range of temperatures. The net result is rapid kinetics from the facile conduction of electrons and O^{2-} ions through the sublattice at elevated temperatures, creating charge imbalances that result in O^{2-} vacancy formations in the sublattice. The state-of-the-art in redox-active MIEC materials will be examined for the different solar thermochemical cycles along with perspectives towards the future.

BIOGRAPHY: Dr. Peter Loutzenhiser is an Associate Professor in the Woodruff School of Mechanical Engineering at the Georgia Institute of Technology (GIT). He joined the faculty of GIT in May 2012 and is pursuing research in the area of Solar Thermochemistry and Technology, and he has directed research in this area funded by the U.S Department of Energy and NASA. He was the recipient of the ASME Solar Energy Division's prestigious Yellott Award in 2018, and he was elected Fellow of the ASME in 2023. He also serves as an Associated Editor for Solar Energy and is on the editorial board of Materials. Dr. Loutzenhiser received his PhD in Mechanical Engineering from Iowa State University in May 2006. Research for his PhD was performed at the Swiss Federal Laboratories for Materials Testing and Research (EMPA) and focused on Building Physics. Dr. Loutzenhiser was a post-doctoral researcher at the Paul Scherrer Institute, applying his extensive solar experience to the field of Solar Thermochemistry. He continued his research at the ETH Zurich in Solar Thermochemistry where he was a Lecturer and Research Associate prior to moving to GIT.

PANEL SESSION

TUESDAY, JULY 11 | 1:45PM–3:15PM

Thermal Energy Storage for Electricity and Industrial Heat Applications

ABSTRACT: Technologies utilizing thermal energy storage (TES) media have application for Long Duration Energy Storage (LDES) to support the decarbonization of the U.S. power grid. In addition, these technologies can supply heat for industrial processes or district energy systems. However, these TES technologies need to scale quickly to reach the conditions that will enable them to compete for this LDES role. Success is contingent on (i) technology cost and performance: costs must come down and the performance and working lifetime of TES/LDES technologies must be demonstrated, and (ii) adequate supply chain formation: GW-scale annual LDES manufacturing will be required by 2035 to meet current projections for grid storage. Furthermore, TES will compete with alternative LDES technology options.

This panel will present the state of the art of TES-based LDES technologies, discuss challenges to deployment and the relevance of thermal-energy supply the market development and competitiveness of TES-based LDES.

Moderator:
Craig Turchi, Ph.D.
National Renewable Energy Laboratory

Panelist:
John Pye, Ph.D.
Australian National University

Topic: Australia's "Green Heat for Industry" Strategy and Glimpse at Current Analysis

Panelist:
Luca Imponenti, Ph.D.
SolarDynamics

Topic: Current Molten Salt Tanks at 560C: Challenges and Developing Solutions

Panelist:
Justin Briggs, Ph.D.
Antora Energy

Topic: High-Temp Graphite for TES

Panelist:
Tim Fuller
Babcock & Wilcox

Topic: Sand-based TES for Industrial Thermal Demand and "Green Steam"

Panelist:
Guangdong Zhu, Ph.D.
National Renewable Energy Laboratory

Topic: Geological Thermal Energy Storage (GeoTES) Hybridized with CSP or Carnot-Battery Heat Pump Techniques for Seasonal Energy Dispatching

Award Recognitions

OUTSTANDING PAPER AWARD

1. ES2023-107445, An Optimization Study of CO_2 Heat Pump Water Heaters Using NSGA-II

Shima Soleimani, Laura Schaefer, Kashif Liaqat, Aaron Cole, Jörg Temming, Heiner Kösters

2. ES2023-107270, Effects of an Annular Baffle on Heat Transfer to an Immersed Coil Heat Exchanger in Thermally Stratified Tanks

Julia Nicodemus, Joshua Smith, Joseph Noreika, Manaka Gomi, Tingyu Zhou

3. ES2023-106662, Fabrication, Modeling, and Testing of a Prototype For Particle Thermal Energy Storage Containment

Jeffrey Gifford, Patrick Davenport, Xingchao Wang, Zhiwen Ma

OUTSTANDING STUDENT PAPER AWARD

1. ES2023-105413, Cellular Inorganic Ceramic for Highly Efficient Daytime Passive Radiative Cooling

Kaixin Lin, Yihao Zhu, Tsz Chung Ho, Chi Yan Tso

2. ES2023-106769, Modeling and Optimization of a PCM-Based Ocean Thermal Energy Harvester for Powering Unmanned Underwater Vehicles

Habilou Ouro-Koura, Hyunjun Jung, Diana-Andra Borca-Tasciuc, Andrea E. Copping, Zhiqun (Daniel) Deng

3. ES2023-106662, Fabrication, Modeling, And Testing Of A Prototype For Particle Thermal Energy Storage Containment

Jeffrey Gifford, Patrick Davenport, Xingchao Wang, Zhiwen Ma

MONDAY, JULY 10, 2023

01-01 A JUST TRANSITION TO A SUSTAINABLE FUTURE
9:00AM– 10:30AM **POTOMAC C**

Chair: **Hamidreza Najafi** - *Florida Institute of Technology*

Just-R Metrics Framework for Integrating Energy Justice Into Early-Stage Research

Technical Presentation Only: ES2023-111263

Bettina Arkhurst - *Georgia Institute of Technology,* **Nikita Dutta** - *National Renewable Energy Laboratory,* **Elizabeth Gill** - *National Renewable Energy Laboratory,* **Kate Anderson** - *National Renewable Energy Laboratory,* **Katherine Fu** - *University of Wisconsin-Madison*

An Exploratory Analysis of the Legal Implication of "A Just Energy Transition"

Technical Presentation Only: ES2023-117994

Kola Odeku - *University of Limpopo*

Evaluation of Transmission Line Hardening Scenarios Using a Machine Learning Approach

Technical Paper Publication: ES2023-107380

Juan Montoya Rincon - *City College of New York,* **Jorge E. Gonzalez** - *University at Albany,* **Michael Jensen** - *Brookhaven National Laboratory*

Economic Feasibility Analysis of Developing Large-Scale Hybrid Solar-Wind Energy Plants on Farms and Ranches in South Texas

Technical Paper Publication: *ES2023-107455,* **Jose Giuffrida** - *Blinn College/Tarleton State University,* **Mariee Cruz** - *Texas A&M University–Kingsville,* **Erick Martinez-Gomez** - *Texas A&M University–Kingsville,* **Sophia Ludtke** - *Harvard University,* **Hua Li** - *Texas A&M University–Kingsville*

Building Inclusive and Just Pathways to a Clean Energy Economy Through Youth Education of Clean Energy

Technical Presentation Only: ES2023-109071

Hyunjung Ji - *The University of Alabama,* **Sally Grace Shettles** - *The University of Alabama,* **Colby Putman** - *The University of Alabama,* **Mark Mueller** - *The University of Alabama,* **Amy Salazar** - *Sam Houston State University,* **Hyun Jin Kim** - *The University of Alabama*

02-01 HEAT PUMP AND BUILDING WASTE HEAT UTILIZATION
9:00AM–10:30AM **DOLLEY MADISON BALLROOM**

Chair: **Monem Beitelmal** - *Qatar Environment and Energy Research Institute*
Co-Chair: **Shuang Cui** - *The University of Texas at Dallas*

Modelling and Experimental Performance Analysis of R410a Heat Pump Systems in Northeastern U.S. Winter Climates

Technical Presentation Only: ES2023-116952

S.M. Abdur Rob - *The City College of New York,* **David Garraway** - *The City College of New York,* **Geoffrey Turbeville** - *The City College of New York,* **Prathap Ramamurthy** - *The City College of New York,* **Jorge E. Gonzalez-Cruz** - *The City College of New York*

Development of Electrified Transcritical R744 Heat Pump Systems for Northeastern Winter Markets

Technical Paper Publication: ES2023-107045

David Garraway - *The City College of New York,* **S.M. Abdur Rob** - *The City College of New York,* **Geoffrey Turbeville** - *The City College of New York,* **Prathap Ramamurthy** - *The City College of New York,* **Jorge Gonzalez**-*Cruz - University at Albany*

Electrification and Decarbonization Using Heat Recovery Heat Pump Technology for Building Space and Water Heating

Technical Paper Publication: ES2023-107117

Byeongho Yu - *Mississippi State University,* **Dongsu Kim** - *Hanbat National University,* **Jaeyoon Koh** - *LG Electronics USA,* **Jinman Kim** - *LG Electronics USA,* **Heejin Cho** - *Mississippi State University*

Waste Heat Assessment of a Manufacturing Facility

Technical Paper Publication: ES2023-107592

Alexander Zeller - *North Dakota State University,* **Adam Gladen** - *North Dakota State University*

An Optimization Study of CO_2 Heat Pump Water Heaters Using NSGA-II

Technical Paper Publication: ES2023-107445

Shima Soleimani - *Rice University,* **Laura Schaefer** - *Rice University,* **Kashif Liaqat** - *Rice University,* **Aaron Cole** - *Rice University,* **Jörg Temming** - *Flowserve Corporation,* **Heiner Kösters** - *Fowserve corporation*

05-01 THERMOCHEMICAL ENERGY STORAGE FOR CSP APPLICATIONS

9:00AM–10:30AM **POTOMAC A**

Chair: **Gregory Jackson** - *Colorado School of Mines*

Startup of a Combined Moving-Fluidized Bed Oxidation Reactor for High Temperature Discharge of Solid-State Thermochemical Energy Storage Particles

Technical Presentation Only: ES2023-114044

Owen Ramsey - *Oregon State University,* **Juve Ortiz-Ulloa** - *Oregon State University,* **David Korba** - *Mississippi State University,* **Michael Hayes** - *Michigan State University,* **Philipp Schimmels** - *Michigan State University,* **Kelvin Randhir** - *RedoxBlox,* **Like Li** - *Mississippi State University,* **Joerg Petrasch** - *RedoxBlox, James Klausner - RedoxBlox,* **Nick Auyeung** - *Oregon State University*

Design, Construction and Testing of a Combined Moving-Fluidized Bed Oxidation Reactor for High Temperature Discharge of Solid-State Thermochemical Energy Storage Particles

Technical Presentation Only: ES2023-114799

Juve Ortiz-Ulloa - *Oregon State University*

Owen Ramsey - *Oregon State University,* **David Korba** - *Mississippi State University,* **Michael Hayes** - *Michigan State University,* **Philipp Schimmels** - *Michigan State University,* **Kelvin Randhir** - *RedoxBlox,* **Like Li** - *Mississippi State University,* **Joerg Petrasch** - *RedoxBlox,* **James Klausner** - *RedoxBlox,* **Nick Auyeung** - *Oregon State University*

Development and Shakedown Testing of 1 Kwth Particle-to-SCO_2 Heat Exchanger for Thermochemical Energy Storage Recovery

Technical Presentation Only: ES2023-115268

Bryan J. Siefering - The Pennsylvania State University, **Muhammad Umer** - *The Pennsylvania State University,* **Brian Fronk** - *The Pennsylvania State University,* **Ellen B. Stechel** - *Arizona State University*

Numerical Investigation of Thermochemical Energy Extraction in a Moving Packed Bed Oxidation Reactor-Heat Exchanger

Technical Paper Publication: ES2023-107384

Ashreet Mishra - *Mississippi State University,* **David Korba** - *Mississippi State University,* **Like Li** - *Mississippi State University*

06-01 THERMOCHEMICAL REDOX CYCLES: DEMONSTRATION AND OPERATION

9:00AM–10:30AM **ADAMS A**

Chair: **Sha Li** - *École Polytechnique Fédérale de Lausanne*

Paths of Solar Energy to Renewable Fuels

Technical Presentation Only: ES2023-115127

Zhiwen Ma - *National Renewable Energy Laboratory,* **Janna Martinek** - *National Renewable Energy Laboratory*

Dynamic Model of a Solar Fuel System for the Thermochemical Production of Syngas From H_2O and CO_2

Technical Presentation Only: ES2023-117630

Remo Schäppi - *ETH Zurich,* **Aldo Steinfeld** - *ETH Zurich*

Demonstration of a Model Predictive Control for a Cluster of Solar Chemical Batch Reactors

Technical Presentation Only: ES2023-115024

Johannes Grobbel - *German Aerospace Center,* **Rudolf Popp** - *RWTH Aachen University,* **David Zanger** - *German Aerospace Center,* **Ante Giljanovic** - *German Aerospace Center,* **Thomas Fend** - *German Aerospace Center,* **Bijan Nouri** - *German Aerospace Cente,* **Gregor Piesche** - *Stausberg & Vosding GmbH,* **Stephan Berger** - *Stausberg & Vosding GmbH,* **Birk Kraas** - *CSP Services GmbH,* **Laurin Oberkirsch** - *German Aerospace Center,* **Stefan Schmitz** - *German Aerospace Center,* **Felix Göhring** - *German Aerospace Center,* **Peter Schwarzbözl** - *German Aerospace Center,* **Dennis Thomey** - *German Aerospace Center,* **Christian Sattler** - *German Aerospace Center,* **Vamshi Krishna Thanda** - *German Aerospace Center*

Demonstration of Multiyear Solar Thermochemical Energy Storage via the Cobalt Oxide Cycle

Technical Paper Publication: ES2023-107692

Katherine Bassett - *Northeastern University,* **Rachel Silcox** - *University of Michigan,* **Ben Smith** - *Valparaiso University,* **Brian Schmit** - *Valparaiso University,* **Jeffrey Will** - *Valparaiso University,* **Luke Venstrom** - *Valparaiso Univeristy,* **Peter Krenzke** - *Valparaiso University*

03-01 THERMOCHEMICAL ENERGY STORAGE

11:00AM–12:30PM **POTOMAC C**

Chair: **Like Li** - *Mississippi State University*

Thermochemical Energy Storage: Zigzag Flow Reactor

Technical Presentation Only: ES2023-112813

Rhushikesh Ghotkar - *Arizona State University,* **Alberto De La Calle** - *Arizona State University,* **Ryan J. Milcarek** - *Arizona State University,* **Ivan Ermanoski** - *Arizona State University,* **James Miller** - *Arizona State University,* **Ellen Stechel** - *Arizona State University*

Experimental Demonstration of the Dynamics of a Novel Thermochemical Oxidation Reactor

Technical Presentation Only: ES2023-114575

Michael Hayes - *Michigan State University,* **Philipp Schimmels** - *Michigan State University,* **David Korba** - *Mississippi State University,* **Juve Ortiz-Ulloa** - *Oregon State University,* **Like Li** - *Mississippi State University,* **Nick Auyeung** - *Oregon State University,* **Andre Benard** - *Michigan State University,* **Joerg Petrasch** - *RedoxBlox,* **Kelvin Randhir** - *RedoxBlox,* **James Klausner** - *RedoxBlox*

Enhancing the Chemical Energy Flux in a Tubular Counterflow Solid Fuel Synthesis Reactor Using Novel Approaches

Technical Presentation Only: ES2023-114787

Philipp Schimmels - *Michigan State University,* **Michael Hayes** - *Michigan State University,* **Kelvin Randhir** - *RedoxBlox,* **James Klausner** - *Michigan State University,* **Joerg Petrasch** - *RedoxBlox*

Salt Hydrate Thermochemical Energy Storage in Buildings: Analyzing Storage Density and Thermal Power Output

Technical Paper Publication: ES2023-106917

Erik Barbosa - *Georgia Institute of Technology,* **Akanksha Menon** - *Georgia Institute of Technology*

Predicting Energy and Power Trade-Offs in Salt Hydrate Composites for Building Heating and Thermal Storage

Technical Presentation Only: ES2023-114587

Bryan Kinzer - *University of Michigan,* **Rohini Bala Chandran** - *University of Michigan*

05-02 METROLOGY IN CSP

11:00AM–12:30PM **POTOMAC A**

Chair: **Randy Brost** - *Sandia National Laboratories*

Stability Assessment of High Temperature Coatings for Flux Measurement Applications

Technical Paper Publication: ES2023-107402

Luke McLaughlin - *Sandia National Laboratories,* **Hendrik Laubscher** - *Sandia National Laboratories,* **Jorgen Konings** - *Hukseflux Thermal Sensors*

Methods for Quantitative Temperature-Dependent Optical Metrology

Technical Presentation Only: ES2023-117099

Mike Mayer - *University of Michigan,* **Brandon Surhigh** - *University of Michigan,* **Minok Park** - *Lawrence Berkeley National Laboratory,* **Vassilia Zorba** - *Lawrence Berkeley National Laboratory,* **Sean Lubner** - *Boston University,* **Rohini Bala Chandran** - *University of Michigan*

Wind Loading on Parabolic Trough Solar Collectors: Wind and Structural Loads Measurements in an Operational Powerplant

Technical Presentation Only: ES2023-112334

Ulrike Egerer - *National Renewable Energy Laboratory,* **Scott Dana** - *National Renewable Energy Laboratory,* **Geng Xia** - *National Renewable Energy Laboratory,* **Brooke Stanislawski** - *National Renewable Energy Laboratory,* **Shashank Yellapantula** - *National Renewable Energy Laboratory*

Temperature Characterization of Flowing Particles With Non-Contact Measurement Techniques

Technical Presentation Only: ES2023-116903

Mike Mayer - *University of Michigan,* **Brandon Surhigh** - *University of Michigan,* **Rohini Bala Chandran** - *University of Michigan*

Technical Sessions

05-03 SOLAR RECEIVER DESIGN 1

11:00AM–12:30PM **DOLLEY MADISON BALLROOM**

Chair: **William Hamilton** - *National Renewable Energy Laboratory*

Experimental Investigation of Heat Transfer Mechanisms in a Beam Down Molten Salt-Based Volumetric Solar Thermal Receiver

Technical Presentation Only: ES2023-108736

Muhammad Taha Manzoor - *McGill University,* **Melanie Tetreault-Friend** - *Hatch*

Design Methodology of a Concentrating Solar Volumetric Receiver

Technical Paper Publication: ES2023-106966

Tufan Akba - *Ozyegin University, Derek Baker - Middle East Technical University & ODTU-GUNAM,* **M. Pinar Menguc** - *Ozyegin University*

Multiphase Modeling in a Parallel Plate Fluidized Bed Receiver for Concentrating Solar Power

Technical Paper Publication: ES2023-106824

Krutika Appaswamy - *Purdue University,* **Jason Schirck** - *Purdue University,* **Chathusha Punchi Wedikkara** - *Purdue University,* **Aaron Morris** - *Purdue University,* **Zhiwen Ma** - *National Renewable Energy Laboratory*

Thermomechanical Stress and Creep-Fatigue Analysis of a High-Temperature Prototype Receiver for Heating Particles

Technical Paper Publication: ES2023-107262

Matt Carter - *Mississippi State University,* **David Korba** - *Mississippi State University,* **Janna Martinek** - *National Renewable Energy Laboratory,* **Zhiwen Ma** - *National Renewable Energy Laboratory,* **Like Li** - *Mississippi State University*

08-01 THERMAL ENERGY CONVERSION TECHNIQUES

11:00AM–12:30PM **ADAMS A**

Chair: **Sidong Lei** - *Georgia State University*

Optical Cavities for Thermophotovoltaic Systems Powered by Multiple Heat Sources

Technical Presentation Only: ES2023-108512

Nima Talebzadeh - *York University,* **Paul O'Brien** - *York University*

Minute-Level Solar Irradiance Estimation via the Sun-Blocking Index Derived From Sky Images

Technical Presentation Only: ES2023-114754

Rial Arifin Rajagukguk - *Kookmin University,* **Hyunjin Lee** - *Kookmin University*

Modeling and Optimization of a PCM-Based Ocean Thermal Energy Harvester for Powering Unmanned Underwater Vehicles

Technical Paper Publication: ES2023-106769

Habilou Ouro-Koura - *Rensselaer Polytechnic Institute,* **Hyunjun Jung** - *Pacific Northwest National Laboratory,* **Diana-Andra Borca-Tasciuc** - *Rensselaer Polytechnic Institute,* **Andrea E. Copping** - *Pacific Northwest National Laboratory,* **Zhiqun (Daniel) Deng** - *Pacific Northwest National Laboratory*

Prediction of Thermionic Energy Conversion Performance and Parametric Effects Using Genetic Algorithms to Fit Physics-Inspired Model Equations to Prototype Test Data

Technical Paper Publication: ES2023-107306

Elizabeth D. Juette - *University of California, Berkeley,* **Van P. Carey** - *University of California, Berkeley,* **Jean-Pierre Fleurial** - *Jet Propulsion Laboratory/California Institute of Technology*

Steady State Modeling of a Regenerative Rankine Cycle for the Natrium System

Technical Paper Publication: ES2023-107345

Aiden Meek - *Utah State University,* **Seth Dana** - *Utah State University,* **Jacob Bryan** - *Utah State University,* **Manjur Basnet** - *Utah State University,* **Hailei Wang** - *Utah State University*

02-02 FLUID MECHANICS AND HEAT TRANSFER IN BUILDING APPLICATIONS

1:45PM–3:15PM **POTOMAC B**

Chair: **Shuang Cui** - *The University of Texas at Dallas*

Enhancing Thermal Resistance of Building Walls by Utilizing Fluid Flow in Microchannel Within the Wall Thermal Resistance of Building Walls by Utilizing Fluid Flow in Microchannel Within the Wall

Technical Paper Publication: ES2023-105632

Shahin Shafiee - *Prairie View A&M University,* **Hamed Dicko** - *Prairie View A&M University*

Airflow Characteristics and Thermal Comfort of Air Diffusers Characteristics and Thermal Comfort of Air Diffusers

Technical Paper Publication: ES2023-107024

Tolga Arda Eraslan - Ozyegin University, **Cem Keskin** - *Ozyegin University,* **Mehmet Pınar Mengüç** - *Ozyegin University*

Effects of an Annular Baffle on Heat Transfer to an Immersed Coil Heat Exchanger in Thermally Stratified Tanks of a Cylindrical Baffle on Heat Transfer to an Immersed Coil Heat Exchanger in Thermally Stratified Tanks

Technical Paper Publication: ES2023-107270

Julia Nicodemus - *Lafayette College,* **Joshua Smith** - Lafayette College, *Joseph Noreika - Lafayette College,* **Manaka Gomi** - *Lafayette College,* **Tingyu Zhou** - *Lafayette College*

Automatic Self-Cleaning System for Window Type Air-Conditioning Unit Using Vacuum Pump

Technical Paper Publication: ES2023-108234

Robert Michael Corpus - *Polytechnic University of the Philippines,* **John Patrick Siobal** - *Polytechnic University of the Philippines,* **Patrick John Julian** - *Polytechnic University of the Philippines,* **Ivan Zeidrick Lazaga** - *Polytechnic university of the Philippines,* **Melchizedek Palenzuela** - *Polytechnic University of the Philippines,* **Jian Mikel Villanueva** - *Polytechnic University of the Philippines*

Using Fertilizer-Based Liquid Desiccants to Efficiently Dehumidify Indoor Plant Environments and Recycle Water

Technical Presentation Only: ES2023-112405

Sarah Moussaddy - *Oakland University,* **Sandeep Aryal** - *Oakland University,* **Jonathan Maisonneuve** - *Oakland University*

03-02 PHASE CHANGE THERMAL STORAGE

1:45PM–3:15PM **POTOMAC C**

Chair: **Bingjia Li** - *University of Michigan*
Co-Chair: **Rohini Bala Chandran** - *University of Michigan*

Shape-Stable Wood-Phase Change Material Composite for Thermal Energy Storage in Buildings

Technical Presentation Only: ES2023-115258

Bernadette Magalindan - The University of Texas at Dallas

, **ustavo Felicio-Perruci** - *The University of Texas at Dallas,* **Kyle Foster** - *National Renewable Energy Laboratory,* **Chuck Booten** - *National Renewable Energy Laboratory,* **Yousuf Islam** - *The University of Texas at Dallas,* **Hongbing Lu** - *The University of Texas at Dallas,* **Shuang Cui** - *The University of Texas at Dallas,* **Lyu Zhou** - *The University of Texas at Dallas*

Phase Change Material for Thermal Energy Storage in Buildings Based on Sodium Sulfate Decahydrate and Disodium Hydrogen Phosphate Dodecahydrate

Technical Paper Publication: ES2023-106796

Tugba Turnaoglu - *Oak Ridge National Laboratory,* **Navin Kumar** - *Oak Ridge National Laboratory,* **Jason R Hirchey** - *Georgia Institute of Technology, Yuzhan Li - Oak Ridge National Laboratory,* **Damilola Akamo** - *University of Tennessee,* **Tim Laclair** - *Oak Ridge National Laboratory,* **Orlando Rios** - *Oak Ridge National Laboratory,* **Kyle Gluesenkamp** - *Oak Ridge National Laboratory,* **Samuel Graham** - *Georgia Institute of Technology*

Expediting Heat Transfer in PCM Solidification With Optimized Fin Configuration

Technical Paper Publication: ES2023-108169

Amrita Sharma - *IIT Jodhpur,* **Hardik Kothadia** - *IIT Jodhpur,* **Shobhana Singh** - *IIT Jodhpur*

05-04 SOLAR RECEIVER DESIGN 2

1:45PM–3:15PM **POTOMAC A**

Chair: **Brantley Mills** - *Sandia National Laboratories*

Tube Geometry Optimization for Concentrating Solar Power Heat Exchangers

Technical Presentation Only: ES2023-114923

Julio Izquierdo - *University of Louisville,* **Bikram Bhatia** - *University of Louisville*

Simulation of the Performance of a High Temperature Solar Thermal Receiver Comprised Parallel Micro-Pin Unit-Cells Fabricated via Additive Manufacturing

Technical Paper Publication: ES2023-107525

Leyli Bahrami - *The Pennsylvania State University,* **Sophia M. Yurkovetsky** - *The Pennsylvania State University,* **Erfan Rasouli** - *University California, Davis,* **Vinod Narayanan** - *University of California, Davis,* **Brian Fronk** - *The Pennsylvania State University*

Investigation on a Double-Pass Tubular Absorber for Application in Solar Towers

Technical Paper Publication: ES2023-108401

Hossein Ebadi - *Politecnico di Torino,* **Antonio Cammi** - *Politecnico di Milano,* **Laura Savoldi** - *Politecnico di Torino*

Numerical Study of Solar Receiver Tube With Modified Surface Roughness for Enhanced and Selective Absorptivity in Concentrated Solar Power Tower

Technical Paper Publication: ES2023-106936

Shawn Hatcher - *Mississippi State University,* **Mathew Farias** - *Mississippi State University,* **Jianzhi Li** - *The University of Texas Rio Grande Valley,* **Peiwen Li** - *The University of Arizona,* **Ben Xu** - *Mississippi State University*

11-01 CARBON CAPTURE AND SEQUESTRATION

1:45PM–3:15PM **ADAMS A**

Chair: **Darshan Pahinkar** - *Florida Institute of Technology*

Modeling the Performance of a Novel Microchannel-Based Mass Exchanger for Carbon Capture

Technical Presentation Only: ES2023-105811

Michael Mayer - *Imperial College London,* **Toby Kirk** - *Imperial College London,* **Haotian Jia** - *Tufts University,* **Hy Dinh** - *Tufts University, Marc Hodes - Tufts University,* **Demetrios Papageorgiou** - *Imperial College London,* **Darren Crowdy** - *Imperial College London,* **Vaibhav Bahadur** - *The University of Texas at Austin*

Techno-Economic Analysis of Hydrates-Based Carbon Dioxide Sequestration on the Seabed

Technical Presentation Only: ES2023-106682

Vaibhav Bahadur - *The University of Texas at Austin, Awan Bhati - The University of Texas at Austin*

Evaluation of a Ph-Shifting Electrochemical Device for Oceanic CO_2 Capture and Grid-Scale Load Shifting

Technical Presentation Only: ES2023-114717

Rachel Silcox - *University of Michigan,* **Rohini Bala Chandran** - *University of Michigan*

A Pathway Towards a Net-Zero: A Study on HVAC and Direct CO_2 Capture as Response to the Climate Crisis and Indoor Air Quality

Technical Presentation Only: ES2023-117439

Abdukarem Amhamed - *Qatar Environment and Energy Research Institute, Ahmed Sodiq - Qatar Environment and Energy Research Institute,* **Yasser Abdellatif** - *Qatar Environment and Energy Research Institute/CSE/HBKU*

Natural Gas to Chemical Intermediate by Highly Efficient Carbon-Neutral Route

Technical Presentation Only: ES2023-114726

Pengxi Zhu - *George Mason University,* **Dong Ding** - *Idaho National Laboratory,* **Hanping Ding** - *The University of Oklahoma, Pei Dong - George Mason University*

14-01 CONFERENCE POSTER PRESENTATION
3:15PM–3:45PM **DOLLEY MADISON BALLROOM**

Chair: **Rydge Mulford** - *University of Dayton*
Co-Chair: **Hamidreza Najafi** - *Florida Institute of Technology*

Industrial Energy Assessments for Small and Medium-Sized Enterprises by College Students

Poster Presentation: ES2023-107392

Riley Marchand - *The University of Alabama,* **Colby Putman** - *The University of Alabama,* **Sally Grace Shettles** - *The University of Alabama,* **Forooza Samadi** - *The University of Alabama,* **Joseph Carpenter** - *The University of Alabama, Hyunjung Ji - The University of Alabama, Timothy Salazar - The University of Alabama,* **Amy Salazar** - *Sam Houston State University,* **Hyun Jin Kim** - *The University of Alabama*

Energy in Action: An Energy Education Outreach Program for High Schools in Disadvantaged Communities of Alabama

Poster Presentation: ES2023-107400

Yakera Ward - *The University of Alabama,* **Mark Mueller** - *The University of Alabama,* **Sally Grace Shettles** - *The University of Alabama,* **Colby Putman** - *The University of Alabama,* **Laurel Holmes** - *Energy Alabama,* **Daniel Tait** - *Energy Alabama,* **Sheree Martin** - *Energy Alabama,* **Hyunjung Ji** - *The University of Alabama, Timothy Salazar - The University of Alabama,* **Amy Salazar** - *Sam Houston State University,* **Hyun Jin Kim** - *The University of Alabama*

Porous Biomass Converted Carbon Electrode Design and Application in Capacitive Deionization

Poster Presentation: ES2023-115164

Rui He - *George Mason University,* **Pei Dong** - *George Mason University*

Kinetic Study for Photodynamic Effect of Single-Walled Carbon Nanotubes in Aprotic Media

Poster Presentation: ES2023-115231

Xiaozhou Huang - *George Mason University, Pei Dong - George Mason University*

Enhancing the University of North Florida's Thermo-Fluids Curriculum: The Integration of Clean Energy Technologies

Poster Presentation: ES2023-117086

Cooper Wolfe - *University of North Florida,* **Calla Taylor** - *University of North Florida,* **David Trosclair** - *University of North Florida,* **Christopher Becker** - *University of North Florida*

Natural Gas to Aromatics by Single-Step Synthesis Using Ternary Catalyst and Proton-Conducting Fuel Cell

Poster Presentation: ES2023-115079

Pengxi Zhu - *George Mason University,* **Dong Ding** - *Idaho National Laboratory,* **Hanping Ding** - *The University of Oklahoma,* **Pei Dong** - *George Mason University*

TUESDAY, JULY 11, 2023

02-03 BUILDING MANAGEMENT AND CONTROL
9:00AM–10:30AM **POTOMAC C**

Chair: **Jian Zhang** - *University of Wisconsin-Green Bay*

Advances in IoT-Integrated Building Management Systems

Technical Presentation Only: ES2023-110785

Monem Beitelmal - *Qatar Environment and Energy Research Institute*

Occupant Behavior Modeling for Building Performance Simulation: Review of the Recent Advances and Research Trends

Technical Paper Publication: ES2023-106807

Omar Ahmed - Concordia University, **Nurettin Sezer** - *Texas A&M University at Qatar,* **Mohamed Ouf** - *Concordia University,* **Liangzhu (Leon) Wang** - *Concordia University, Ibrahim Hassan - Texas A&M University at Qatar*

Multi-Objective Optimization of Distributed Energy Systems Considering Time-of-Use Pricing Impacts

Technical Paper Publication: ES2023-107282

Krisha Maharjan - *Mississippi State University,* **Jian Zhang** , **Cho** - *Mississippi State University,* **Yang Chen** - *North Carolina A&T State University*

Stochastic Method for Generating Residential Household Energy Models of Varying Income Level and Climate Zone for Testing Energy Fairness of Dynamic Electricity Pricing for Residential Buildings by Income Level

Technical Paper Publication: ES2023-107421

Hannah Covington - *Santa Clara University,* Brian Woo-Shem - *Santa Clara University,* Chenli Wang - *National Institute of Standards and Technology,* Thomas Roth - *National Institute of Standards and Technology,* Cuong Nguyen - *National Institute of Standards and Technology,* Hohyun Lee - *Santa Clara University*

Leveraging HVAC Set Point Changes for Operational Energy Performance Efficiency and Flexibility in Commercial Buildings: Experiments in a Moist Climate Zone

Technical Paper Publication: ES2023-107885

Rebecca Grekin - *Stanford University,* Jacques De Chalendar - *Stanford University*

04-01 RESEARCH FOR CLEAN ENERGY TRANSITION (SOCIO-TECHNICAL, EDUCATION AND POLICY)

9:00AM–10:30AM **ADAMS B**

Chair: Rebecca Mitchell - *National Renewable Energy Laboratory*

Process-Based Cost Estimation Framework for Assessing Economic Viability of Environmentally and Socially Sustainable Rare Earth Element Feedstocks

Technical Presentation Only: ES2023-105585

Alison Fritz , Tarka - *National Energy Technology Laboratory,* Meagan Mauter - *Stanford University*

A Transdisciplinary Approach and Design-Thinking Methodology for Energy Transition

Technical Paper Publication: ES2023-106943

Canan M. Ozsoy - *Ozyegin University,* M. Pinar Mengüç - *Ozyegin University*

Pathways to Improve the Energy Efficiency of Residential Air-Conditioning Systems in Saudi Arabia

Technical Paper Publication: ES2023-108145

Abdulaziz Alotaibi - *King Fahd University of Petroleum and Minerals,* Taha Makhdoom - *King Fahd University of Petroleum and Minerals,* Awad Bin Saud Alquaity - *King Fahd University of Petroleum and Minerals*

The Difference in Blue Water Usage of Meals Prepared at Home Versus Meals Prepared Away From Home

Technical Paper Publication: ES2023-106820

Schuyler Sices - *Villanova University,* Aaron Wemhoff - *Villanova University*

Hydrogel-Coated Mesh for High-Efficiency, Ultra-Fast Oil-Water Separation

Technical Paper Publication: ES2023-106938

Amanda Williams - *University of Arkansas,* Shuqi Zhou - *University of Houston,* Ben Xu - *University of Houston,* Han Hu - *University of Arkansas*

05-05 SOLAR RECEIVER DESIGN 3

9:00AM–10:30AM **POTOMAC A**

Chair: Krutika Appaswamy - Purdue University

Principle of Planar-Cavity Receiver and Its Application in a Particle CSP System

Technical Presentation Only: ES2023-115294

Zhiwen Ma - *National Renewable Energy Laboratory,* Janna Martinek - *National Renewable Energy Laboratory*

Modeling Receiver Flux of Commercial Power Tower Concentrating Solar Power Plants Using Ray Tracing: A Round-Robin Comparison of Soltrace, Solstice, and Tiesol

Technical Presentation Only: ES2023-116829

Rebecca Mitchell - *National Renewable Energy Laboratory, Ye Wang - Australian National University,* Michel Izygon - *Tietronix Software, Inc.,* John Pye - *Australian National University,* Guangdong Zhu - *National Renewable Energy Laboratory,* Joe Coventry - *Australian National University*

Assessing the Optical Performance Impact of Tracking Error in an Operational Concentrating Solar Power Plant Using Monte Carlo Ray-Tracing Simulation

Technical Presentation Only: ES2023-112266

Brooke Stanislawski - *National Renewable Energy Laboratory*

Michael Wagner - *University of Wisconsin-Madison,* Ulrike Egerer - *National Renewable Energy Laboratory,* Scott Dana - *National Renewable Energy Laboratory,* Ashesh Sharma - *National Renewable Energy Laboratory,* Shashank Yellapantula - *National Renewable Energy Laboratory*

Radiative Transfer in Luminescent Solar Concentrators

Technical Presentation Only: ES2023-115121

Sha Li - *École Polytechnique Fédérale de Lausanne,* **Suiying Ye** - *ETH Zurich,* **Yinyin Bao** - *ETH Zurich,* **Sophia Haussener** - *École Polytechnique Fédérale de Lausanne*

Optical Characterization of a Cavity Falling-Particle Snout Receiver

Technical Presentation Only: ES2023-114940

William Hamilton - *National Renewable Energy Laboratory,* **Michael Wagner** - *University of Wisconsin-Madison*

05-06 OTHER CSP TECHNOLOGIES
9:00AM–10:30AM **MONTPELIER B**

Chair: **John Pye** - *Australian National University*

Supercritical CO_2 Recompression Cycle Design Optimization to Maximize MSPT Internal Rate of Return

Technical Presentation Only: ES2023-110363

Ty Neises - *National Renewable Energy Laboratory*

Concentrated Solar Power as an Energy Source for the Ignition of Self-Sustained Smoldering Remediation of Petroleum-Contaminated Soils

Technical Presentation Only: ES2023-110650

Corey Trujillo , **Saldana Campos** - *University of Colorado, Boulder,* **Daniel Segal** - *Chevron Technical Center,* **Michael Veres** - *Colorado School of Mines,* **Karl Linden** - *University of Colorado, Boulder*

Design, Fabrication, and Initial Characterization of a 13 kWe Metal-Halide and Xenon Short-Arc Lamp High-Flux Solar Simulator With Adjustable Concentration Profiles Using a Horizontally-Translating Central Lamp

Technical Presentation Only: ES2023-117004

Andrew Schrader - *University of Dayton,* **Alexander Ferreira** - *University of Dayton*

Feasibility of High Temperature Concentrated Solar Power for Cogeneration of Electricity and Hydrogen Using Supercritical Carbon Dioxide Receiver Technology

Technical Paper Publication: ES2023-107082

Nader A. Khormi - *Oregon State University,* **Brian Fronk** - *The Pennsylvania State University*

An Experimental Investigation of a Water-Based C-Dot Nanofluid Optical Filter for Concentrated Photovoltaic-Thermal (CPV-T) Systems

Technical Presentation Only: ES2023-107263

Sandesh Surendra Chougule - *Imperial College London,* **Sagas M.S.** - *National Institute of Technology Calicut,* **Sujith Kumar C.S.** - *National Institute of Technology Calicut, Christos Markides - Imperial College London*

09-01 INDUSTRIAL PROCESS HEAT AND WASTE HEAT
9:00AM–10:30AM **ADAMS A**

Chair: **Sarvenaz Sobhansarbandi** - *University of Missouri-Kansas City*

Scalable and Sustainable High-Performance Condensation for Waste Heat Recovery

Technical Presentation Only: ES2023-107078

Deepak Monga - *The University of Texas at Dallas,* **Jyotirmoy Sarma** - *The University of Texas at Dallas,* **Fangying Chen** - *The University of Texas at Dallas,* **Dylan Boylan** - *The University of Texas at Dallas,* **Xianming Dai** - *The University of Texas at Dallas*

Comparison Between Organic Rankine Vapor Compression Configurations With Variable Operating Conditions

Technical Presentation Only: ES2023-114938

Nickolas Roberts - *Colorado State University,* **Ben Platt** - *Colorado State University,* **Derek Young** - *Colorado State University,* **Todd Bandhauer** - *Colorado State University*

Decarbonizing Industrial Process Heat: A Technoeconomic Framework for Heat Source Selection

Technical Presentation Only: ES2023-116484

Akanksha Menon - *Georgia Institute of Technology*

Green Heat for Industry: Least-Cost Off-Grid Energy Collection and Storage Options for Multiple Australian Locations

Technical Presentation Only: ES2023-116871

Ye Wang - *Australian National University,* **Ahmad Mojiri** - *Australian National University,* **Joe Coventry** - *Australian National University,* **John Pye** - *Australian National University*

Thermodynamic Analysis of a Solar Driven Particle Reactor for Paraffin Dehydrogenation

Technical Presentation Only: ES2023-117046

Justin Lapp - *University of Maine,* **Thomas Schwartz** - *University of Maine,* **Alireza Kianimoqadam** - *University of Maine,* **Temidayo Ogunjinmi** - *University of Maine*

03-03 PUMPED THERMAL ENERGY STORAGE
11:00AM–12:30PM **ADAMS B**

Chair: **Bryan Kinzer** - *University of Michigan*
Co-Chair: **Rohini Bala Chandran** - *University of Michigan*

Pumped Thermal Energy Storage as Combined Heat and Power

Technical Presentation Only: ES2023-116672

Ty Neises - *National Renewable Energy Laboratory,* **William Hamilton** - *National Renewable Energy Laboratory,* **Josh Mctigue** - *National Renewablel Energy Laboratory*

Thermodynamic Performance Investigation of Environmentally Friendly Working Fluids in a Geothermal Integrated Pumped Thermal Energy Storage System

Technical Paper Publication: ES2023-107001

Aggrey Mwesigye - *University of Calgary*

Analysis of Renewable Energy Integrated Pumped Thermal Energy Storage Systems of Renewable Energy Integrated Pumped Thermal Energy Storage Systems

Technical Paper Publication: ES2023-107521

Nishith B. Desai - *Technical University of Denmark,* **Simone Parisi** - *Technical University of Denmark,* **Nikolaos Remygiakis** - *Technical University of Denmark,* **Fredrik Haglind** - *Technical University of Denmark*

Thermo-Economic Assessment of Pumped Thermal Electricity Storage Systems Employing Reversible Turbomachinery

Technical Paper Publication: ES2023-106297

Simone Parisi - *Technical University of Denmark,* **Nishith Babubhai Desai** - *Technical University of Denmark,* **Fredrik Haglind** - *Technical University of Denmark*

05-11 HELIOSTAT CONSORTIUM 1
11:00AM–12:30PM **MONTPELIER A**

Chair: **Mark Mehos** - *National Renewable Energy Laboratory*

An Overview on HelioCon: An International Heliostat Consortium to Advance Concentrating Solar-Thermal Technologies

Technical Presentation Only: ES2023-117125

Guangdong Zhu - *National Renewable Energy Laboratory*

Status Update on Metrology and Standard in the Heliostat Consortium (HelioCon)

Technical Presentation Only: ES2023-117150

Guangdong Zhu - *National Renewable Energy Laboratory*

HelioCon: Evaluation of Composite Materials for Heliostat Cost Reduction

Technical Presentation Only: ES2023-117413

Matthew Muller - *National Renewable Energy Laboratory,* **Daniel Tsvankin** - *National Renewable Energy Laboratory,* **Kenneth Armijo** - *Sandia National Laboratories,* **Dimitri Madden** - *Sandia National Laboratories*

Heliostat Consortium: Update on Resource, Training, and Education Development and Women+ in Concentrating Solar

Technical Presentation Only: ES2023-117031

Rebecca Mitchell - *National Renewable Energy Laboratory,* **Guangdong Zhu** - *National Renewable Energy Laboratory,* **Alina Gilmanova** - *Cosin Solar Technology Co.,* **Marina Casanova** - *ACCIONA,* **Audrey Soum-Glaude** - *PROMES-CNRS Laboratory,* **Sabrina Hasni** - *Shell*

05-08 PARTICLES FOR THERMAL STORAGE IN CSP 1

11:00AM–12:30PM **POTOMAC C**

Chair: **Jeremy N. Sment** - *Sandia National Laboratories*

Coupled Acoustic Emission and Radiofrequency Sensing for Dynamic Characterization of Particulate Flow

Technical Presentation Only: ES2023-106693

Jackson Marsh - *University of Arkansas, Logan Raben - University of Arkansas,* **Noshin Nawar** - *University of Arkansas,* **Han Hu** - *University of Arkansas*

Particle Dispersion and Heat Transfer in Fluidized Bed Heat Exchangers From Eulerian-Lagrangian Simulations

Technical Presentation Only: ES2023-111527

Gregory Jackson - *Colorado School of Mines,* **Federico Municchi** - *Colorado School of Mines*

Optimum System Configuration for Different Nominal Powers in Particle-Based CSP Systems

Technical Presentation Only: ES2023-113092

Luis F. Gonzalez-Portillo - *Universidad Politecnica de Madrid,* **Clifford Ho** - *Sandia National Laboratories,* **Kevin Albrecht** - *Sandia National Laboratories,* **Brantley Mills** - *Sandia National Laboratories*

Modeling Radiative Heat Transfer in Dispersed Particle Flow System Using a Stochastic Approach

Technical Presentation Only: ES2023-114612

Muhammad Umer - *The Pennsylvania State University,* **Bryan J. Siefering** - *The Pennsylvania State University,* **Brian M. Fronk** - *The Pennsylvania State University*

06-02 MATERIALS AND FUNDAMENTALS

11:00AM–12:30PM **ADAMS A**

Chair: **Shang Zhai** - *Stanford University*

The Role of Plasmonic Photocatalysts in Sunlight-Powered Sabatier and Reverse Water Gas Shift Processes

Technical Presentation Only: ES2023-115116

Sha Li - *École Polytechnique Fédérale de Lausanne,* **Francesc Sastre** - *TNO,* **Jonathan Van Den Ham** - *TNO,* **Nicole Meulendijks** - *TNO,* **Pascal Buskens** - *TNO,* **Sophia Haussener** - *École Polytechnique Fédérale de Lausanne*

Superior Photodynamic Effect of Carbon Nanomaterials for the Generation of Reactive Oxygen Species

Technical Presentation Only: ES2023-115208

Xiaozhou Huang - *George Mason University,* **Yaonian Li** - *George Mason University,* **Qiliang Li** , **Dong -** George Mason University

Parametric Study of Solar Chemical-Looping Reforming of Methane Using Ni Promoted Ceria

Technical Presentation Only: ES2023-115295

Caroline Hill - *University of Florida,* **Simon Ackermann** - *Synhelion SA,* **Philipp Furler** - *Synhelion SA,* **Jonathan Scheffe** - *University of Florida*

High Flux Solar-Driven Thermogravimetric Analysis of Candidate Redox Materials Synthesized via Replica Foam Method

Technical Presentation Only: ES2023-113581

Dylan McCord - *University of Florida,* **Elizabeth Gager** - *University of Florida,* **Sebastian Sas Brunser** - *ETH Zurich,* **Juan Nino** - *University of Florida,* **Aldo Steinfeld** - *ETH Zurich, Jonathan Scheffe - University of Florida*

10-01 HYDROGEN ENERGY, ALTERNATIVE FUELS, BIOENERGY, AND BIOFUELS

11:00AM–12:30PM **MONTPELIER B**

Chair: **Wahiba Yaici** - *Natural Resources Canada/CanmetENERGY Research Centre*
Co-Chair: **Xinhai Xu** - *Harbin Institute of Technology*

Control of Bubble Dynamics for Enhancing Performance of Hydrogen Electrolyzers

Technical Presentation Only: ES2023-106683

Vaibhav Bahadur - *The University of Texas at Austin,* **Tejaswi Soori** - *The University of Texas at Austin*

Sensitivity Analysis of Process Conditions for Molten Salt Torrefaction

Technical Presentation Only: ES2023-117026

Lee Kohlin - *North Dakota State University,* **Adam C. Gladen** - *North Dakota State University*

Investigation of the Effects of Hydrogen-Enriched Natural Gas Blends and Pure Hydrogen on the Performance of a Domestic Condensing Boiler

Technical Paper Publication: ES2023-106980

Wahiba Yaici - *Natural Resources Canada/CanmetENERGY Research Centre,* **Evgueniy Entchev** - *Natural Resources Canada/CanmetENERGY Research Centre*

Analysis on Economy and Carbon Emission of a Carbon Neutralized Integrated Energy System Supplied With Different Energy

Technical Paper Publication: ES2023-107137

Jiao Li - *Shanghai Jiao Tong University,* **Daoming Hu** - *Shanghai Jiao Tong University,* **Yuzhang Wang** - *Shanghai Jiao Tong University,* **Kunyu Zhang** - *Shanghai Jiao Tong University*

Design Strategies for Biomass-Based CHP Systems in Rural Communities

Technical Paper Publication: ES2023-107125

Krisha Maharjan - *Mississippi State University,* **Joonsik Hwang** - *Mississippi State University,* **Heejin Cho** - *Mississippi State University*

02-04 BUILDING ENVELOPE, BUILDING ENERGY, AND DATA CENTERS

1:45PM–3:15PM **MONTPELIER A**

Chair: **Jorge Gonzalez-Cruz** - *University at Albany*

Steady State Analytical Modeling of a Thermal Panel of a Climate Adaptive Building Envelope for Energy Efficient Buildings

Technical Presentation Only: ES2023-116870

Amogh Wasti - *Rensselaer Polytechnic Institute,* **Youngjin Hwang** - *The University of Oklahoma,* **Alexandros Tsamis** - *Rensselaer Polytechnic Institute,* **Theodorian Borca-Tasciuc** - *Rensselaer Polytechnic Institute*

Cellular Inorganic Ceramic for Highly Efficient Daytime Passive Radiative Cooling

Technical Paper Publication: ES2023-105413

Kaixin Lin - *City University of Hong Kong,* **Yihao Zhu** - *City University of Hong Kong,* **Tsz Chung Ho** - *City University of Hong Kong,* **Chi Yan Tso** - *City University of Hong Kong*

Durability-Enhanced Thermochromic Perovskite Smart Window for Energy-Efficient Buildings

Technical Paper Publication: ES2023-106197

Sai Liu - *City University of Hong Kong,* **Yuwei Du** - *City University of Hong Kong,* **Huanfeng He** - *City University of Hong Kong,* **Aiqiang Pan** - *City University of Hong Kong,* **Chi Yan Tso** - *City University of Hong Kong*

A Simulation Study of Factors Affecting Cooling Performance of a Fan Wall-Cooled Data Center

Technical Paper Publication: ES2023-106727

Wei Ling - *Nanjing Tech University,* **Zhaoyang Bi** - *Nanjing Tech University,* **Tailian Chen** - *Gonzaga University*

Data Center Environmental Burden Reduction Through On-Site Renewable Power Generation

Technical Paper Publication: ES2023-107496

Matt Mcmullen - *Villanova University,* **Aaron Wemhoff** - *Villanova University*

05-07 CSP SYSTEM ANALYSIS, CONTROLS, AND STANDARDS

1:45PM–3:15PM **MONTPELIER B**

Chair: **Alexander Zolan** - *National Renewable Energy Laboratory*
Co-Chair: **Juan Ordonez** - *Florida State University*

Model Characterization of Blocking and Shading Losses in a Novel Two-Stage Heliostat

Technical Presentation Only: ES2023-114552

Ty Glisczinski - *University Wisconsin-Madison,* **Sammie Lundin** - *University Wisconsin-Madison,* **Michael Cheadle** - *University Wisconsin-Madison, Michael Wagner - University Wisconsin-Madison,* **Ty Neises** - *National Renewable Energy Laboratory*

Layout and Optimization of a Novel Two-Stage Heliostat Field

Technical Presentation Only: ES2023-111479

Sammie Lundin - *University of Wisconsin-Madison,* **Ty Glisczinski** - *University of Wisconsin-Madison,* **Michael Cheadle** - *University of Wisconsin-Madison,* **Michael Wagner** - *University of Wisconsin-Madison,* **Ty Neises** - *National Renewable Energy Laboratories*

Progress Update on the Development of an Internationally-Recognized Heliostat Design Qualification Standard

Technical Presentation Only: ES2023-117425

Daniel Tsvankin - *National Renewable Energy Laboratory,* **Matthew Muller** - *National Renewable Energy Laboratory,* **Kenneth Armijo** - *Sandia National Laboratories,* **Dimitri Madden** - *Sandia National Laboratories*

Assessment of Storage Sizing for Solar Tower Plants Using Model-Predictive Control in Self-Dispatch Optimization

Technical Paper Publication: ES2023-107480

Navid Mohammadzadeh - *Queensland University of Technology,* **Huy Truong-Ba** - *Queensland University of Technology,* **Giovanni Picotti** - *Queensland University of Technology,* **Michael E. Cholette** - *Queensland University of Technology*

Controls and Operational Strategy for Gen 3 Particle Pilot Plant

Technical Paper Publication: ES2023-107547

Hendrik Frederik Laubscher - *Sandia National Laboratories,* **Luis Garcia Maldonado** - *Sandia National Laboratories,* **Francisco Alvarez** - *Sandia National Laboratories,* **Luke P. Mclaughlin** - *Sandia National Laboratories,* **Nathan R. Schroeder** - *Sandia National Laboratories,* **Kevin J. Albrecht** - *Sandia National Laboratories,* **Jeremy N. Sment** - *Sandia National Laboratories,* **Kaden E. Plewe** - *The University of Texas at Austin*

08-02 ALTERNATIVE ENERGY CONVERSION TECHNIQUES

1:45PM–3:15PM **ADAMS A**

Chair: **Aggrey Mwesigye** - *University of Calgary*

MEMS Electrostatic Energy Harvesters With Dual Frequency Up-Conversion Techniques

Technical Presentation Only: ES2023-114615

Hannah Arnow - *Rensselaer Polytechnic Institute,* **Habilou Ouro-Koura** - *Rensselaer Polytechnic Institute,* **Jinglun Li** - *Rensselaer Polytechnic Institute,* **Arian Nowbahari** - *University of South-Eastern Norway,* **Matthew Galarza** - *Rensselaer Polytechnic Institute,* **Meg Obispo** - *Rensselaer Polytechnic Institute,* **Xing Tong** - *Rensselaer Polytechnic Institute,* **Mehdi Azadmehr** - *University of South-Eastern Norway,* **Mona Hella** - *Rensselaer Polytechnic Institute,* **John Tichy** - *Rensselaer Polytechnic Institute,* **Diana-Andra Borca-Tasciuc** - *Rensselaer Polytechnic Institute*

Investigation of Non-Linear Coupled Oscillators Utilized by Electrostatic Vibrational Energy Harvesters

Technical Presentation Only: ES2023-117129

Matthew Galarza - *Rensselaer Polytechnic Institute,* **Diana-Andra Borca-Tasciuc** - *Rensselaer Polytechnic Institute*

Power Generation Maximization Control Framework for Ocean Current Turbine Farms

Technical Paper Publication: ES2023-106960

Ertugrul Baris Ondes - *Virginia Polytechnic Institute and State University,* **Cornel Sultan** - *Virginia Polytechnic Institute and State University,* **James Vanzwieten** - *Florida Atlantic University*

Modeling and Analysis of Hydrogen Supply System With Dual Ejector Concept for Vehicular Proton Exchange Membrane Fuel Cell

Technical Paper Publication: ES2023-107152

Dat Truong Le Tri - *Chungnam National University,* **Hoang Nghia Vu** - *Chungnam National University,* **Younghyeon Kim** - *Chungnam National University,* **Sangseok Yu** - *Chungnam National University*

Design and Fabrication of Optimized Retrofit Electrostatic Precipitator as Exhaust Particulate Filter for Diesel Engine

Technical Paper Publication: ES2023-108223

Robert Michael Corpus - *Polytechnic University of the Philippines,* **Karylle Lucero** - *Polytechnic University of the Philippines,* **Allysa Mae Aldabe** - *Polytechnic University of the Philippines,* **Dee Anne Aralar** - *Polytechnic University of the Philippines,* **Geriel Calupig** - *Polytechnic University of the Philippines,* **Princess Angela Ortega** - *Polytechnic University of the Philippines*

WEDNESDAY, JULY 12, 2023

05-09 PARTICLES FOR THERMAL STORAGE IN CSP 2

9:00AM–10:30AM **MOUNT VERNON A**

Chair: **Zhiwen Ma** - *National Renewable Energy Laboratory*

Development of a Particle-Based Thermal Battery Using Pumped Thermal Energy Storage

Technical Presentation Only: ES2023-115296

Zhiwen Ma - *National Renewable Energy Laboratory,* **Jeffrey Gifford** - *National Renewable Energy Laboratory,* **Xingchao Wang** - *National Renewable Energy Laboratory,* **Josh Mctigue** - *National Renewable Energy Laboratory*

Falling Particle Receiver Mass Flow Rate Discretization for Homogenous Particle Heating and Increased Efficiency

Technical Presentation Only: ES2023-116503

Nathan Schroeder - *Sandia National Laboratories,* **Brantley Mills** - *Sandia National Laboratories*

Simulating Particle Fines in Falling Particle Receivers Subject to Wind Using High-Performance Computing

Technical Presentation Only: ES2023-116548

Brantley Mills - *Sandia National Laboratories,* **Nathaniel Schroeder** - *Sandia National Laboratories*

Enhanced Heat Transfer in Indirect Particle Receivers With Bubbling Fluidization

Technical Presentation Only: ES2023-116863

Keaton Brewster - *Colorado School of Mines,* **Katherine Schubert** - *Colorado School of Mines,* **Fuqiong Lei** - *Colorado School of Mines,* **Winfred Arthur-Arhin** - *Colorado School of Mines,* **Gregory Jackson** - *Colorado School of Mines*

Adaptation of Two-Fluid Models for Particle-Wall Heat Transfer in Fluidized Beds for Concentrating Solar Applications

Technical Presentation Only: ES2023-116867

Yahya Bokhary - *Colorado School of Mines,* **Gregory Jackson** - *Colorado School of Mines*

05-12 HELIOSTAT CONSORTIUM 2

9:00AM–10:30AM **POTOMAC A**

Chair: **Chad Augustine** - *National Renewable Energy Laboratory*
Co-Chair: **Guangdong Zhu** - *National Renewable Energy Laboratory*

NSTTF HelioCon Wireless Closed-Loop Controls Test Bed Development

Technical Presentation Only: ES2023-110772

Kenneth Armijo - *Sandia National Laboratories,* **Ansel Blumenthal** - *Sandia National Laboratories,* **Aaron Overacker** - *Sandia National Laboratories,* **Luis Garcia-Maldonado** - *Sandia National Laboratories*

Development of a Closed Loop Control and Wireless Test Bed for Concentrating Solar Tower Heliostats

Technical Presentation Only: ES2023-117137

Dimitri Madden - *Sandia National Laboratories,* **Ansel Blumenthal** - *Sandia National Laboratories,* **Kenneth Armijo** - *Sandia National Laboratories*

A Performance Forecasting Framework for Concentrated Solar Power Tower Systems

Technical Presentation Only: ES2023-117421

Alexander Zolan - *National Renewable Energy Laboratory,* **Chad Augustine** - *National Renewable Energy Laboratory,* **Guangdong Zhu** - *National Renewable Energy Laboratory,* **Jeremy Sment** - *Sandia National Laboratories*

Extending Deflectometry Metrology Capability for Concentrating Solar Power

Technical Presentation Only: ES2023-113406

Randy Brost - *Sandia National Laboratories,* **Braden Smith** - *Sandia National Laboratories,* **Felicia Brimigion** - *Sandia National Laboratories,* **Anthony Evans** - *Sandia National Laboratories*

Characterizing Heliostats at a Commercial Scale With Non-Intrusive Optics

Technical Presentation Only: ES2023-116766

Tucker Farrell - *National Renewable Energy Laboratory,* **Devon Kesseli** - *National Renewable Energy Laboratory*

06-03 NOVEL REACTORS AND PROCESSES
9:00AM–10:30AM **ADAMS A**

Chair: **Johannes Grobbel** - *German Aerospace Center*

Modelling Development of a Receiver-Reactor of Type R2Mx for Thermochemical Water Splitting

Technical Paper Publication: ES2023-107871

Estefania Vega Puga - *German Aerospace Center,* **Stefan Brendelberger** - *German Aerospace Center,* **Anika Weber** - *German Aerospace Center,* **Christian Sattler** - *German Aerospace Center*

Implementation of Thermochemical Oxygen Pumping for Improved Efficiency and Throughput of Solar Thermochemical Hydrogen Production

Technical Presentation Only: ES2023-107385

Aniket Patankar - *Massachusetts Institute of Technology,* **Xiaoyu Wu** - *University of Waterloo,* **Wonjae Choi** - *Ewha Womans University,* **Harry Tuller** - *Massachusetts Institute of Technology,* **Ahmed Ghoniem** - *Massachusetts Institute of Technology*

Solar Hydrogen Production With a Membrane Reactor: Process Description and Reactor Design

Technical Presentation Only: ES2023-117923

Juan Pablo Rincon Duarte - *German Aerospace Center,* **Nicole Neumann** - *German Aerospace Center,* **Falk Schulze-Küppers** - *Forschungszentrum Jülich GmbH,* **Bernd Büddefeld** - *Forschungszentrum Jülich GmbH,* **Stefan Baumann** - *Forschungszentrum Jülich GmbH,* **Christian Sattler** - *German Aerospace Center*

Solar Thermal Ammonia Production via Metal Nitride Looping

Technical Presentation Only: ES2023-117211

James Miller - *Arizona State University,* **Andrea Ambrosini** - *Sandia National Laboratories,* **Hagan Bush** - *Sandia National Laboratories,* **Xiang Gao** - *Arizona State University,* **Nhu Nguyen** - *Georgia Institute of Technology,* **Alberto De La Calle** - *Arizona State University,* **Ivan Ermanoski** - *Arizona State University,* **Tyler Farr** - *Georgia Institute of Technology,* **Kevin Albrecht** - *Sandia National Laboratories,* **Matthew Kury** - *Sandia National Laboratories,* **Peter Loutzenhiser** - *Georgia Institute of Technology,* **Ellen Stechel** - *Arizona State University*

Solar Hydrogen From Water Splitting Using Liquid Metal Oxidation/ Reduction Cycles H2pr Electrochemistry System Development

Technical Presentation Only: ES2023-110773

Kenneth Armijo - *Sandia National Laboratories,* **Aaron Overacker** - *Sandia National Laboratories,* **Dimitri Madden** - *Sandia National Laboratories,* **Anthony Mcdaniel** - *Sandia National Laboratories,* **Felicia Brimigion** - *Sandia National Laboratories,* **Guillermo Anaya** - *Sandia National Laboratories*

07-01 PHOTOVOLTAIC & ELECTROCHEMICAL TECHNOLOGIES
9:00AM–10:30AM **ADAMS B**

Chair: **Wilson K. S. Chiu** - *University of Connecticut*
Co-Chair: **Luke Venstrom** - *Valparaiso University*

Predicting the State of Charge of a Battery at Rest Using the Open Circuit Voltage

Technical Presentation Only: ES2023-112419

Sahana Upadhya - *University of Wisconsin-Madison,* **Allison Mahvi** - *University of Wisconsin-Madison,* **Michael Wagner** - *University of Wisconsin-Madison*

Utilizing Machine Learning Methods to Enable the Design of Perovskite Solar Cells: A Perspective

Technical Presentation Only: ES2023-116822

Jiawei Gong - *Penn State Behrend,* **Jie Zhao** - *Houghton University*

Impact of Temperature and Ethanol Concentration on High Temperature Direct Ethanol-Based Proton Exchange Membrane Fuel Cell

Technical Paper Publication: ES2023-107446

Prantik Roy Chowdhury - *North Dakota State University,* **Adam C. Gladen** - *North Dakota State University*

Integration of Photovoltaic-Based Smart Disinfectant Machine With Ultrasonic Waste Bin for Sanitation and Hygienics

Technical Paper Publication: ES2023-107515

Robert Michael Corpus - *Polytechnic University of the Philippines,* **Jeimarie Barairo** - *Polytechnic University of the Philippines,* **Ameer Mazen Ibrahim** - *Polytechnic University of the Philippines,* **Eleiza Eirynne Bautista** - *Polytechnic University of the Philippines,* **Mari Yzabelle Victa Gallardo** - *Polytechnic University of the Philippines,* **Marcus Deon Santos** - *Polytechnic University of the Philippines,* **John Iris Serrano** - *Polytechnic University of the Philippines*

Energy and Exergy Analysis of a Locally Developed 6W VRE Mobile Solar Charger

Technical Paper Publication: ES2023-108154

Phodiso Gothaang - *University of Botswana,* **Okatoseng Masoso** - *University of Botswana,* **Kevin Nwaigwe** - *University of Botswana*

09-02 SOLAR DESALINATION

9:00AM–10:30AM **MONTPELIER A**

Chair: **Sarvenaz Sobhansarbandi** - *University of Missouri-Kansas City*

Potassium Hydroxide Activated Wood Converted Carbon for Electrochemical Water Desalination

Technical Presentation Only: ES2023-114833

Rui He - *George Mason University,* **Pei Dong** - *George Mason University*

Distributed Solar Desalination With Energy Storage and Brine Management

Technical Presentation Only: ES2023-116473

Akanksha Menon - *Georgia Institute of Technology*

Numerical Heat and Mass Transfer Modeling and Techno-Economic Analysis of Metallic Porous Structures for Passive Pumping in Solar-Thermal Desalination Systems

Technical Presentation Only: ES2023-117023

Andrew Schrader - *University of Dayton,* **Abdullah Alfarhan** - *University of Dayton,* **Allison Lenhardt** - *University of Dayton,* **Rydge Mulford** - *University of Dayton*

02-05 INNOVATIONS FOR SUSTAINABLY BUILT ENVIRONMENTS

11:00AM–12:30PM **MONTPELIER A**

Chair: **Krisha Maharjan** - *Mississippi State University*

Performance of a Solid-State Thermoelectric Thermoregulation System Under Different Climate Zones in the U.S.

Technical Presentation Only: ES2023-116809

Amogh Wasti - *Rensselaer Polytechnic Institute,* **Berardo Matalucci** - *MIMiC Systems Inc.,* **Theodorian Borca-Tasciuc** - *Rensselaer Polytechnic Institute*

Urban Scale Cooling Load Prediction of High-Rise Buildings in a Hot and Arid Climate

Technical Paper Publication: ES2023-107814

Omar Ahmed - *Concordia University, Majd Moujahed - Concordia University,* **Nurettin Sezer** - *Texas A&M University at Qatar,* **Liangzhu (Leon) Wang** - *Concordia University, Ibrahim Hassan - Texas A&M University at Qatar*

Pathways for Atmospheric Water Harvesting to Reach Cost Parity With Distributed Desalination

Technical Paper Publication: ES2023-107067

Jordan Kocher - *Georgia Institute of Technology, Akanksha Menon - Georgia Institute of Technology*

Energy Analysis of a Solar-Powered Heating System for a Greenhouse in the Martian Environment

Technical Paper Publication: ES2023-107043

Nivedha Karigiri Madhusudhan - *Florida Institute of Technology,* *Hamidreza Najafi - Florida Institute of Technology*

03-04 SENSIBLE ENERGY STORAGE
11:00AM–12:30PM **ADAMS A**

Chair: **Zijie Chen** - *University of Michigan-Ann Arbor*
Co-Chair: **Rohini Bala Chandran** - *University of Michigan*

Energy Storage Using a High-Performance Adsorption System

Technical Paper Publication: ES2023-105306

Animesh Vyas - *Indian Institute of Technology Kanpur,* **Darshan Pahinkar** *- Florida Institute of Technology,* **Vaibhav Arghode** - *Indian Institute of Technology Kanpur*

Heat Transfer Models of High-Temperature Gravity-Driven Granular Flows Between Vertical Parallel Plates for Solar Thermal Energy Storage and Transport

Technical Presentation Only: ES2023-116598

Shin Young Jeong - *Georgia Institute of Technology,* **Malavika Bagepalli** *- Lawrence Berkeley National Laboratory,* **Joshua Brooks** - *Georgia Institute of Technology,* **Devesh Ranjan** - *Georgia Institute of Technolog,* **Zhuomin Zhang** - *Georgia Institute of Technology,* **Peter Loutzenhiser** *- Georgia Institute of Technology*

Fabrication, Modeling, and Testing of a Prototype for Particle Thermal Energy Storage Containment

Technical Paper Publication: ES2023-106662

Jeffrey Gifford - *Colorado School of Mines,* **Patrick Davenport** - *National Renewable Energy Laboratory,* **Xingchao Wang** - *Colorado School of Mines,* **Zhiwen Ma** - *National Renewable Energy Laboratory*

Nanoconfined Polyethylene Glycol With Expanded Graphite for Energy-Efficient Thermal Energy Storage

Technical Presentation Only: ES2023-115239

Lyu Zhou - *The University of Texas at Dallas,* **Zainab Faheem** - *The University of Texas at Dallas,* **Bernadette Magalindan** - *The University of Texas at Dallas,* **Shiwen Wu** - *The University of Texas at Dallas,* **Arslan Umer** - *The University of Texas at Dallas, Kenneth Balkus - The University of Texas at Dallas,* **Guoping Xiong** - *The University of Texas at Dallas,* **Shuang Cui** - *The University of Texas at Dallas*

05-10 PARTICLES FOR THERMAL STORAGE IN CSP 3
11:00AM–12:30PM **MOUNT VERNON A**

Chair: **Nathan Schroeder** - *Sandia National Laboratories*

Investigation of Best-Practices and Computationally Inexpensive Radiative Exchange Models for Discrete Element Method Modeling of Aluminosilicate Particles in Concentrating Solar Power Environments

Technical Presentation Only: ES2023-116992

Andrew Schrader - *University of Dayton,* **Aaron Spieles** - *University of Dayton,* **Natalie Douglass** - *University of Dayton,* **Rydge Mulford** *- University of Dayton*

Particle-Wall Heat Transfer Enhancements With Extended Surfaces in Narrow Channel Fluidized Beds

Technical Presentation Only: ES2023-116993

Fuqiong Lei - Colorado School of Mines, **Katherine Schubert** - *Colorado School of Mines,* **Keaton Brewster** - *Colorado School of Mines,* **Winfred Arthur-Arhin** - *Colorado School of Mines,* **Jesse R. Fosheim** - *Brayton Eenergy,* **Bill Caruso** - *Brayton Energy,* **Gregory S. Jackson** - *Colorado School of Mines*

Coupled Experimental and High-Temperature Discrete-Element Method Modeling Studies of Aluminosilicate Particle Handling in Concentrated Solar Power Environments

Technical Presentation Only: ES2023-117010

Andrew Schrader - *University of Dayton,* **Natalie Douglass** - *University of Dayton,* **Aaron Spieles** - *University of Dayton,* **Rydge Mulford** - *University of Dayton*

Modeling Tool Development and Validation for Solar Industry Process Heat Using Particle Thermal Energy Storage

Technical Paper Publication: ES2023-106984

Jeffrey Gifford - *National Renewable Energy Laboratory,* **William Hamilton** - *National Renewable Energy Laboratory,* **Jing Wang** - *National Renewable Energy Laboratory,* **Zhiwen Ma** - *National Renewable Energy Laboratory*

05-13 HELIOSTAT CONSORTIUM 3

11:00AM–12:30PM **POTOMAC A**

Chair: **Margaret Gordon** - *Sandia National Laboratories*

Status Quo of Heliostat Field Deployment Processes

Technical Paper Publication: ES2023-107501

Jeremy Sment - *Sandia National Laboratories,* **Alexander Zolan** - *National Renewable Energy Laboratory,* **Guangdong Zhu** - *National Renewable Energy Laboratory*

Heliostat Field Optimization for Power Tower Solar Industrial Process Heat Applications

Technical Presentation Only: ES2023-116768

Chad Augustine - *National Renewable Energy Laboratory,* **Alexander Zolan** - *National Renewable Energy Laboratory,* **Ye Wang** - *Australian National University,* **John Pye** - *Australian National University*

High-Speed Assessment of Heliostat Fields Without Disrupting Operations

Technical Presentation Only: ES2023-116619

Randy Brost - *Sandia National Laboratories,* **Daniel Small** - *Sandia National Laboratories,* **David Novick** - *Sandia National Laboratories,* **Benjamin Bean** - *Sandia National Laboratories*

An Indoor Reflected Target Optical Measurement System for Concentrated Solar Power Mirrors

Technical Presentation Only: ES2023-114008

Devon Kesseli - *National Renewable Energy Laboratory,* **Mojolaoluwa Keshiro** - *National Renewable Energy Laboratory,* **Rebecca Mitchell** - *National Renewable Energy Laboratory,* **Guangdong Zhu** - *National Renewable Energy Laboratory*

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Ahmed	Omar	106807	Occupant Behavior Modeling for Building Performance Simulation: Review of the Recent Advances and Research Trends	02-03 Building Management and Control
Ahmed	Omar	107814	Urban Scale Cooling Load Prediction of High-Rise Buildings in a Hot and Arid Climate	02-05 Innovations for Sustainably Built Environments
Alfarhan	Abdullah	117023	Numerical Heat and Mass Transfer Modeling and Techno-Economic Analysis of Metallic Porous Structures for Passive Pumping in Solar-Thermal Desalination Systems	09-02 Solar Desalination
Alotaibi	Abdulaziz	108145	Pathways to Improve the Energy Efficiency of Residential Air-Conditioning Systems in Saudi Arabia	04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)
Amhamed	Abdukarem	117439	A Pathway Towards a Net-Zero: A Study on HVAC and Direct CO_2 Capture as Response to the Climate Crisis and Indoor Air Quality	11-01 Carbon Capture and Sequestration
Appaswamy	Krutika	106824	Multiphase Modeling in a Parallel Plate Fluidized Bed Receiver for Concentrating Solar Power	05-03 Solar Receiver Design 1
Arkhurst	Bettina	111263	Just-R Metrics Framework for Integrating Energy Justice Into Early-Stage Research	01-01 A Just Transition to a Sustainable Future
Armijo	Kenneth	110772	NSTTF HelioCon Wireless Closed-Loop Controls Test Bed Development	05-12 Heliostat Consortium 2
Armijo	Kenneth	110773	Solar Hydrogen From Water Splitting Using Liquid Metal Oxidation/Reduction Cycles H2pr Electrochemistry System Development	06-03 Novel Reactors and Processes
Arnow	Hannah	114615	MEMS Electrostatic Energy Harvesters With Dual Frequency Up-Conversion Techniques	08-02 Alternative Energy Conversion Techniques
Augustine	Chad	116768	Heliostat Field Optimization for Power Tower Solar Industrial Process Heat Applications	05-13 Heliostat Consortium 3
Bahadur	Vaibhav	106682	Techno-Economic Analysis of Hydrates-Based Carbon Dioxide Sequestration on the Seabed	11-01 Carbon Capture and Sequestration
Bahadur	Vaibhav	106683	Control of Bubble Dynamics for Enhancing Performance of Hydrogen Electrolyzers	10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels
Bahrami	Leyli	107525	Simulation of the Performance of a High Temperature Solar Thermal Receiver Comprised Parallel Micro-Pin Unit-Cells Fabricated via Additive Manufacturing	05-04 Solar Receiver Design 2
Bala Chandran	Rohini	117099	Methods for Quantitative Temperature-Dependent Optical Metrology	05-02 Metrology in CSP
Barairo	Jeimarie	107515	Integration of Photovoltaic-Based Smart Disinfectant Machine With Ultrasonic Waste Bin for Sanitation and Hygienics	07-01 Photovoltaic & Electrochemical Technologies
Barbosa	Erik	106917	Salt Hydrate Thermochemical Energy Storage in Buildings: Analyzing Storage Density and Thermal Power Output	03-01 Thermochemical Energy Storage

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Beitelmal	Monem	110785	Advances in IoT-Integrated Building Management Systems	02-03 Building Management and Control
Bokhary	Yahya	116867	Adaptation of Two-Fluid Models for Particle-Wall Heat Transfer in Fluidized Beds for Concentrating Solar Applications	05-09 Particles for Thermal Storage in CSP 2
Brewster	Keaton	116863	Enhanced Heat Transfer in Indirect Particle Receivers With Bubbling Fluidization	05-09 Particles for Thermal Storage in CSP 2
Brost	Randy	113406	Extending Deflectometry Metrology Capability for Concentrating Solar Power	05-12 Heliostat Consortium 2
Brost	Randy	116619	High-Speed Assessment of Heliostat Fields Without Disrupting Operations	05-13 Heliostat Consortium 3
Carter	Matt	107262	Thermomechanical Stress and Creep-Fatigue Analysis of a High-Temperature Prototype Receiver for Heating Particles	05-03 Solar Receiver Design 1
Chen	Tailian	106727	A Simulation Study of Factors Affecting Cooling Performance of a Fan Wall-Cooled Data Center	02-04 Building Envelope, Building Energy, and Data Centers
Chougule	Sandesh Surendra	107263	An Experimental Investigation of a Water-Based C-Dot Nanofluid Optical Filter for Concentrated Photovoltaic-Thermal (CPV-T) Systems	05-06 Other CSP Technologies
Chowdhury	Prantik Roy	107446	Impact of Temperature and Ethanol Concentration on High Temperature Direct Ethanol-Based Proton Exchange Membrane Fuel Cell	07-01 Photovoltaic & Electrochemical Technologies
Covington	Hannah	107421	Stochastic Method for Generating Residential Household Energy Models of Varying Income Level and Climate Zone for Testing Energy Fairness of Dynamic Electricity Pricing for Residential Buildings by Income Level	02-03 Building Management and Control
Douglass	Natalie	117010	Coupled Experimental and High-Temperature Discrete-Element Method Modeling Studies of Aluminosilicate Particle Handling in Concentrated Solar Power Environments	05-10 Particles for Thermal Storage in CSP 3
Ebadi	Hossein	108401	Investigation on a Double-Pass Tubular Absorber for Application in Solar Towers	05-04 Solar Receiver Design 2
Egerer	Ulrike	112334	Wind Loading on Parabolic Trough Solar Collectors: Wind and Structural Loads Measurements in an Operational Powerplant	05-02 Metrology in CSP
Ferreira	Alexander	117004	Design, Fabrication, and Initial Characterization of a 13 kWe Metal-Halide and Xenon Short-Arc Lamp High-Flux Solar Simulator With Adjustable Concentration Profiles Using a Horizontally-Translating Central Lamp	05-06 Other CSP Technologies
Galarza	Matthew	117129	Investigation of Non-Linear Coupled Oscillators Utilized by Electrostatic Vibrational Energy Harvesters	08-02 Alternative Energy Conversion Techniques

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Garraway	David	107045	Development of Electrified Transcritical R744 Heat Pump Systems for Northeastern Winter Markets	02-01 Heat Pump and Building Waste Heat Utilization
Ghotkar	Rhushikesh	112813	Thermochemical Energy Storage: Zigzag Flow Reactor	03-01 Thermochemical Energy Storage
Gifford	Jeffrey	106662	Fabrication, Modeling, and Testing of a Prototype for Particle Thermal Energy Storage Containment	03-04 Sensible Energy Storage
Gifford	Jeffrey	115296	Development of a Particle-Based Thermal Battery Using Pumped Thermal Energy Storage	05-09 Particles for Thermal Storage in CSP 2
Giuffrida	Jose	107455	Economic Feasibility Analysis of Developing Large-Scale Hybrid Solar-Wind Energy Plants on Farms and Ranches in South Texas	01-01 A Just Transition to a Sustainable Future
Gladen	Adam	107592	Waste Heat Assessment of a Manufacturing Facility	02-01 Heat Pump and Building Waste Heat Utilization
Glisczinski	Ty	114552	Model Characterization of Blocking and Shading Losses in a Novel Two-Stage Heliostat	05-07 CSP System Analysis, Controls, and Standards
Gong	Jiawei	116822	Utilizing Machine Learning Methods to Enable the Design of Perovskite Solar Cells: A Perspective	07-01 Photovoltaic & Electrochemical Technologies
Gonzalez-Portillo	Luis F.	113092	Optimum System Configuration for Different Nominal Powers in Particle-Based CSP Systems	05-08 Particles for Thermal Storage in CSP 1
Grekin	Rebecca	107885	Leveraging HVAC Set Point Changes for Operational Energy Performance Efficiency and Flexibility in Commercial Buildings: Experiments in a Moist Climate Zone	02-03 Building Management and Control
Grobbel	Johannes	115024	Demonstration of a Model Predictive Control for a Cluster of Solar Chemical Batch Reactors	06-01 Thermochemical Redox Cycles: Demonstration and Operation
Hamilton	William	114940	Optical Characterization of a Cavity Falling-Particle Snout Receiver	05-05 Solar Receiver Design 3
Hayes	Michael	114575	Experimental Demonstration of the Dynamics of a Novel Thermochemical Oxidation Reactor	03-01 Thermochemical Energy Storage
He	Rui	114833	Potassium Hydroxide Activated Wood Converted Carbon for Electrochemical Water Desalination	09-02 Solar Desalination
He	Rui	115164	Porous Biomass Converted Carbon Electrode Design and Application in Capacitive Deionization	14-01 Conference Poster Presentation
Hill	Caroline	115295	Parametric Study of Solar Chemical-Looping Reforming of Methane Using Ni Promoted Ceria	06-02 Materials and Fundamentals
Huang	Xiaozhou	115208	Superior Photodynamic Effect of Carbon Nanomaterials for the Generation of Reactive Oxygen Species	06-02 Materials and Fundamentals
Huang	Xiaozhou	115231	Kinetic Study for Photodynamic Effect of Single-Walled Carbon Nanotubes in Aprotic Media	14-01 Conference Poster Presentation
Izquierdo	Julio	114923	Tube Geometry Optimization for Concentrating Solar Power Heat Exchangers	05-04 Solar Receiver Design 2

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Jeong	Shin Young	116598	Heat Transfer Models of High-Temperature Gravity-Driven Granular Flows Between Vertical Parallel Plates for Solar Thermal Energy Storage and Transport	03-04 Sensible Energy Storage
Juette	Elizabeth D.	107306	Prediction of Thermionic Energy Conversion Performance and Parametric Effects Using Genetic Algorithms to Fit Physics-Inspired Model Equations to Prototype Test Data	08-01 Thermal Energy Conversion Techniques
Karigiri Madhusudhan	Nivedha	107043	Energy Analysis of a Solar-Powered Heating System for a Greenhouse in the Martian Environment	02-05 Innovations for Sustainably Built Environments
Kesseli	Devon	114008	An Indoor Reflected Target Optical Measurement System for Concentrated Solar Power Mirrors	05-13 Heliostat Consortium 3
Kesseli	Devon	116766	Characterizing Heliostats at a Commercial Scale With Non-Intrusive Optics	05-12 Heliostat Consortium 2
Khormi	Nader A.	107082	Feasibility of High Temperature Concentrated Solar Power for Cogeneration of Electricity and Hydrogen Using Supercritical Carbon Dioxide Receiver Technology	05-06 Other CSP Technologies
Kinzer	Bryan	114587	Predicting Energy and Power Trade-Offs in Salt Hydrate Composites for Building Heating and Thermal Storage	03-01 Thermochemical Energy Storage
Kocher	Jordan	107067	Pathways for Atmospheric Water Harvesting to Reach Cost Parity With Distributed Desalination	02-05 Innovations for Sustainably Built Environments
Kohlin	Lee	117026	Sensitivity Analysis of Process Conditions for Molten Salt Torrefaction	10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels
Krenzke	Peter	107692	Demonstration of Multiyear Solar Thermochemical Energy Storage via the Cobalt Oxide Cycle	06-01 Thermochemical Redox Cycles: Demonstration and Operation
Lapp	Justin	117046	Thermodynamic Analysis of a Solar Driven Particle Reactor for Paraffin Dehydrogenation	09-01 Industrial Process Heat and Waste Heat
Laubscher	Hendrik Frederik	107547	Controls and Operational Strategy for Gen 3 Particle Pilot Plant	05-07 CSP System Analysis, Controls, and Standards
Lei	Fuqiong	116993	Particle-Wall Heat Transfer Enhancements With Extended Surfaces in Narrow Channel Fluidized Beds	05-10 Particles for Thermal Storage in CSP 3
Li	Jiao	107137	Analysis on Economy and Carbon Emission of a Carbon Neutralized Integrated Energy System Supplied With Different Energy	10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels
Li	Sha	115116	The Role of Plasmonic Photocatalysts in Sunlight-Powered Sabatier and Reverse Water Gas Shift Processes	06-02 Materials and Fundamentals
Li	Sha	115121	Radiative Transfer in Luminescent Solar Concentrators	05-05 Solar Receiver Design 3

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Lin	Kaixin	105413	Cellular Inorganic Ceramic for Highly Efficient Daytime Passive Radiative Cooling	02-04 Building Envelope, Building Energy, and Data Centers
Liu	Sai	106197	Durability-Enhanced Thermochromic Perovskite Smart Window for Energy-Efficient Buildings	02-04 Building Envelope, Building Energy, and Data Centers
Lucero	Karylle	108223	Design and Fabrication of Optimized Retrofit Electrostatic Precipitator as Exhaust Particulate Filter for Diesel Engine	08-02 Alternative Energy Conversion Techniques
Lundin	Sammie	111479	Layout and Optimization of a Novel Two-Stage Heliostat Field	05-07 CSP System Analysis, Controls, and Standards
Ma	Zhiwen	106984	Modeling Tool Development and Validation for Solar Industry Process Heat Using Particle Thermal Energy Storage	05-10 Particles for Thermal Storage in CSP 3
Ma	Zhiwen	115127	Paths of Solar Energy to Renewable Fuels	06-01 Thermochemical Redox Cycles: Demonstration and Operation
Madden	Dimitri	117137	Development of a Closed Loop Control and Wireless Test Bed for Concentrating Solar Tower Heliostats	05-12 Heliostat Consortium 2
Magalindan	Bernadette	115258	Shape-Stable Wood-Phase Change Material Composite for Thermal Energy Storage in Buildings	03-02 Phase Change Thermal Storage
Maharjan	Krisha	107125	Design Strategies for Biomass-Based CHP Systems in Rural Communities Strategies	10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels
Maisonneuve	Jonathan	112405	Using Fertilizer-Based Liquid Desiccants to Efficiently Dehumidify Indoor Plant Environments and Recycle Water	02-02 Fluid Mechanics and Heat Transfer in Building Applications
Manzoor	Muhammad Taha	108736	Experimental Investigation of Heat Transfer Mechanisms in a Beam Down Molten Salt-Based Volumetric Solar Thermal Receiver	05-03 Solar Receiver Design 1
Marchand	Riley	107392	Industrial Energy Assessments for Small and Medium-Sized Enterprises by College Students	14-01 Conference Poster Presentation
Marsh	Jackson	106693	Coupled Acoustic Emission and Radiofrequency Sensing for Dynamic Characterization of Particulate Flow	05-08 Particles for Thermal Storage in CSP 1
Martinek	Janna	115294	Principle of Planar-Cavity Receiver and Its Application in a Particle CSP System	05-05 Solar Receiver Design 3
Mayer	Michael	105811	Modeling the Performance of a Novel Microchannel-Based Mass Exchanger for Carbon Capture	11-01 Carbon Capture and Sequestration
Mayer	Mike	116903	Temperature Characterization of Flowing Particles With Non-Contact Measurement Techniques	05-02 Metrology in CSP

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
McCord	Dylan	113581	High Flux Solar-Driven Thermogravimetric Analysis of Candidate Redox Materials Synthesized via Replica Foam Method	06-02 Materials and Fundamentals
McLaughlin	Luke	107402	Stability Assessment of High Temperature Coatings for Flux Measurement Applications	05-02 Metrology in CSP
Meek	Aiden	107345	Steady State Modeling of a Regenerative Rankine Cycle for the Natrium System	08-01 Thermal Energy Conversion Techniques
Menguc	M. Pinar	106966	Design Methodology of a Concentrating Solar Volumetric Receiver	05-03 Solar Receiver Design 1
Menon	Akanksha	116473	Distributed Solar Desalination With Energy Storage and Brine Management	09-02 Solar Desalination
Menon	Akanksha	116484	Decarbonizing Industrial Process Heat: A Technoeconomic Framework for Heat Source Selection	09-01 Industrial Process Heat and Waste Heat
Miller	James	117211	Solar Thermal Ammonia Production via Metal Nitride Looping	06-03 Novel Reactors and Processes
Mills	Brantley	116548	Simulating Particle Fines in Falling Particle Receivers Subject to Wind Using High-Performance Computing	05-09 Particles for Thermal Storage in CSP 2
Mishra	Ashreet	107384	Numerical Investigation of Thermochemical Energy Extraction in a Moving Packed Bed Oxidation Reactor-Heat Exchanger	05-01 Thermochemical Energy Storage for CSP Applications
Mitchell	Rebecca	116829	Modeling Receiver Flux of Commercial Power Tower Concentrating Solar Power Plants Using Ray Tracing: A Round-Robin Comparison of Soltrace, Solstice, and Tiesol	05-05 Solar Receiver Design 3
Mitchell	Rebecca	117031	Heliostat Consortium: Update on Resource, Training, and Education Development and Women+ in Concentrating Solar	05-11 Heliostat Consortium 1
Mohammadzadeh	Navid	107480	Assessment of Storage Sizing for Solar Tower Plants Using Model-Predictive Control in Self-Dispatch Optimization	05-07 CSP System Analysis, Controls, and Standards
Monga	Deepak	107078	Scalable and Sustainable High-Performance Condensation for Waste Heat Recovery	09-01 Industrial Process Heat and Waste Heat
Montoya Rincon	Juan	107380	Evaluation of Transmission Line Hardening Scenarios Using a Machine Learning Approach	01-01 A Just Transition to a Sustainable Future
Muller	Matthew	117413	HelioCon: Evaluation of Composite Materials for Heliostat Cost Reduction	05-11 Heliostat Consortium 1
Municchi	Federico	111527	Particle Dispersion and Heat Transfer in Fluidized Bed Heat Exchangers From Eulerian-Lagrangian Simulations	05-08 Particles for Thermal Storage in CSP 1
Mwesigye	Aggrey	107001	Thermodynamic Performance Investigation of Environmentally Friendly Working Fluids in a Geothermal Integrated Pumped Thermal Energy Storage System	03-03 Pumped Thermal Energy Storage

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Neises	Ty	110363	Supercritical CO_2 Recompression Cycle Design Optimization to Maximize MSPT Internal Rate of Return	05-06 Other CSP Technologies
Neises	Ty	116672	Pumped Thermal Energy Storage as Combined Heat and Power	03-03 Pumped Thermal Energy Storage
Nicodemus	Julia	107270	Effects of an Annular Baffle on Heat Transfer to an Immersed Coil Heat Exchanger in Thermally Stratified Tanks of a Cylindrical Baffle	02-02 Fluid Mechanics and Heat Transfer in Building Applications
Nwaigwe	Kevin	108154	Energy and Exergy Analysis of a Locally Developed 6W VRE Mobile Solar Charger	07-01 Photovoltaic & Electrochemical Technologies
O'Brien	Paul	108512	Optical Cavities for Thermophotovoltaic Systems Powered by Multiple Heat Sources	08-01 Thermal Energy Conversion Techniques
Odeku	Kola	117994	An Exploratory Analysis of the Legal Implication of “A Just Energy Transition”	01-01 A Just Transition to a Sustainable Future
Ortiz-Ulloa	Juve	114799	Design, Construction and Testing of a Combined Moving-Fluidized Bed Oxidation Reactor for High Temperature Discharge of Solid-State Thermochemical Energy Storage Particles	05-01 Thermochemical Energy Storage for CSP Applications
Ouro-Koura	Habilou	106769	Modeling and Optimization of a PCM-Based Ocean Thermal Energy Harvester for Powering Unmanned Underwater Vehicles	08-01 Thermal Energy Conversion Techniques
Ozsoy	Canan M.	106943	A Transdisciplinary Approach and Design-Thinking Methodology for Energy Transition	04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)
Pahinkar	Darshan	105306	Energy Storage Using a High-Performance Adsorption System Storage	03-02 Phase Change Thermal Storage
Parisi	Simone	106297	Thermo-Economic Assessment of Pumped Thermal Electricity Storage Systems Employing Reversible Turbomachinery	03-03 Pumped Thermal Energy Storage
Parisi	Simone	107521	Analysis of Renewable Energy Integrated Pumped Thermal Energy Storage Systems	03-03 Pumped Thermal Energy Storage
Patankar	Aniket	107385	Implementation of Thermochemical Oxygen Pumping for Improved Efficiency and Throughput of Solar Thermochemical Hydrogen Production	06-03 Novel Reactors and Processes
Pınar Mengüç	Mehmet	107024	Airflow Characteristics and Thermal Comfort of Air Diffusers	02-02 Fluid Mechanics and Heat Transfer in Building Applications
Platt	Ben	114938	Comparison Between Organic Rankine Vapor Compression Configurations With Variable Operating Conditions	09-01 Industrial Process Heat and Waste Heat
Putman	Colby	109071	Building Inclusive and Just Pathways to a Clean Energy Economy Through Youth Education of Clean Energy	01-01 A Just Transition to a Sustainable Future
Pye	John	116871	Green Heat for Industry: Least-Cost Off-Grid Energy Collection and Storage Options for Multiple Australian Locations	09-01 Industrial Process Heat and Waste Heat

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Rajagukguk	Rial Arifin	114754	Minute-Level Solar Irradiance Estimation via the Sun-Blocking Index Derived From Sky Images	08-01 Thermal Energy Conversion Techniques
Ramsey	Owen	114044	Startup of a Combined Moving-Fluidized Bed Oxidation Reactor for High Temperature Discharge of Solid-State Thermochemical Energy Storage Particles	05-01 Thermochemical Energy Storage for CSP Applications
Rincon Duarte	Juan Pablo	117923	Solar Hydrogen Production With a Membrane Reactor: Process Description and Reactor Design	06-03 Novel Reactors and Processes
Rob	S.M. Abdur	116952	Modelling and Experimental Performance Analysis of R410a Heat Pump Systems in Northeastern U.S. Winter Climates	02-01 Heat Pump and Building Waste Heat Utilization
Schäppi	Remo	117630	Dynamic Model of a Solar Fuel System for the Thermochemical Production of Syngas From H_2O and CO_2	06-01 Thermochemical Redox Cycles: Demonstration and Operation
Schimmels	Philipp	114787	Enhancing the Chemical Energy Flux in a Tubular Counterflow Solid Fuel Synthesis Reactor Using Novel Approaches	03-01 Thermochemical Energy Storage
Schroeder	Nathan	116503	Falling Particle Receiver Mass Flow Rate Discretization for Homogenous Particle Heating and Increased Efficiency	05-09 Particles for Thermal Storage in CSP 2
Shafiee	Shahin	105632	Enhancing Thermal Resistance of Building Walls by Utilizing Fluid Flow in Microchannel Within the Wall	02-02 Fluid Mechanics and Heat Transfer in Building Applications
Sharma	Amrita	108169	Expediting Heat Transfer in PCM Solidification With Optimized Fin Configuration	03-02 Phase Change Thermal Storage
Siefering	Bryan J.	115268	Development and Shakedown Testing of 1 Kwth Particle-to-SCO_2 Heat Exchanger for Thermochemical Energy Storage Recovery	05-01 Thermochemical Energy Storage for CSP Applications
Silcox	Rachel	114717	Evaluation of a Ph-Shifting Electrochemical Device for Oceanic CO_2 Capture and Grid-Scale Load Shifting	11-01 Carbon Capture and Sequestration
Siobal	John Patrick	108234	Automatic Self-Cleaning System for Window Type Air-Conditioning Unit Using Vacuum Pump	02-02 Fluid Mechanics and Heat Transfer in Building Applications
Sment	Jeremy	107501	Status Quo of Heliostat Field Deployment Processes	05-13 Heliostat Consortium 3
Soleimani	Shima	107445	An Optimization Study of CO_2 Heat Pump Water Heaters Using NSGA-II	02-01 Heat Pump and Building Waste Heat Utilization
Spieles	Aaron	116992	Investigation of Best-Practices and Computationally Inexpensive Radiative Exchange Models for Discrete Element Method Modeling of Aluminosilicate Particles in Concentrating Solar Power Environments	05-10 Particles for Thermal Storage in CSP 3

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Stanislawski	Brooke	112266	Assessing the Optical Performance Impact of Tracking Error in an Operational Concentrating Solar Power Plant Using Monte Carlo Ray-Tracing Simulation	05-05 Solar Receiver Design 3
Sultan	Cornel	106960	Power Generation Maximization Control Framework for Ocean Current Turbine Farms	08-02 Alternative Energy Conversion Techniques
Tarka	Thomas	105585	Process-Based Cost Estimation Framework for Assessing Economic Viability of Environmentally and Socially Sustainable Rare Earth Element Feedstocks	04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)
Taylor	Calla	117086	Enhancing the University of North Florida's Thermo-Fluids Curriculum: The Integration of Clean Energy Technologies	14-01 Conference Poster Presentation
Trujillo	Corey	110650	Concentrated Solar Power as an Energy Source for the Ignition of Self-Sustained Smoldering Remediation of Petroleum-Contaminated Soils	05-06 Other CSP Technologies
Truong Le Tri	Dat	107152	Modeling and Analysis of Hydrogen Supply System With Dual Ejector Concept for Vehicular Proton Exchange Membrane Fuel Cell	08-02 Alternative Energy Conversion Techniques
Tsvankin	Daniel	117425	Progress Update on the Development of an Internationally-Recognized Heliostat Design Qualification Standard	05-07 CSP System Analysis, Controls, and Standards
Turnaoglu	Tugba	106796	Phase Change Material for Thermal Energy Storage in Buildings Based on Sodium Sulfate Decahydrate and Disodium Hydrogen Phosphate Dodecahydrate	03-02 Phase Change Thermal Storage
Umer	Muhammad	114612	Modeling Radiative Heat Transfer in Dispersed Particle Flow System Using a Stochastic Approach	05-08 Particles for Thermal Storage in CSP 1
Upadhya	Sahana	112419	Predicting the State of Charge of a Battery at Rest Using the Open Circuit Voltage	07-01 Photovoltaic & Electrochemical Technologies
Vega Puga	Estefania	107871	Modelling Development of a Receiver-Reactor of Type R2Mx for Thermochemical Water Splitting	06-03 Novel Reactors and Processes
Ward	Yakera	107400	Energy in Action: An Energy Education Outreach Program for High Schools in Disadvantaged Communities of Alabama	14-01 Conference Poster Presentation
Wasti	Amogh	116809	Performance of a Solid-State Thermoelectric Thermoregulation System Under Different Climate Zones in the US.	02-05 Innovations for Sustainably Built Environments
Wasti	Amogh	116870	Steady State Analytical Modeling of a Thermal Panel of a Climate Adaptive Building Envelope for Energy Efficient Buildings	02-04 Building Envelope, Building Energy, and Data Centers
Wemhoff	Aaron	106820	The Difference in Blue Water Usage of Meals Prepared at Home Versus Meals Prepared Away From Home	04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)

Presenting Author Index

LAST NAME	FIRST NAME	SUBMISSION CODE	SUBMISSION NAME	TRACK/SESSION
Wemhoff	Aaron	107496	Data Center Environmental Burden Reduction Through On-Site Renewable Power Generation	02-04 Building Envelope, Building Energy, and Data Centers
Williams	Amanda	106938	Hydrogel-Coated Mesh for High-Efficiency, Ultra-Fast Oil-Water Separation	04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)
Xu	Ben	106936	Numerical Study of Solar Receiver Tube With Modified Surface Roughness for Enhanced and Selective Absorptivity in Concentrated Solar Power Tower	05-04 Solar Receiver Design 2
Yaici	Wahiba	106980	Investigation of the Effects of Hydrogen-Enriched Natural Gas Blends and Pure Hydrogen on the Performance of a Domestic Condensing Boiler	10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels
Yu	Byeongho	107117	Electrification and Decarbonization Using Heat Recovery Heat Pump Technology for Building Space and Water Heating	02-01 Heat Pump and Building Waste Heat Utilization
Zhang	Jian	107282	Multi-Objective Optimization of Distributed Energy Systems Considering Time-of-Use Pricing Impacts	02-03 Building Management and Control
Zhou	Lyu	115239	Nanoconfined Polyethylene Glycol With Expanded Graphite for Energy-Efficient Thermal Energy Storage	03-04 Sensible Energy Storage
Zhu	Guangdong	117125	An Overview on HelioCon: An International Heliostat Consortium to Advance Concentrating Solar-Thermal Technologies	05-11 Heliostat Consortium 1
Zhu	Guangdong	117150	Status Update on Metrology and Standard in the Heliostat Consortium (HelioCon)	05-11 Heliostat Consortium 1
Zhu	Pengxi	114726	Natural Gas to Chemical Intermediate by Highly Efficient Carbon-Neutral Route	11-01 Carbon Capture and Sequestration
Zhu	Pengxi	115079	Natural Gas to Aromatics by Single-Step Synthesis Using Ternary Catalyst and Proton-Conducting Fuel Cell	14-01 Conference Poster Presentation
Zolan	Alexander	117421	A Performance Forecasting Framework for Concentrated Solar Power Tower Systems	05-12 Heliostat Consortium 2

Track Organizers

TRACK	TRACK CHAIR	TRACK CO-CHAIR(S)
Track 1: A Just Transition to a Sustainable Future (Conference Theme)	Hamidreza Najafi, Florida Institute of Technology	Julia Nicodemus, Lafayette College
Track 2: Sustainable Buildings and Communities	Jian Zhang , University of Wisconsin-Green Bay	Shuang Cui, Shuang., The University of Texas at Dallas
Track 3: Energy Storage: Thermal, Mechanical, Thermochemical	Like Li, Mississippi State University	Nicholas AuYeung, Oregon State University
Track 4- Research for Clean Energy Transition (Socio-Technical, Education and Policy)	Rebecca Mitchell, National Renewable Energy Laboratory	
Track 5: Concentrating Solar Power	Jeremy Sment, Sandia National Laboratories	Alexander Zolan, National Renewable Energy Laboratory
Track 6: Solar Chemistry	Johannes Grobbel, German Aerospace Center	Shang Zhai, The Ohio State University
Track 7: Photovoltaic & Electrochemical Technologies	Wilson Chiu, University of Connecticut	
Track 8: Alternative Energy Conversion Tech (incl Wind, Geothermal, Hydro, Ocean)	Sidong Lei, Georgia State University	Aggrey Mwesigye, University of Calgary
Track 9: Solar Desalination, Industrial Process Heat, and Waste Heat Recovery	Sarvenaz Sobhansarbandi, University of Missouri-Kansas City	
Track 10: Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels	Wahiba Yaïci, CanmetENERGY Research Centre, Canada	Xinhai Xu, Harbin Institute of Technology
Track 11: Carbon Capture & Cleaner Fossil Fuel Technologies	Hanping Ding, The University of Oklahoma	Darshan Pahinkar, Florida Institute of Technology
Track 12: Sustainable Manufacturing Processes for Low Carbon Emissions	Zhaohui Geng, The University of Texas Rio Grande Valley	Shivakumar Raman, The University of Oklahoma
Track 13: Lightning Talks	Rohini Bala Chandran, University of Michigan	
Track 14: Poster Presentations	Hamidreza Najafi, Florida Institute of Technology	

Session Organizers

SESSION	TRACK/SESSION PRIMARY CHAIR
01-01 A Just Transition to a Sustainable Future	Hamidreza Najafi, Florida Institute of Technology
02-01 Heat Pump and Building Waste Heat Utilization	Monem Beitelmal, Qatar Environment and Energy Research Institute
02-02 Fluid Mechanics and Heat Transfer in Building Applications	Shuang Cui, The University of Texas at Dallas
02-03 Building Management and Control	Jian Zhang, University of Wisconsin-Green Bay
02-04 Building Envelope, Building Energy, and Data Centers	Jorge Gonzalez-Cruz, University at Albany
02-05 Innovations for Sustainably Built Environments	Krisha Maharjan, Mississippi State University
03-01 Thermochemical Energy Storage	Like Li, Mississippi State University
03-02 Phase Change Thermal Storage	Bingjia Li, University of Michigan
03-03 Pumped Energy Thermal Storage	Bryan Kinzer, University of Michigan
03-04 Sensible Energy Storage	Zijie Chen, University of Michigan-Ann Arbor
04-01 Research for Clean Energy Transition (Socio-Technical, Education and Policy)	Rebecca Mitchell, National Renewable Energy Laboratory
05-01 Thermochemical Energy Storage for CSP Applications	Gregory Jackson, Colorado School of Mines
05-02 Metrology in CSP	Randy Brost, Sandia National Laboratories
05-03 Solar Receiver Design 1	William Hamilton, National Renewable Energy Laboratory
05-04 Solar Receiver Design 2	Brantley Mills, Sandia National Laboratories
05-05 Solar Receiver Design 3	Krutika Appaswamy, Purdue University
05-06 Other CSP Technologies	John Pye, Australian National University
05-07 CSP System Analysis, Controls, and Standards	Alexander Zolan, National Renewable Energy Laboratory
05-08 Particles for Thermal Storage in CSP 1	Jeremy N. Sment, Sandia National Laboratories
05-09 Particles for Thermal Storage in CSP 2	Zhiwen Ma, National Renewable Energy Laboratory
05-10 Particles for Thermal Storage in CSP 3	Nathan Schroeder, Sandia National Laboratories
05-11 Heliostat Consortium 1	Mark Mehos, National Renewable Energy Laboratory
05-12 Heliostat Consortium 2	Guangdong Zhu, National Renewable Energy Laboratory
05-13 Heliostat Consortium 3	Margaret Gordon, Sandia National Laboratories
06-01 Thermochemical Redox Cycles: Demonstration and Operation	Sha Li, École Polytechnique Fédérale de Lausanne
06-02 Materials and Fundamentals	Shang Zhai, Stanford University
06-03 Novel Reactors and Processes	Johannes Grobbel, German Aerospace Center
07-01 Photovoltaic & Electrochemical Technologies	Wilson K. S. Chiu, University of Connecticut
08-01 Thermal Energy Conversion Techniques	Sidong Lei, Georgia State University
08-02 Alternative Energy Conversion Techniques	Aggrey Mwesigye, University of Calgary
09-01 Industrial Process Heat and Waste Heat	Sarvenaz Sobhansarbandi, University of Missouri-Kansas City
09-02 Solar Desalination	Sarvenaz Sobhansarbandi, University of Missouri-Kansas City
10-01 Hydrogen Energy, Alternative Fuels, Bioenergy, and Biofuels	Wahiba Yaici, Natural Resources Canada/CanmetENERGY Research Centre
11-01 Carbon Capture and Sequestration	Darshan Pahinkar, Florida Institute of Technology
14-01 Conference Poster Presentation	Hamidreza Najafi, Florida Institute of Technology Rydge Mulford, University of Dayton

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Hamidreza Najafi, Ph.D.
Florida Institute of Technology
Melbourne, FL

Biography: Dr. Hamidreza Najafi is an Associate Professor of Mechanical Engineering and the Director of the Innovations in Sustainable Energy and Thermal Systems (ISETS) lab at the Florida Institute of Technology. Dr. Najafi research and teaching have been focused on designing and optimization of thermal/energy systems, energy efficiency, renewable energy, and computational heat transfer. He has served as PI/CO-PI on multiple projects funded by the Florida Department of Agriculture and Consumer Services (FDACS), National Aeronautics and Space Administration (NASA), American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and several private industries. Dr. Najafi is the author/co-author of more than 50 peer-reviewed journal and conference publications, the co-author of one book (Wiley, 2023) and one book chapter (Springer, 2021). He is serving as the Chair of the ASME Renewable Energy and Energy Conversion (REEC) Technical Committee, Guest Editor of the ASME Journal of Energy Resources Technology, and a member of the ASME Computational Heat Transfer Committee (K20). Dr. Najafi also serves as the Florida Tech ASHRAE Students Branch Advisor, and Vice Chair of the ASHRAE Extraterrestrial and Deep Space Environmental Control Systems Task Group (ASHRAE TG 9. SPACE).

Julia Nicodemus, Ph.D.
Lafayette College
Easton, PA

Biography: Julia Nicodemus is an Associate Professor of Engineering Studies at Lafayette College. She holds degrees from Grinnell College (BA in Physics), Brooklyn College (M.S. in Math Education), and the University of Minnesota (M.S. and PhD in Mechanical Engineering and M.S. in Science, Technology, and Environmental Policy). Her scholarly interests include techno-economic and policy analyses of sustainable fuels and the use of baffles, manifolds and other passive means to control flow and temperature fields and enhance heat transfer to immersed heat exchangers in solar thermal storage tanks. Working in an undergraduate institution, she invites undergraduates into her research program and involves them deeply in her work. She teaches interdisciplinary classes in engineering and public policy, energy technologies, and sustainability to engineering and non-engineering undergraduate students. At Lafayette, she was awarded the John T. McCartney Excellence in Diversity Education Award in 2015 and the B. Vincent Viscomi Engineering Prize for Excellence in Mentoring and Teaching in 2021.

TECHNICAL PROGRAM CHAIRS

Luke J. Venstrom, Ph.D
Valparaiso University
Valparaiso, IN

Biography: Dr. Luke Venstrom is an Associate Professor of Mechanical Engineering and the Paul H. Brandt Professor of Engineering at Valparaiso University where he co-directs the James S. Markiwiecz Solar Energy Research Facility, home to the only solar furnace at a primarily undergraduate engineering college. He is a graduate of Valparaiso University (B.S.) and the University of Minnesota—Twin Cities (M.S., Ph.D.). His research broadly encompasses the thermal fluid sciences, with a focus on renewable energy systems and, in particular, high-temperature solar thermal and electrothermal chemistry. He was the 2019-2020 Valparaiso University Research Professor and the 2021 recipient of the Award for Excellence in Research and Creative Work for his integration of undergraduate students into cutting-edge, high-temperature concentrated solar energy research.

Ben Xu, Ph.D.
University of Houston
Houston, TX

Biography: Dr. Ben Xu is currently Assistant Professor, Presidential Frontier Faculty Fellow in the Department of Mechanical Engineering at University of Houston (UH). His research interests focus on multiphase flow and heat transfer in advanced energy systems, high temperature solar thermal storage, additive manufacturing of Nickel-based super alloys, and laser-assisted 3D bioprinting. Prior to joining UH, Dr. Xu worked as Assistant Professor of Mechanical Engineering in Mississippi State University (MSU) and University of Texas Rio Grande Valley (UTRGV), Postdoctoral Research Fellow at Drexel University. Dr. Xu has been PI, Co-PI and senior personnel at UH, MSU and UTRGV on multiple funded projects from US Department of Energy, Department of Agriculture, and National Science Foundation. He has more than 50 scholarly publications in the field of renewable energy systems and advanced manufacturing. Currently, he is serving as the guest editor of Journal of Thermal Science and ASME Journal of Energy Resources Technology.

Acknowledgments

TECHNICAL PROGRAM CO-CHAIRS

Rohini Bala Chandran, Ph.D.
University of Michigan
Ann Arbor, MI

Biography: Rohini Bala Chandran is an Assistant Professor in Mechanical Engineering at the University of Michigan since January 2018. Previously, she was a postdoctoral research fellow at Lawrence Berkeley National Lab and obtained an M.S. (2010) and Ph.D. (2015) from the University of Minnesota, Twin Cities, in Mechanical Engineering. At Michigan, Prof. Bala Chandran leads the Transport and Reaction Engineering for Sustainable Energy Lab (TREE Lab) to pursue multidisciplinary research in the areas of thermal and fluid sciences, multiscale computational modeling, electrochemical engineering, and semiconductor physics. Dr. Bala Chandran is a recipient of the NSF-CAREER award (2022), Doctoral New Investigator awardee from the American Chemical Society Petroleum Research Fund (2021), and one of 100 selected attendees at the US Frontiers of Engineering meeting organized by the National Academy of Engineering (2020). Research in her group is additionally also funded by the US Advanced Research Projects Agency – Energy (ARPA-E), and the US Department of Energy Fuel Cell Technologies Office (DOE-FCTO).

Pei-Dong, Ph.D.
George Mason University
Fairfax, VA

Biography: Pei Dong is an Assistant Professor in the Department of Mechanical Engineering at George Mason University. She obtained her B.S. in Microelectronics from Nankai University and her Ph.D. in Mechanical Engineering from Rice University. She then did her postdoctoral research in the Department of Materials Science and NanoEngineering at Rice University before joining George Mason University. She was the recipient of the Franz and Frances Brotzen Fellowship Award. Her current research interests include advanced materials design, and their applications in energy, water, and biomedical areas.

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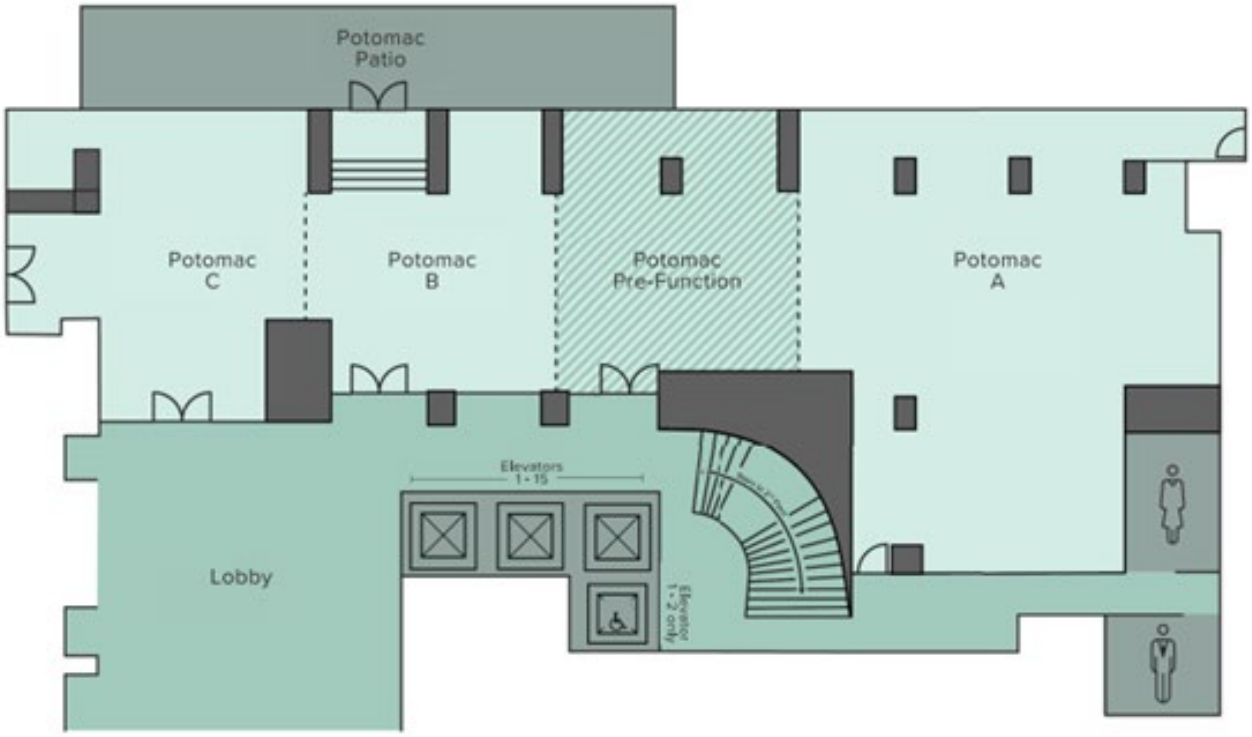
Hotel Floor Plan



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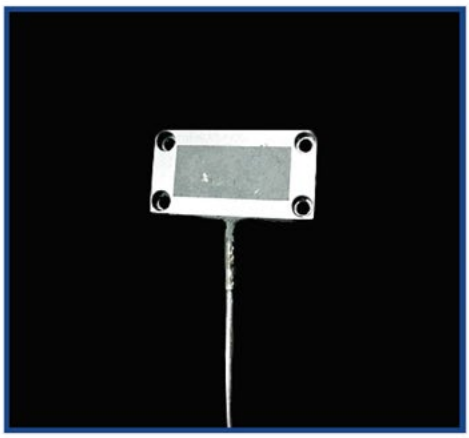

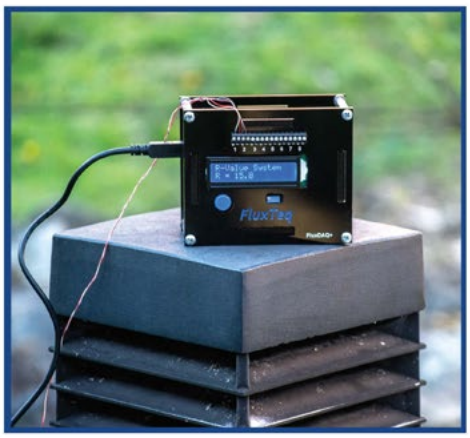

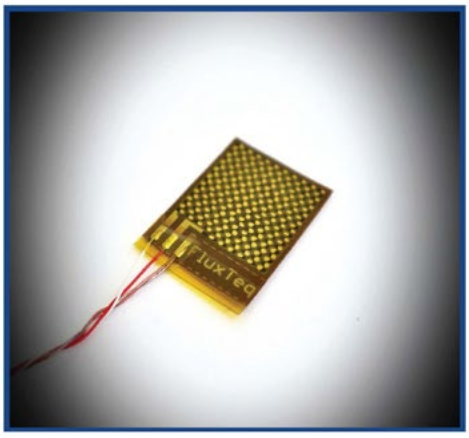

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