2024 8th International Conference on Sustainable Energy Engineering

(ICSEE 2024)

2024 6th International Conference on Energy Management and Applications Technologies

(ICEMAT 2024)

Brisbane, Australia | February 2-4, 2024

Co-sponsored by

UNIVERSITY of TASMANIA

CQUniversity AUSTRALIA

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Pusan National University

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The University of Melbourne

Shanghai University of Engineering Science

Venue: Rydges Fortitude Valley Brisbane

Add.: 601 Gregory Terrace, Bowen Hills QLD 4006, Brisbane, Australia

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WELCOME MESSAGE

Dear all, we are delighted to welcome you to these conferences 2024 8th International Conference on Sustainable Energy Engineering (ICSEE 2024), along with the workshop 2024 6th International Conference on Energy Management and Applications Technologies (ICEMAT 2024) to be held in Brisbane, Australia during February 2-4, 2024, which are co-sponsored by University of Tasmania, Australia and Central Queensland University, Australia.

The objective of the conference is to provide a premium platform to bring together researchers, scientists, engineers, academics and graduate students to share up-to-date research results. We are confident that during this time you will get the theoretical grounding, practical knowledge, and personal contacts that will help you build a long term, profitable and sustainable communication among researchers and practitioners in the related scientific areas.

This year's program is composed of the keynote speeches delivered respectively by Prof. Xiaolin Wang (University of Tasmania, Australia), Prof. Mohammad Rasul (Central Queensland University, Australia), Prof. Firoz Alam (RMIT university, Australia), Assoc. Prof. Wenming Yang (National University of Singapore, Singapore), and 2 technical parallel sessions. We would like to express our gratitude to all the speakers in these conferences. Special thanks to all of our committee members, all the reviewers, the attendees for your active participation. We hope the conferences will be proved to be intellectually stimulating to us all. Finally, we wish you very successful conferences!

Conference Organizing Committee

ICSEE 2024
Ms. Veronica Reed
Email: icsee_conf@163.com

ICEMAT 2024
Ms. Teri Zhang
Email: icemat_conf@126.com

CONFERENCE COMMITTEE *(in no particular order)*

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Conference Chair
Xiaolin Wang, University of Tasmania, Australia

Conference Organizing Chair
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Wenbin Yu, Shandong University, China
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Mohamad Fani Sulaima, Universiti Teknikal Malaysia Melaka, Malaysia
Chong Wen Tong, University Malaya, Malaysia
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Nallusamy Nallusamy, SSN College of Engineering, India
Ahmed Kadhim Hussein, University of Babylon, Iraq
Iessa Sabbe Moosa, University of Buraimi, Oman
Ghassan Fadil Lattif Al-Doori, International College Engineering and Management, Oman

GENERAL INFORMATION

A Conference Venue

Hotel: Rydges Fortitude Valley Brisbane

Add.: 601 Gregory Terrace, Bowen Hills QLD 4006, Brisbane, Australia

Email: Functions_RydgesFortitudeValley@evt.com

Tel.: +61 7 3188 3000 | Direct: +61 7 3188 3041

B On-site Registration

Registration desk→ Inform the staff of your paper ID→ Sign-in→ Claim your conference kits.

C Devices Provided by the Organizer

Laptops (with MS-Office & Adobe Reader) / Projectors & Screen / Laser Sticks

D Materials Provided by the Presenter

Oral Session: Slides (pptx or pdf version). Format 16:9 is preferred.

Presentation Language: English only.

E Duration of Each Presentation

Keynote Speech: 40min, including 5 min Q&A. Oral Session: 15min, including 3 min Q&A.

F Notice

※ Please wear your delegate badge (name tag) for all the conference activities. Lending your badge to others is not allowed.

※ Please take good care of your valuables at any time during the conferences. The conference organizer does not assume any responsibility for the loss of personal belongings of the participants during conference day.

G Zoom Meeting

zoom	Room	Meeting ID	Link
✓ Zoom Download ✓ Zoom Background	A	815 1624 6331	https://us02web.zoom.us/j/81516246331

Note:

1. We recommend to install the Zoom platform beforehand. New users can login the Zoom meeting **without registration**.
2. Please set your display name before joining the online meeting. For instance,

   Author/Presenter: Paper ID_Name < SE001_Veronica Reed >

   Listener: Listener_Name < Listener_Veronica Reed >

AGENDA OVERVIEW

FRIDAY, FEBRUARY 2, 2024 (UTC+10)	
14:00~17:00	On-site Registration (Pre-event Area <Level Ground>)
14:00~15:00	Zoom Test Session **SE012, SE015, SE022, SE029-A, SE033, SE039, SE031** (Room A: 815 1624 6331, Link: https://us02web.zoom.us/j/81516246331)
15:00~15:30	For other online participants, includes but not limited to keynote speakers, session chairs, committee members, listeners, etc.

Presenters are required to join the rehearsal in Zoom on Friday, February 2. Duration: 2~3min apiece. Feel free to leave after you finish the test.

AGENDA OVERVIEW

SATURDAY, FEBRUARY 3, 2024 (UTC+10)

Event Space 1 <Level Ground>

08:30~08:50 On-site Registration *For offline participant who is not able to sign in on the first day.*

Event Space 1 <Level Ground> | Room A: 815 1624 6331

Chairperson: **Prof. Yinghui Tian,** Program Co-Chair (University of Melbourne, Australia)

09:00~09:10 Opening Speech
Prof. Xiaolin Wang, Conference Chair (University of Tasmania, Australia)

09:10~09:50 Keynote Speech I
"Navigating Challenges and Opportunities for Hydrogen as Sustainable Energy Future"
Prof. Mohammad Rasul (Central Queensland University, Australia)

09:50~10:30 Keynote Speech II
"High Performance Textile Aerodynamics in Elite Sports"
Prof. Firoz Alam (RMIT University, Australia)

10:30~11:00 Group Photo / Coffee Break (Level Ground)

11:00~11:40 Keynote Speech III
"Some Recent Development of Compressed Air Energy Storage Technologies"
Prof. Xiaolin Wang (University of Tasmania, Australia)

11:40~12:20 Keynote Speech IV
"Investigation on the Major Factors Affecting the Performance of Biomass Boiler"
Assoc. Prof. Wenming Yang (National University of Singapore, Singapore)

12:20~13:30 Lunch Time (Six Acres Restaurant <Level Lower Ground>)

Event Space 1 <Level Ground> | Room A: 815 1624 6331

13:30~16:00 **Technical Session 1:** Renewable Energy and Energy Conservation
SE015 SE033 SE022 SE031 SE016 SE010 SE029-A SE014 SE910 SE012

16:00~16:15 Coffee Break (Level Ground)

16:15~18:45 **Technical Session 2:** Thermal Engineering and Energy Chemistry
SE024 SE021 SE034-A SE905-A SE002 SE907-A SE013 SE023 SE027-A SE039

18:45~21:00 Dinner Time (Six Acres Restaurant <Level Lower Ground>)

SUNDAY, FEBRUARY 4, 2024 (UTC+10)

08:15~19:00 One-day Tour in Brisbane

INTRODUCTION OF KEYNOTE SPEAKER

Prof. Mohammad Rasul

Central Queensland University, Australia

Navigating Challenges and Opportunities for Hydrogen as Sustainable Energy Future

Abstract: The escalating hydrogen demand, expected to surge eightfold by 2050 compared to 2020, poses multifaceted challenges for its energy sector deployment. Hydrogen's exceptional calorific value, ranking second at 120-142 MJ/kg, positions it as the prime energy-to-weight ratio among conventional fuels. Green hydrogen production, with readiness levels around 7-8 and commercial readiness indices of about 4-5, commands a significant 30% market share with 55-80% efficiency and production costs of $4-7/kg H2. While costs are projected to reach $1-2/kg H2 in the future, integrating various production processes is crucial, transcending mass-scale production. Metal hydride emerges as an economical hydrogen storage solution at $125/m3, while ammonia leads with a low specific energy cost of $13/GJ. Streamlined infrastructure development is imperative for efficient storage, transportation, and delivery. This exhaustive review encompasses hydrogen production, storage, costs, and applications, offering insightful analysis and guidance on hydrogen's energy carrier challenges. Achieving sustainable development goals by 2050 necessitates integrated planning, infrastructure, cost reduction, net-zero emissions, and innovative storage. Policymakers, researchers, and scientists can utilize this review as a blueprint to shape hydrogen's future role in energy.

Biography: MOHAMMAD RASUL obtained his PhD in Clean Energy from The University of Queensland (Australia). Currently, he is a Professor of Mechanical Engineering at the School of Engineering and Technology, Central Queensland University (CQUniversity). He is the recipient of Vice-Chancellor’s awards for outstanding researchers in excellence in research category, VC’s awards for research higher degree supervision, good practice in learning and teaching, and several students’ voice awards. He has published over 500 research articles/papers in journals, refereed conferences, books, and book chapters. His notable edited book is on “Clean Energy for Sustainable Development: Comparisons and Contrast of New Approaches”, published by Elsevier. He is the recipient of 10th anniversary best paper award for highest citation in Energies journal. Professor Rasul is listed within the top 1% researchers in the world as per 2020 survey by Stanford University (USA). His publications have created strong impact to the scientific and professional communities and attracted over 17,000 citations with h-index of 64 as of 6 January 2024.

He has supervised 33 Higher Degree by Research (HDR) students to completion and currently supervising 9. His grant funding has totaled over $6 million. He is the founder of Clean Energy Academy of CQUniversity and leader of Fuel and Energy Research Group at CQUniversity. He is recognised, both nationally and internationally, through his varied roles and activities, for example, he is an editor of the Australian Journal of Mechanical Engineering (Taylor and Francis), section editor of Encyclopedia of Renewable Energy, Sustainability and The Environment (Elsevier), editorial board member of 5 journals, technical and scientific committee member of about 14 conferences, and grant assessor for different countries (Australia, Qatar and Singapore). He frequently creates attention of media and community engagement through expert opinion and interview by different media, such as ABC 7 TV, ABC 7 News, ABC Tropical North, ABC Capricornia FM, Morning Bulletin and News Mail.

INTRODUCTION OF KEYNOTE SPEAKER

Prof. Firoz Alam

RMIT university, Australia

High Performance Textile Aerodynamics in Elite Sports

Abstract: The application of science and technology can improve sports performance. Particularly in high-speed sports like ski jumping, cycling, skiing, bobsledding, sprinting, speed skating, and swimming, aerodynamics is seen as a decisive element in winning margins and elite sporting competitions. Wearing sports apparel has advantages over traditional clothing for athletes. As a result, aerodynamic performance in sportswear is increasingly being considered while designing sportswear. Evaluating the aerodynamic performance of sports textiles is essential to producing aerodynamically successful sports gear for faster-paced activities. The main goal of this article is to highlight some aero/hydrodynamic research done at RMIT University on high-performance textiles used in speed sports and the ramifications of the research findings for competitive sports and other domains.

Biography: Dr. Firoz Alam is a Professor in the School of Engineering (Aerospace, Mechanical and Manufacturing) at RMIT University in Melbourne, Australia. He completed his PhD in vehicle aerodynamics from the same university in 2000. He received his Master's degree (combined with Bachelors) in Aeronautical Engineering with Honours (First Class First) from Riga Civil Aviation Engineers Institute, former Soviet Republic of Latvia in 1991. Prof Alam's research interest includes aerodynamics and hydrodynamics (aircraft, road vehicles, trains, buildings and structures), energy, engineering education (curriculum design, quality assurance and accreditation). He has over 250 publications (including scholarly books, book chapters, journal articles and peer reviewed conference papers). He is currently serving as editor in chief and editorial board member for over half a dozen international scientific journals. Prof Alam is a Fellow of the Institution of Engineers Australia, Chartered Professional Engineer (CPEng), and APEC Engineer. He is an active member of several other professional societies and associations including American Society of Mechanical Engineers (ASME), American Institute of Aeronautics and Astronautics (AIAA), Society of Automotive Engineers USA & Australia, and International Society of Bionic Engineering. Prof Alam is the recipient of RMIT University's best Teacher Award in 2004.

INTRODUCTION OF KEYNOTE SPEAKER

Prof. Xiaolin Wang

University of Tasmania, Australia

Some Recent Development of Compressed Air Energy Storage Technologies

Abstract: This presentation discusses the current development and advances of compressed air energy storage technology. The general concept of compressed air energy storage technology will be first introduced. Then a new concept of combined pump hydro and compressed air energy storage systems was proposed and the performance of the combined system was evaluated under different working conditions. The effect of the key parameters such as storage pressure, initial pressure, and compression process on the system performance was further studied and reported. Furthermore, the heat and mass transfer in the compression air storage vessel was analysed, and its impact on the compression process and system performance was investigated. Finally, the latest research on wave-driven compressed air energy storage was briefly presented. This lecture highlights the potential and design consideration of the compressed air energy storage system in real applications.

Biography: Professor Wang enjoys his strong research in Cooling and Power Engineering, Energy Storage and Conversion, Desalination and Utilization of Renewable Energy. He was named as National Field Leader in Thermal Science by the Australian Research Magazine in 2018. He is a Fellow of Engineers Australia. He won the DAAD visiting fellowship by DAAD Germany in 2003 and the Ludwig Mond Prize 2005, from the Institute of Mechanical Engineers (IMechE) of the United Kingdom. He won the Australian China Young Scientist Exchange Program award in 2009 and the Australian Japan Emerging Research Leader Program award in 2016 by the Australia Academy of Technological Sciences and Engineering (ATSE). He received "Dean's Award" for outstanding research performance in 2016 and "College Award-Research Excellence" in 2023. He is the Subject Editor of Applied Thermal Engineering, Associate Editor of IMechE Part E: Journal of Process Engineering, Scientific Reports and Frontiers in Built Environment, Topic Editor of Applied Sciences, Energies, sustainability and Thermos, and Editorial board member for five other international journals. He has completed many national/international research projects with a total value of more than $7 million. He has published more than 260 international journal and conference papers with an H-index of 47 in Google Scholar and 40 in Scopus/Web of Sciences.

INTRODUCTION OF KEYNOTE SPEAKER

Assoc. Prof. Wenming Yang

National University of Singapore, Singapore

Investigation on the Major Factors Affecting the Performance of Biomass Boiler

Abstract: With the increased concern on greenhouse gas emissions and global warming, various alternative fuels are attracting the attentions of worldwide researchers to replace the fossil fuel. Of which biomass is one of the most promising candidates due to its intrinsic properties: renewable, carbon neutral, vast available. In this work, by combining numerical modelling and experimental test, the impact of various factors such as ash content, moisture level, excess air coefficients, addition of methane and oxygen enrichment etc on the combustion process and emissions formation will be presented, and the optimal operating conditions with high efficiency and low emission will be disclosed.

Biography: After obtaining his Ph.D degree in 2000, Wenming Yang has been employed as a research fellow in the Department of Mechanical Engineering, National University of Singapore, followed by a teaching instructor and assistant professor in 2006 and 2011, respectively. Since 2017, He has been employed as an associate professor in National University of Singapore. His research interests include: Internal combustion engine fueled by biofuels and blend fuels, development of advanced platform for boilers with high efficiency and low emissions, incinerators and micro power generators etc. He is now looking for Ph.D. candidates with interests in IC engines, waste to energy (WTE) incineration power plant, biomass boilers and CFB boilers.

TECHNICAL SESSION 1

SATURDAY, FEBRUARY 3, 2024 <13:30~16:00>
Technical Session 1: Renewable Energy and Energy Conservation
Chairperson:Prof. Rabee Reffat, University of Nottingham Ningbo China, China

Event Space 1
<Level Ground>
Room A: 815 1624 6331

13:30-13:45 SE015	Harnessing Solar Energy for Efficient Cooling in Hot Weather Regions: A Comparative Experiment on Solar-Assisted Air Conditioning' s Energy Efficiency **Sayed Mohamad Soleimani**, The Pennsylvania State University, USA Abstract-As countries continue to develop their industries while failing to acknowledge climate change and the intensifying concerns of global warm-ing, energy consumption through fossil fuels will only increase. Hot coun-tries in the Middle East, specifically Kuwait, have seen a trend of increasing overall temperatures for the past decades. The results of this increase have caused a stressful energy consumption from air conditioners (AC) as a need for a comfortable indoor climate. Conventional AC units can be substituted or supported with solar energy as an attempt to decrease energy consump-tion. The research compared conventional and solar assisted air conditioning energy consumption in two identical novel portable cabins while maintain-ing an indoor temperature of 22 Celsius. The results have shown an energy saving of 28% ,31% ,24%, and 18% by an integrated solar PV panels and batteries during the last five days of April and the first three weeks of May, respectively. The investigation provides great insights for manufacturers to consider solar energy as a source of electrical power of AC.
13:45~14:00 SE033	Mk4 Kiln in Brick Manufacturing in Peru: Reduction of Pollutants and Maximum Energy Efficiency for Sustainable Production **Junior Jhordan Cordova Rosales**, Continental University, Peru Abstract-The study of the MK4 kiln reveals notable results, highlighting its efficiency in firing bricks through convection heat exchange, avoiding heat losses in kilns (1) and (2), achieving a final firing temperature of 995.6 ° C in 160 minutes, this system not only accelerates the cooking process, but also contributes significantly to the overall efficiency, benefiting comprehensive operational efficiency not only improves the quality of the final product, but also promotes sustainability and profitability in the manufacture of bricks, indicating a faster and more uniform firing. Likewise, it demonstrates optimal results in its cogeneration system, having an energy efficiency of 80% in 160 minutes of cooking, generating a heat recovery temperature of 799.5 ° C in each oven (3) and (4). In addition, the pollutants (PM2.5 and PM10), through the gravitational force, the particles settle during the cooking process and remain within the environmental quality standards, registering 23 〖μg/m〗^3 and 60 〖μg/m〗^3, respectively. . Finally, the MK4 oven is presented as an effective and sustainable solution, surpassing inefficient and polluting artisanal ovens. marking a milestone in the search for environmental sustainability and efficiency in the brick production industry, allowing an impact on the firing time and, therefore, on the quality of the final product that allows improving the quality of life of the society and environment.

14:00~14:15 SE022	The Role of Integration of Hybrid Microgrids in Decarbonising Copper Deposits Mining in Australia **Hanrong Huang**, The University of New South Wales, Australia Abstract-This research offers an innovative perspective on decarbonising copper deposits mining in Australia through renewable microgrids. The study bridges geological exploration and renewable energy, analysing the distribution, depth, and ore grade of copper deposits and their influence on microgrid design and economics. Simulations using HOMER reveal that hybrid microgrids that have around 80% renewable penetration, harnessing solar, wind, and storage technologies, can significantly lower the Levelised Cost of Electricity (LCOE), reduce emissions, and enhance energy reliability in mining operations. The findings high-light hybrid microgrids with high renewable penetration have significant potential to con-tribute to sustainable mining practices, though economic feasibility varies, influenced by policy, financing, and market factors. The study calls for integrated strategies encompassing policy support, innovative financing, and stakeholder engagement to realise renewable ener-gy's full potential in the mining sector.
14:15~14:30 SE031	Exploring Weather Research and Forecasting (WRF) Model Parameterizations for Enhanced Solar and Wind Energy Resources Predictions in Malawi **Sylvester William Chisale**, Hiroshima University, Japan Abstract-The need to utilize renewable energy to address climate challenges and CO2 emissions, while ensuring improved access to energy, is critical. This research focuses on a sensitivity analysis of the WRF-Solar model, par-ticularly its shortwave (SW) irradiance parameterization, as well as the WRF model, examining microphysics, land surface, planetary boundary layer (PBL), and cumulus schemes for solar and wind energy assessment. The study identifies optimal parameterization schemes for assessing wind and so-lar energy resources using the WRF and WRF-Solar models. After a year of simulations using the optimal design, the average wind speed in the region at 50 meters above sea level is roughly 4.1 m/s, with higher values in some places. In addition, there are notable variations in the global horizontal irra-diance (GHI), with larger values seen across the northern part of the lake and over much of the southern region. Furthermore, the GHI values can reach as high as 8 kWh/m^2/day. Similarly, the lake and Malawi's southern region are shown as having high temperatures. Thus, effectively parameterizing solar and wind energy is crucial for future national energy strategies.

14:30~14:45 SE016	Potentiality of Agricultural Residues from Pruning Fruit Trees for Energy Source in Northern Thailand **Chatchawan Chaichana**, Chiang Mai University, Thailand Abstract-Agricultural biomass is considered an appropriate resource for energy production in any country where the economy is based on agriculture. There-fore, the objective of this research was to investigate the availability and fuel properties of pruning wood from fruit trees as a source of alternative energy production for thermal biomass power plants. The study areas were in four dis-tricts of Lampang Province, Northern Thailand. Two different common fruit va-rieties, such as longan and mango, were selected for data collection. Total planted areas of longan and mango were 8,983 ha (longan 7,321 ha and mango 1,662 ha). A field survey was conducted to display the overall data of the study areas, with total areas of longan 196 ha and mango 44 ha. Pruning wood sam-ples were collected directly after fruit harvesting and the wood samples were then transformed into woodchip. Woodchip samples were taken for property analysis. The results showed that the weight of pruning wood was 36 and 26 kg/tree in longan and mango, respectively. The availability of fresh pruned wood was 20,571 t/y and 12,525 t/y for dried woodchip. The lower heating val-ues of dried woodchip varied from 17.8 MJ/kg in mango to 18.0 MJ/kg. Then, the minimum installed capacity of the thermal biomass power plant was approx-imately 2 MW. The levelized cost of energy (LCOE) for a biomass thermal power plant based on 100% dried woodchip from longan and mango fruit trees was 0.071 USD/kWh.
14:45~15:00 SE010	Interdependency of Passive Design Strategies for Ener-gy-Efficient Building Envelope **Rabee M. Reffat**, Nottingham University Ningbo China, China Abstract-Achieving energy efficiency in buildings is quite important since it significantly contributes to the reduction of energy consumption and leads to bet-ter utilization of existing energy resources. This paper investigates and identifies a set of passive design strategies of building shape and proportion, orientation, envelope materials, glazing that helps in minimizing the energy consumption of buildings and achieves an energy-efficient building envelope. A set of 51 passive design rules for achieving energy-efficient building envelope in a hot humid cli-mate is induced from a thorough investigation of the related literature. An inter-dependency matrix that represents the consequential effects and embodiment among these rules is established. The paper introduces an interdependency anal-ysis of passive design strategies for energy-efficient building envelope leading to the identification of both the influential and interdependency levels among the induced rules. The obtained results are expected to be beneficial to building de-signers during the conceptual designing of buildings to better achieve energy ef-ficiency.

15:00~15:15 SE029-A	Production of Hydrogen-rich Gas from Catalytic Pyrolysis of Waste Textiles **Xiang Li**, Zhaoqing University, China Abstract-China is the largest textile and garment producer and consumer over the world, with the total textile fiber processing accounting for more than 50% of the world, and the output of waste textiles in 2020 is about 22 million tons, but the recycling rate is poor[1]. With the improvement of people's living conditions and the continuous change of fashion, the per capita fiber consumption increase progressively, and the output of waste textiles increase accordingly, thus the treatment of waste textiles has attracted broad attention. At present, the main treatment methods of waste textiles are landfill or incineration. Due to the limitations of site, process and cost, the application of landfill and incineration has been severely restricted. Therefore, it is urgent to develop waste textile treatment technology with good environmental compatibility and full resource utilization. Pyrolysis is a process in which organic matter decomposed into pyrolysis gas, oil and solid carbon by high temperature heat treatment in the absence of oxygen or lack of oxygen[2], which can reduce the production of dioxins, consequently generate less secondary pollution. Pyrolysis technology has good pollution control effect, remarkable capacity reduction effect and high resource recovery rate, which is considered as a potential alternative technology for incineration. However, the pyrolysis oil content of traditional non-catalytic pyrolysis is high, and the pyrolysis oil has several drawbacks such as high acidity, low calorific value, high oxygen content and poor stability. In addition, the traditional non-catalytic pyrolysis mainly regulates the product distribution by changing the pyrolysis temperature, which makes the traditional pyrolysis technology unfavorable to be effectively promoted and applied. In this paper, to gain as much hydrogen as possible, the effects of non-catalytic pyrolysis and catalytic pyrolysis on the distribution of the three-phase product and gas phase composition from waste jeans were investigated in a fixed bed reactor with NiOx/Al2O3 catalyst were investigated. When the pyrolysis and catalytic reaction temperature was 500℃, the gas phase product content of non-catalytic pyrolysis was 28.85% and the hydrogen content is 0.48%, while the gas phase product content of catalytic pyrolysis is 47.56% and hydrogen content is 4.81%. The hydrogen yield of catalytic pyrolysis is significantly higher than that of non-catalytic pyrolysis, which is 16 times that of non-catalytic pyrolysis. The catalytic pyrolysis was optimized by changing the loading position and heating operation mode of the catalyst, and the gas phase component content increased to 59.23% and hydrogen content increased to 12.72%. The effect of reduction temperature on pyrolysis behavior was investigated. It was found that 700℃ was the optimal reduction temperature. When the catalytic reaction temperature was 600℃, the gas phase component increased to 78.06% and the hydrogen content reached 41.20%. XRD analysis showed that the Ni0 appeared in the catalyst when the reduction temperature exceeded 700℃, which might be one of the reasons for the increase of hydrogen yield. This study provides a reliable path for efficient thermal conversion and product distribution control of organic solid waste.

15:15~15:30 SE014	Utilizing Wind Farms and Electric Vehicles to Mitigate the First and Second Frequency Dips in Power Systems **Seyed Amir Hosseini**, Aalborg University, Denmark Abstract-In this paper, we address the challenge of mitigating the impact of low system inertia by harnessing the synergies between electric vehicles (EVs) and wind farms (WFs) in modern power system frequency regulation. We introduce a virtual inertia controller, compliant with the IEC 61851 standard, designed to leverage the contributions of EVs to frequency regula-tion. This controller measures the rate-of-change-of-frequency (ROCOF) and computes an optimal EV current set point accordingly. To address concerns regarding the impact of frequency regulation on EV owners, we propose a stochastic allocation method for distributing the regulation tasks among EVs parked at different locations. Furthermore, we present an algorithm for wind turbines participation in frequency control. This algorithm dynamically ad-justs the wind turbines' output power based on wind velocity, reaching a maximum acceptable value, and stabilizing it. We develop a method to de-termine this maximum acceptable power increment, considering wind tur-bine constraints. The algorithm employs two PID controllers for the support and recovery phases. During the recovery phase, we identify and address a second frequency dip, leveraging EV collaboration to mitigate this adverse event. To assess the performance of our proposed algorithms and controllers, we conduct extensive simulation studies using the modified IEEE 39-bus test power system. Our results validate the effectiveness of these methods in providing robust system frequency support.
15:30~15:45 SE910	Integrated Energy Management System Approach for Off-Grid Residential Home **Tolulope Olumuyiwa Falope**, Cranfield University, UK Abstract-Efficient management of renewable energy sources is crucial for grid integration. This paper proposes an integrated energy management system (IEMS) that combines supply and demand-side management to manage the use of solar energy. An off-grid residential load supplied by a 7.5 kVA diesel generator (DG) and 10 kW photovoltaic (PV) supply is considered. The main objective of the IEMS framework is to increase PV usage through solar energy forecasting (SEF), time-of-use (TOU) criteria, direct load control (DLC) and generator control (GC). Firstly, the PV is optimally sized using the Performance Ratio method. Next, a three-step SEF approach predicts the next-day ahead PV generation. Finally, the IEMS’ s decision algorithm sets the TOU, initiates DLC to reduce excess load, and/or increase supply by calling up the DG. The performance of three configurations is compared: DG, DG/PV, and DG/PV/IEMS. The DG/PV/IEMS configuration showed an increase PV usage over the DG/PV by 57%. In addition, the IEMS reduces CO2 emissions by 88% and 54% in the DG and DG/PV configurations respectively.

15:45~16:00 SE012	Intraday Solar Irradiance Forecasting based on Hybrid Machine Learning Methodology for Photovoltaic Power Applications **Rania A. Ibrahim**, Arab Academy for Science, Technology and Maritime Transport, Egypt Abstract-Accurate prediction of solar radiation provides significant potential for enhancement of smart grid distribution networks efficiency and electricity management. However, the inherent non-stationary behavior and unpredictability render its estimation a challenging task. In this respect, this paper investigates the potential of ensembled-based machine learning (ML) models in con-trast to individual regression models for predicting solar irradiance using meteorological variables. Multiple ensemble models are assessed using simple aver-aging, combining Artificial Neural Network (ANN), Support Vector Machine Regression (SVMR), and Decision Tree (DT). The comparative results demon-strate that the ensembled model comprising ANN and DT showed improved prediction accuracies for an hour ahead forecasting, surpassing both individual ML models and other ensembled algorithms.

TECHNICAL SESSION 2

SATURDAY, FEBRUARY 3, 2024 <16:15~18:45>
Technical Session 2: Thermal Engineering and Energy Chemistry
Chairperson:Prof. Murugan Sivalingam, National Institute of Technology Rourkela, India

Event Space 1
<Level Ground>
Room A: 815 1624 6331

16:15~16:30 SE024	Performance Assessment of Co-MnO2/C Cathodic Catalyst in Pipe-Type Microbial Fuel Cells **Trang Nakamoto**, Ritsuumeikan University, Japan Abstract-Cobalt ion intercalated MnO2 on carbon black (Co-MnO2/C) is a promising low-cost catalyst for improving the air-cathode performance in microbial fuel cells (MFCs). This research focused on assessing the perfor-mance of the Co-MnO2/C catalyst used in the cathode of a pipe-type MFC, which had both the anode and cathode placed inside wastewater. Co-MnO2 was synthesized by the redox reaction of cobalt nitrate hexahydrate and po-tassium permanganate in aqueous conditions, and then carbon black was added to the result solution. The catalyst was separated from the solution by centrifugation and drying processes. The catalyst was mixed with a carbon-based ink binder to fabricate the cathode. In addition, a control cathode without the catalyst was used for comparison. Experimental results showed that the cathode with the catalyst generated much higher output voltage and power than the control cathode. Although the cathodes worked in low-oxygen diffusion conditions, the cathode with the catalyst generated signifi-cant output with a maximum power density of 76 mW/m2.
16:30~16:45 SE021	Performance Analysis of PEMFC Coupled with Recuperative Organic Rankine Cycle for Waste Heat Recovery **Murugan Sivalingam**, National Institute of Technology Rourkela, India Abstract-In this research work, a hybrid system comprising a PEMFC cou-pled with a recuperative organic Rankine cycle was proposed to improve the performance of PEMFC by harnessing thermal energy from the cooling wa-ter using a heat exchanger. Steady state mathematical modeling of PEMFC thermally integrated with RORC was established based on the laws of ther-modynamics. Three working refrigerants namely R-245fa, R-123, and R-141b were analyzed for this purpose. MATLAB environment was used to simulate the hybrid system model and predict the performance of the sys-tem. Based on the simulation results, a parametric analysis was performed to study a few performance parameters of the hybrid system. The results were analyzed, and are now presented in this paper.

16:45~17:00 SE034-A	Interfacial Energy Barrier Tuning in MnO2/MoS2/Carbon Fabric for Highly Efficient Wearable Thermoelectric Generator **Santhana Krishnan Harish**, Shizuoka University, Japan Abstract-With evolution of Internet of Things, the real time data monitoring has become highly convenient using a variety of wearable electronic sensors. These new-generation smart sensors having similar mechanical properties as that of human skin tissues are being developed for embedding it in human clothing. Nonetheless, the power source associated with these devices lacks flexibility and demands for frequent recharging and replacement. Wearable thermoelectric generators (WTEGs), enabling direct conversion of human body heat into electricity is the most promising alternative for conventional batteries in these wearable electronic devices. The prime challenge associated in fabricating a high-performance wearable thermoelectric material is to combine the non-toxicity with high mechanical flexibility, excellent electrical conductivity and high Seebeck coefficient. In this work we propose a facile approach to fabricate a textile-based WTEG with outstanding TE properties and exceptional flexibility. Herein, molybdenum disulphide (MoS2) nanosheets were grown on conductive carbon fabric (CF) via in-situ binder-free hydrothermal technique and manganese dioxide (MnO2) nanorods were decorated on it via dip coating, to form a 1D/2D interface. We investigated the in-plane TE properties of MnO2/MoS2/CF and observed a superior power factor of 548.7 nW/mK2 which is 49.5% higher than that of the pristine MoS2/CF. Such behaviour can be explained by the selective transmission of high energy carriers at the optimized MnO2/MoS2 interface. Moreover, this study is the first to employ a textile-based contact electrode in fabrication of WTEG that resulted in ultra-low internal resistance of the fabricated device (30 – 300 Ω). The lack of rigid contact electrodes leaves more flexibility, which benefits in enhanced wearability of the device. Owing to minimal internal resistance (29.4 Ω), the WTEG comprising of 1 -n/p pair could produce an open circuit voltage, as high as 0.2 mV under the thermal gradient of 15 – 20 K. Additionally, we demonstrated that increasing the number of modules from 1 pair to 4 pairs systematically improved the device performance. The open circuit voltage and output power generated for WTEG comprising of 4 -n/p pairs are measured to be 1.2 mV and 1 nW, respectively. This work provides a feasible design solution for a low resistance, rigid-free WTEGs with high performance which can significantly support the growth of research in wearable thermoelectrics.

17:00~17:15 SE905-A	Numerical Study on the Heat Transfer Characteristics of Louver Finned-tube Heat Exchangers with Variations in Fin Geometric Parameters **Seunghwan Im**, Korea University, South Korea Abstract-Finned-tube heat exchangers have been widely used in the heating, ventilating, and air-conditioning industry. Fin shapes in finned-tube heat ex_x005fchangers have been studied because the fin geometry shows a significant effect on the overall heat transfer performance. This study investigates the heat transfer and pressure drop of louver finned-tube heat exchangers with variations in geometric parameters of the louver fin. The considered geometric parameters include the louver angle, pitch, length, and number of louvers. Based on numerical study, the heat transfer coefficient and pressure drop of the finned-tube heat exchangers are analyzed according to the geometry parameters. As the louver angle and pitch increased, the pressure drop increased at an almost constant rate, whereas the increase in heat transfer coefficient decreased notably. As the louver length and number of louvers increased, the heat transfer coefficient and the pressure drop increased at an almost constant rate. The optimum louver pitch, angle, length, and the number of louvers were recommended as 1.4 mm, 27, 7.646 mm, and 5 respectively, to obtain high heat transfer coefficient and low pressure drop in the louver finned-tube heat exchangers.
17:15~17:30 SE002	Analyzing Supply Chain Structures with Petri Nets: A Composition Based Approach **Abobaker Mohammed Qasem Farhan**, University of Electronic Science and Technology of China, China Abstract-The purpose of this paper is to provide a detailed composition analysis of the supply chain by examining its various components and relationships. In recent times, math-ematical modeling languages like Petri Nets have proven to be highly effective in describing complex systems such as supply chains. Our model takes into consideration all the opera-tions involved in the supply chain, from the very beginning to the end. In addition, we have designed another model specifically for the food supply chain. This model aims to provide a better understanding of the behavior of the food supply chain, including its handling and distribution from the farmer to the end customers. Petri Nets tools have been utilized in the development of this model. This composition analysis offers a number of advantages for describing complex supply chains based on their unique requirements. The simulation and analysis results obtained from this model can be used to further refine the food supply chain, leading to more efficient and effective operations.

17:30~17:45 SE907-A	Pressure Reactive Flow-induced Noise Reduction through Electronic Expansion Valve in Simultaneous Heating and Cooling Heat Pump **Junhyeok Jang**, Korea University, South Korea Abstract-A simultaneous heating and cooling heat pump can change operation modes depending on the building load. Flow-induced noise occurs as the refrig_x005ferant flows through an electric expansion valve (EEV) when the operation modes are switched. The noise causes acoustical discomfort to occupants in many residential and commercial buildings. In this study, the noise generation mechanism through the EEV in simultaneous heating and cooling heat pumps is investigated according to the pressure difference across the EEV. Additionally, the noise re- duction control logic is developed by distributing the flow-induced noise energy. The flow-induced noise was determined by the choked and laminar flow of the gas that was varied with the pressure difference. The total sum of noise distribution was proportional to the refrigerant flow rate of the entire system. As a result, the flow-induced noise was regulated to the target value by controlling the pressure difference using the opening speed of the EEV. When the target noise was set to 2 dBA, the noise deviation remained at 2.05 dBA. Similarly, when the target noise was set to 3 dBA, the noise deviation remained at 2.52 dBA, which indicates an effective noise reduction. Therefore, the flow-induced noise can be distributed by controlling the pressure difference in terms of the EEV opening.
17:45~18:00 SE013	Microwave-assisted Pretreatment of Lignocellulosic Biomass with a Low Transition Temperature Mixture: Choline Chloride/Glycerol **Nakorn Tippayawong**, Chiang Mai University, Thailand Abstract-Biomass pretreatment can enhance the potential of the lignocellu-losic structure. Corncob is an available agricultural biomass residue that can be found in many countries. The pretreatment can improve the efficiency of converting corncob into bioenergy. A novel approach using low transition temperature mixtures (LTTMs) based on choline chloride combined with glycerol as the solvent for microwave-irradiation heating pretreatment pro-cess was explored. The effectiveness of microwave-irradiation heating was investigated as an alternative pretreatment method, with variations in tem-perature (90 and 150° C) and residence time (5 and 10 min). The results re-vealed that the lignin-carbohydrate complex could be effectively broken down, leading to the fractionation of lignin and hemicellulose. The obtained biomass is known as cellulose-rich material (CRM). The microwave-irradiation heating combined with LTTMs proved to be successful for the generation of CRMs, resulting in an increase in cellulose content and effec-tive lignin removal. The microwave-irradiation heating exhibited high per-formance in lignocellulosic fractionation compared to conventional heating. The method allowed for the optional preservation of hemicellulose at lower temperatures or its extraction at higher temperatures. The parameters inves-tigated in this study can be applied to biomass pretreatment using LTTMs with microwave-irradiation heating to obtain the desired CRM tailored for each specific biomass conversion process.

18:00~18:15 SE023	Study on Enhancement of the Interfacial Water Absorption Process by an Electrostatic Field **Fangsu Fan**, Southeast university, China Abstract-The electrostatic fields (E-fields) come from a wide range of sources and the polarization effect on charged ions has been widely used in gas-liquid separation systems. In terms of dehumidification, the effect of E-fields on the absorption process of water molecules on the solution surface is of interest. The authors applied uniform normal E-fields to an aqueous solu-tion of lithium chloride through molecular dynamics (MD) simulations and investigated the effect of E-fields on the adsorption rate of concentrated lith-ium chloride during the absorption of water molecules on a microscopic scale, and explored the mechanism of accelerated adsorption by E-fields. The results showed that the E-fields accelerated the adsorption rate of lithium chloride on water molecules, and at the early stage of adsorption, a large number of water molecules appeared in the middle of the interfacial layer close to the gas phase, and the E-fields mainly weakened the hydrogen-bonded mesh structure of the water molecules and facilitated the entry of water molecules.
18:15~18:30 SE027-A	Boosted Design of Sprayed Water Boiler for Steam Generation **Mohammad Almajali**, Rabdan Academy, UAE Abstract-Conventional boilers have several drawbacks such as; a long time to reach the steady state, large size, large pressure drop, and high cost. This paper aims to develop a new design for the boiler to gain better performance based on the sprayed water boiler (SWB) through injectors with a specific spray rate in a near atomized form over tubes containing hot gases. As the water temperature in SWB equals the sprayed water temperature sprayed from the injectors, the temperature difference between the hot gases and the water will be higher than that of the conventional one. Parametric study was carried out to investigate the main parameters affecting the boiler performance such as; the quantity and quality of steam, the time required to reach the steady state condition, the size of the boiler, and the drop pressure in the hot gases side. The results from show that the size of the SWB is significantly small compared to the conventional boiler. When generating the same quantity and quality of steam, the size for the SWB is equivalent to one-third of the conventional one. This will reduce the cost of manufacturing the boiler and the pressure drop of the hot gases inside the boiler. Additionally, the thermal efficiency of the SWB was found to be higher and the starting time to reach the steady state of operation is less than 1% of the time required for the conventional one. To fulfill some gaps in the theoretical design, an experimental test should be performed.

18:30~18:45 SE039	Optimizing the Urban Rail Transit System for Minimal Passenger Waiting Time and Reduced Traction Energy Consumption **George Yikwanga**, Southwest Jiaotong University, China Abstract-Urban rail transit systems face challenges due to increased energy costs and the growing need for cleaner energy solutions. Reducing energy con-sumption while ensuring reliable and timely transportation for passengers is a major challenge. This study developed a model to optimize train timetables by adjusting stop times. Factors considered include passenger demand, scheduling limitations, train intervals, capacity, and stop times. To reduce energy consump-tion, the paper suggests extending the running time of the train's energy-efficient driving strategy by optimizing stop times based on fixed timetables. The primary goal is to minimize passenger waiting times and traction energy consumption. A specialized genetic algorithm tailored to the model characteris-tics was utilized. Validation was demonstrated through a case study of a one-way subway line with varying running intervals, indicating a 3.94% improve-ment in passenger wait times and a 5% decrease in traction energy consump-tion. These findings signify important development in improving passenger ex-perience while reducing energy consumption in urban rail transit.

Listeners
Saeed Peyghami, Aalborg University, Denmark
Xiangying Hao, Zhaoqing University, China Kyunghan Chun, Daegu Catholic University, South Korea
Usha Carter, SVM Associates Ltd, UK
Anna Palmer, Curious Capital, Australia Muhammad Waqar Zahid, Southeast University, China
Mark Carter, SVM Associates Ltd, UK Christopher Mosoro, National Institute of Standards and Industrial Technology, Papua New Guinea

ONE-DAY TOUR

08:15	Gather in the Lobby <Level Lower Ground>, Rydges Fortitude Valley Brisbane (Please be sure you will be there on time as the bus will set out on time)
10:00	Lone Pine Koala Sanctuary (Extra fee 45 AUD/person for koala cuddling)
12:00~13:00	Lunch (Excluding in the one-day tour charge)
13:30	Mount Coot-Tha Park and Mount Coot-tha Lookout
15:00	South Bank Parklands
17:00	Story Bridge
18:00~19:00	Back to Rydges Fortitude Valley Brisbane
Note: The tour itinerary may vary due to change of visitors' number.	

NOTE