# CONFERENCE PROGRAM

FCEE

# 2ND INTERNATIONAL FORUM ON CLEAN ENERGY ENGINEERING

January 19-21 2024 TOKYO JAPAN

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# Location

## TKP Tokyo Station Conference Center

**Address:**

**〒103-0028 Tokyo, Chuo City, Yaesu, 1 Chome−8−16 TKP office 2F**

**Room1:カンファレンスルーム 2B (2nd floor)**

**Room2:ミーティングルーム 2E (2nd floor)**

## Location & Directions


TKP Tokyo station conference center is a conference room facility located one minute walk from Tokyo station yaesu exit.

It is also directly connected to the yaesu underground shopping mall. Thanks to its convenient location, the hotel is ideal for seminars and training. We also recommend that you use this venue as a TKP webinar center to distribute webinars.

# Welcome Message

Greetings and welcome to the 10th International Conference on Advances in Environment Research (ICAER 2024), held in conjunction with the 2nd International Forum on Clean Energy Engineering (FCEE 2024) and the 3rd International Conference on Smart City and Green Energy (ICSCGE 2023) in Tokyo, Japan from January 19 to 21, 2024.

We extend our sincere gratitude for your valuable support to this conference. The program features five distinguished Keynote Speakers, with a total of four onsite sessions, and one poster session. With approximately 60 submissions received, we are thrilled to have around 40 confirmed attendees.

Our heartfelt thanks go to everyone who contributed to the success of FCEE 2024. Special recognition is given to our program committee colleagues for their meticulous review of submissions, crucial to the conference's success. We also appreciate the dedication of the organizing committee members who devoted their time and efforts to planning, promoting, organizing, and assisting with the conference.

FCEE 2024 offer a platform for delegates from diverse areas to engage in face-to-face exchange of new ideas, share application experiences, establish business or research relations, and seek global partners for future collaboration. It serves as an excellent opportunity to discuss the latest innovations, trends, concerns, practical challenges, and solutions in the fields of Clean Energy Engineering.

We hope you have a fantastic experience during the conference and extend a warm invitation for your participation in our conference next year!

**Conference Organizing Committee**

# Conference Committee

## Conference Chairs

Kokyo Oh, Center for Environmental Science in Saitama, Japan

Ngai Weng Chan, Universiti Sains Malaysia, Malaysia

Akira Kondo, Osaka University, Japan

## Conference Program Chairs

Solomon W. Leung, Idaho State University, USA

Pedro Joaquín Gutiérrez-Yurrita, Instituto Politecnico Nacional, Mexico

Zhi Chen, Concordia University, USA

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Yun Ii Go, Heriot-Watt University Malaysia, Malaysia

Andrej Senegačnik,University of Ljubljana,Slovenia

Ali Mohammadipour, Iranian Association for Energy Economies&Payame noor University, Iran.

Cheng Chin, Newcastle University, Singapore

Haliza Abdul Rahman, Universiti Putra Malaysia (UPM), Malaysia

J. Helan Chandra, Jeppiaar Engineering College, India

Kei EGUCHI, Fukuoka Institute of Technology, Japan

I-Chun Tsai, National Tsing Hua University, Taiwan

Jeyashelly Andas, Universiti Teknologi Mara, Perlis, Malaysia

Dat Doan, Auckland University of Technology, New Zealand

Tahir Wardah, Universiti Teknologi MARA, Malaysia

Andri Kusbiantoro, Universiti Tun Hussein Onn Malaysia, Malaysia

Yaolin Lin, University of Shanghai for Science and Technology, China

# Presentation Guidelines

**Devices Provided by the Conference Organizer:**
Laptop Computer (MS Windows Operating System with MS PowerPoint and Adobe Acrobat Reader)
Digital Projectors and Screen
Laser Sticks

**Materials Provided by the Presenters:**
PowerPoint or PDF Files (Files should be copied to the Conference laptop at the beginning of each Session.)

**Please do arrival registration.** On January 19, 2024, we will have arrival registration and conference materials collection.

For participants who will attend the physical conference, the organizer doesn't provide accommodation, and we suggest you make an early reservation.

## *Duration of Each Presentation*

Keynote Speech: about 30 Minutes of Presentation and 5 Minutes of Question and Answer
Regular Oral Presentation: about 12 Minutes of Presentation and 3 Minutes of Question and Answer

## *Dress code*

Please wear formal clothes or national representative of clothing.

# Overview Agenda

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| **January 19, 2024 \| Friday (GMT+9)** | | |
| 13:00-17:00 | Onsite Registration and Materials Collection | ミーティングルーム 2E<br>(2nd floor) |
| **January 20, 2024 \| Saturday (GMT+9)** | | |
| 09:00-09:05 | **Opening Remark**<br>Prof. Kokyo Oh, Center for Environmental Science in Saitama, Japan | Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 09:05-09:40 | **Keynote Speech I**<br>Prof. Akira Kondo, Osaka University, Japan | Chaired by<br>Prof. Kokyo Oh<br>Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 09:40-10:15 | **Keynote Speech II**<br>Prof. Xiao-Dong Zhou, University of Connecticut, USA | |
| 10:15-10:50 | **Keynote Speech III**<br>Prof. Kokyo Oh, Center for Environmental Science in Saitama, Japan | Chaired by<br>Prof. Akira Kondo<br>Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| **10:50-11:05** | **Group Photo and Coffee Break** | |
| 11:05-11:40 | **Keynote Speech IV**<br>Prof. Jihyun Hwang, Korea Institute of Energy Technology, South Korea | Chaired by<br>Prof. Akira Kondo<br>Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 11:40-12:15 | **Keynote Speech V**<br>Prof. Hossam A. Gabbar, Ontario Tech University, Canada | |
| 12:15-13:30 | Lunch Time | カンファレンスルーム 2B |
| 13:30-15:15 | **Session 1**<br>OJ5006 OJ1003-A OJ1005-A<br>OJ5007-A OJ1009-A OJ5032-A<br>OJ5024 | Chaired by<br>Prof. Yu-Chung Tsao<br>Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 13:30-15:15 | **Session 2**<br>OJ5009-A OJ5022 OJ5033-A<br>OJ5023-A OJ5005-A OJ5028<br>OJ5031-A | Chaired by<br>Prof. Akira Kondo<br>Venue:<br>ミーティングルーム 2E |

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| | | (2nd floor) |
| **15: 15-15:35** | **Break time** | |
| 15:35-17:35 | **Session 3**<br>OJ6005 OJ5026 OJ5048-A<br>OJ1002 ISG003 ISG005<br>OJ1011 ISG006-A | Chaired by<br>Prof. Jihyun Hwang<br>Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 15:35-17:20 | **Session 4**<br>OJ0001-A OJ5046-A OJ5025<br>OJ5003-A OJ5027 OJ5040<br>OJ5037 | Chaired by<br>Prof. Kokyo Oh<br>Venue:<br>ミーティングルーム 2E<br>(2nd floor) |
| 17:35-17:50 | **Poster Session**<br>OJ1004 OJ1006 | Venue:<br>カンファレンスルーム 2B<br>(2nd floor) |
| 18:00-19:35 | **Dinner** | ホール１B (1st floor) |

# Keynote Speaker I

**January 20, 2024 (Saturday) 09:05-09:40| GMT+9**

**Venue:カンファレンスルーム 2B (2nd floor)**

## Prof. Akira Kondo

**Osaka University, Japan**

Prof. Kondo Akira was graduated from Faculty Engineering, Osaka University in 1982 and from Graduated School of Engineering, Osaka University in 1984. After that, he had worked in Matsushita Electric Industry (Panasonic) for 5 years. From 1989, he has been working in Osaka University as an assistant professor, associated professor and professor. He received PhD in 1999 and its thesis is “Study on development of numerical simulation model in order to mitigate urban atmospheric environment”. He is researching on the environmental dynamics modeling in the wide ranges from global scale to indoor scale. Moreover he carried out the joint researches in South-East Asia; Nepal, Indonesia, Korea, China, Vietnam, and Thailand. Throughout these researches, he received the best paper award from The Society of Heating, Air Conditioning and Sanitary Engineering of Japan in 2010 and received the best paper award from the Society of Environmental Science of Japan in 2012 and received the best academic award from Atmospheric Environmental Society of Japan in 2015. He is also the author of more than 90 peer-reviewed articles including articles written in Japanese, and 80 international conference papers with limited peer review.

### Speech Title---Evaluation on Current and Future Air Quality in Southeast Asia by using WRF/CMAQ

Abstract-Air quality in future will change in response to climate change as well as anthropogenic emission change. In this research, a coupled Weather Research and Forecasting (WRF) and Community Multiscale Air Quality (CMAQ) model was applied. This research aims are to investigate the impacts of climate change alone, the impacts of anthropogenic emission change alone, and the combined impacts of changes in both climate and anthropogenic emissions on future air quality in Southeast Asia where the pollutant emissions were estimated to increase in the future.

In Southeast Asia, the aerosol direct effects generally decreased shortwave radiation, temperature, planetary boundary layer (PBL) height, and wind speed. $PM_{2.5}$ concentrations were found to increase while $O_3$ concentration was found to decrease due to direct effects.

Investigating the impacts of climate change alone on meteorology and air quality over Southeast Asia in the decade 2050s revealed the followings. Future atmosphere gets warmer, more humid, rainy and stagnant. Affected by climate change, nitrogen oxides ($NO_x$) and non-methane volatile organic compounds (NMVOCs) biogenic emissions increase. Subsequently, the changes in meteorology and biogenic emission affect air quality. Under Representative Concentration Pathway

(RCP) 4.5 scenario, future atmosphere appears to be reduced in $O_3$ and $PM_{2.5}$ concentrations. However, climate change worsens $O_3$ and $PM_{2.5}$ air pollution under RCP8.5 scenario.
Projected anthropogenic emission change alone produces higher $PM_{2.5}$ and $O_3$ levels in the decade 2050s over Southeast Asia in general. $PM_{2.5}$ increase is attributed to the emission growth of primary $PM_{2.5}$ and $PM_{2.5}$ precursors. $O_3$ increase is driven by $NO_x$ emission increase rather than NMVOCs emission increase. Both future $PM_{2.5}$ and $O_3$ air quality in Southeast Asia are also affected more by pollutant emission growth in India.
Driven by climate change and emission change in combination, $PM_{2.5}$ and $O_3$ concentrations increase. The rise in $PM_{2.5}$ and $O_3$ concentrations is larger in RCP8.5 scenario that than in RCP4.5 scenario.
The simulation results indicated that emission trend is a major factor in the variation in $PM_{2.5}$ and $O_3$ concentrations, while the climate change also plays an important role.

# Keynote Speaker II

**January 20, 2024 (Saturday) 09:40-10:15| GMT+9**

**Venue:カンファレンスルーム 2B (2nd floor)**

## Prof. Xiao-Dong Zhou

**University of Connecticut, USA**

Professor Xiao-Dong Zhou is the Connecticut Clean Energy Fund professor in Sustainable Energy, The Nicholas E. Madonna Chair in Sustainability, Director of the, Center for Clean Energy Engineering, and a Professor in Chemical and Biomolecular Engineering, Mechanical Engineering, and Materials Science and Engineering at University of Connecticut. He is a special advisor to UConn President Radenka Maric in Sustainability. Dr. Zhou received J. B. Wagner Jr. Young Investigator Award in 2007 from the Electrochemistry Society - High Temperature Materials Division. He is the recipient of 2011 US DOD – DARPA Young Faculty Award. He is a Fellow of the Electrochemical Society. His research interests span theoretical and experimental studies of materials and interfaces for energy systems, including batteries, fuel cells, and electrolyzers.

### Speech Title---Innovative Horizons in Energy: UConn's Clean Energy Approach to Sustainability

Abstract- At the forefront of sustainable energy engineering, the University of Connecticut's Center for Clean Energy Engineering (C2E2) strives for innovations in applied research. In this talk, I will elaborate our center's key programs and contributions to sustainable energy engineering.

Our center's approach is multidisciplinary, integrating advanced manufacturing, electrochemistry, materials science, process engineering, and characterization technology to develop efficient, cost-effective energy systems. A standout feature is our research in fuel cells and electrolysis cells, which are revolutionizing the way we harness and store energy. Our current projects and initiatives also encompass renewable energy systems and microgrids, reflecting our commitment to reducing carbon footprints and promoting energy efficiency.

In collaboration with industry partners, our center is involved in numerous projects aimed at practical applications of clean energy technologies. These range from developing scalable renewable energy solutions for industrial applications to innovative research in battery technology and smart grid systems.

At the conference, we will present our latest findings, including breakthroughs in energy storage and conversion, and discuss the future of sustainable energy engineering. UConn's Center for Clean Energy Engineering exemplifies the synthesis of academic research with real-world application, setting a standard for sustainable energy engineering globally.

# Keynote Speaker III

**January 20, 2024 (Saturday) 10:15-10:50| GMT+9**

**Venue:カンファレンスルーム 2B (2nd floor)**

## Prof. Kokyo Oh

**Center for Environmental Science in Saitama, Japan**

Prof. Dr. Kokyo Oh is a senior researcher in Center for Environmental Science in Saitama, Japan. He obtained Ph.D. degree (soil science) in 1995, and was honored as a research fellow by Japan Science and Technology Agency (STA) from 1997 to 1999. His research areas include soil science, environmental conservation, environmental chemistry and biology, and environmental agronomy. He has published more than 200 major academic papers, has presided over and participated in more than 100 scientific research fund projects, and has been invited to be the chairman of more than 20 international conferences.

### Speech Title---Contaminated Soils: Valuable Utilization and Resource Conservation with Phytoremediation Technology

Abstract-Soils are fundamental natural resources indispensable for living organisms, including humans, to sustain their lives on the earth. However, soil contamination has become one of the global environmental problems posing significant risks to earth ecology, human health, and the lives of organisms. There is a great need for the development and practical application of effective technologies to utilize and remedy extensively distributed contaminated soils.

Phytoremediation is an umbrella term for a set of technologies that utilize natural plants and their associated microorganisms to treat contaminated or degraded environmental matrices without damage to the function of natural resources. It has excellent potential and has gained increasing attention as a natural, low-cost, and eco-friendly technology in the remediation and conservation of soil resources. So far, soil phytoremediation has mainly focused on removing or degrading hazardous contaminants from contaminated soils. As a plant-based technology, phytoremediation applications have expanded to soil resource management, biomass and bioenergy crop production, biodiversity protection, and other critical environmental issues in recent years. This study aims to discuss the treatment of extensively distributed contaminated soils, emphasizing phytoremediation technology for the valuable utilization and remediation of the contaminated soils.

# Keynote Speaker IV

**January 20, 2024 (Saturday) 11:05-11:40| GMT+9**

**Venue:カンファレンスルーム 2B (2nd floor)**

## Prof. Jihyun Hwang

**Korea Institute of Energy Technology, South Korea**

Prof. Dr. Jihyun Hwang holds a PhD in offshore cryogenic liquefaction process optimization from graduate school of Seoul National University, South Korea. He is an experienced Hydrogen, LNG, Oil & Gas process professional who brings 20 years of relevant experience to specific projects and technology development. He is a Professor, Head of Hydrogen Energy at KENTECH (https://www.kentech.ac.kr), a managing director for FIP (Fraunhofer Innovation Platform)-H2Energy@KENTECH (FIP-H2ENERGY@KENTECH) as well as Head of the HYLOT R&D lab (https://hylot.kentech.ac.kr), specialized in Hydrogen & LNG processes and project engineering. Before joining KENTECH, Prof. Dr. Jihyun Hwang worked as an expert in different international companies in South Korea, the United States, the Netherlands, and Germany. He is an esteemed technology development leader for (floating and onshore) hydrogen production & storage projects with in-depth knowledge and technical expertise in process engineering for cryogenic processes (LNG, hydrogen) and liquefaction engineering, blue hydrogen, green and blue ammonia, and methanol production.

### Speech Title---Development of Technical Specifications and Process System Requirements for the World's Largest LH2 Refueling Station

Abstract- Hydrogen is emerging as one of the premising energy sources to achieve carbon neutral society. To efficiently store and make use of the produced hydrogen by various methods, liquid hydrogen and liquid hydrogen refueling station (LHRS) are spotlighted as solutions for storage and utilization sector respectively. However, technical limitations of cryogenic pumps, heat exchangers and unconsolidated standards for LHRS led to hinder the wide spread of the stations. This paper reviews general technical specifications and safety standards of commercialized small-scale LHRS and suggests technical specifications and safety standards for largescale LHRS. Especially, an application of separated cryogenic pumps and heat integration for the vaporizer specializes the designed station charging 1000kg of hydrogen per day in this paper from small-scale LHRS and other large-scale LHRS. The authors expect commercializing large-scale LHRS with the proposed technical specification and process system requirements to be able and the safety standards set for the designed station can contribute to the unification of world LHRS standards.

# Keynote Speaker V

**January 20, 2024 (Saturday) 11:40-12:05| GMT+9**

**Venue:カンファレンスルーム 2B (2nd floor)**

## Prof. Hossam A. Gabbar

**Ontario Tech University, Canada**

Dr. Gabbar is a full Professor in the Department of Energy and Nuclear Engineering, the Faculty of Engineering and Applied Science, at Ontario Tech University (UOIT), where he has established the Energy Safety and Control Lab (ESCL), Smart Energy Systems Lab, and Advanced Plasma Engineering Lab. He is the recipient of the Senior Research Excellence Aware for 2016, UOIT. He is recognized among the top 2% of worldwide scientists with high citation in the area of energy. He is a Distinguished Lecturer – IEEE NPSS on Nuclear-Renewable Hybrid Energy Systems and Plasma-based Waste-to-Energy. He is leading national and international research in the areas of smart energy grids, energy safety and control systems, and waste to energy using advanced plasma technologies. Dr. Gabbar obtained his B.Sc. degree in 1988 with first class of honor from the Faculty of Engineering, Alexandria University (Egypt). In 2001, he obtained his Ph.D. degree from Okayama University (Japan). From 2001 till 2004, he joined Tokyo Institute of Technology (Japan), as a research associate. From 2004 till 2008, he joined Okayama University (Japan) as an Associate Professor, in the Division of Industrial Innovation Sciences. From 2007 till 2008, he was a Visiting Professor at the University of Toronto. He also worked as process control, safety, and automation specialist in energy and oil & gas industries. Dr. Gabbar has more than 230 publications, including patents, books / chapters, journal and conference papers.

### Speech Title---Resilient Energy Systems for Interconnected Infrastructures

Abstract- This talk will present advances in research on planning, design and control strategies of hybrid energy systems and their applications on interconnected infrastructures. The talk will explain design approaches, strategies, and planning of smart energy grids. Nuclear-renewable hybrid energy systems will be discussed with different coupling strategies. Interconnected infrastructures are modeled and linked with energy, water, transportation, waste, food, health, and social systems. Fast charging station design is illustrated using hybrid energy systems with diverse energy storage and integrated within transportation electrification based on resiliency demand and control strategies. Demonstration of resilient micro energy grid is discussed and analyzed in view of different application scenarios, such as energy-water systems, modeling, and simulation of fast charging stations.

## Session 1: Clean Energy Generation and Smart Grid

## 13:30-15:15 GMT+9 | January 20, 2024 (Saturday)

## Venue: カンファレンスルーム 2B （2nd floor）

## Chaired by: Prof. Yu-Chung Tsao, National Taiwan University of Science and Technology, Taiwan

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| Presentation 1<br>13:30-13:45<br>OJ5006 | From User Experience to Environmentally Sustainable Markets: Exploring the Sustainability Innovation of Cultural and Creative Market Mobile Interfaces<br><br>Yi-Chun Kuo, **Chung-Shun Feng**, and Chia-Wen Tsai<br>Chaoyang University of Technology, Taiwan<br><br>*Abstract*—In recent years, the concept of achieving net-zero carbon emissions by 2050 and the trend of carbon border adjustment mechanisms in Europe and America have been advocated worldwide. Cultural and creative markets have already assumed a highly significant role in people's daily lives. Consequently, cultural and creative market activities also need to align with the concept of the "Net Zero Carbon Emission Wave." By implementing net-zero carbon emission activities within small groups of cultural and creative markets, it becomes possible to achieve environmental sustainability.<br>cultural and creative markets have often integrated festival events and historical heritage with sustainable environmental concepts. This approach attracts crowds, fostering a sense of local culture and enlivening the environment. Cultural and creative markets have become increasingly popular in Taiwan. These markets serve as friendly venues that combine art, handicrafts, niche brands, and local agricultural products.<br>This study employs the method of visualizing customer journey in service design. It utilizes semi-structured interviews, observations, and customer journey mapping to record data. Analysis is carried out using task time performance, the System Usability Scale (SUS), and the Questionnaire for User Interaction Satisfaction (QUIS). This approach leads to the formulation of prototype designs for two interface options, labeled as A and B. Relevant experts and scholars are invited to evaluate and provide suggestions. A comparative analysis of experimental tasks is also conducted for the two interface designs.<br>This study employs a user-participatory approach to involve users in the design and improvement process of the cultural and creative market interface. By integrating sustainability and perpetual concepts to enhance innovative models, the goal is to achieve a more appealing and user-friendly interface. Simultaneously, through a co-creative approach, users are engaged in the creation and design of the interface, thereby increasing their emotional investment in the design and fostering long-term engagement, ultimately leading to sustainable innovative energy. This fusion ensures the sustainable development of the cultural and creative market while also enabling it to generate positive impacts for users and the environment on various levels. |

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| Presentation 2<br>13:45-14:00<br>OJ1003-A | An Artificial Intelligence-Based Approach for Enhancing Voltage Stability Situational Awareness in Clean Energy-Enriched Smart Grids<br><br>Heng-Yi Su and **Chia-Ching Lai**<br>National Taiwan Ocean University, Taiwan<br><br>*Abstract*—Over the last two decades, numerous regions across the globe have experienced a significant increase in the incorporation of clean energy sources (CES) into their power grids. This surge can be attributed to the growing awareness of environmental issues and heightened concerns regarding carbon emissions. However, this extensive integration, particularly involving wind and solar energy resources, has ushered in a new set of technical challenges for modern power grids. Specifically, due to the inherently stochastic nature of wind and solar energy resources, power grids are increasingly prone to operating in close proximity to the voltage collapse threshold. This places even greater emphasis on the importance of voltage stability, both from economic and security standpoints. Consequently, the evaluation of grid voltage stability under conditions of uncertainty has assumed paramount significance.<br>In this paper, we introduce an innovative adaptive improved extreme learning machine (AI-ELM) devised for the purpose of precise and dependable voltage stability assessment in power grids. The cornerstone of the proposed AI-ELM algorithm is a hierarchical residual compensation scheme. Notably, the algorithm harnesses the potential of the Internet of Things (IoT) technologies and the wide-area measurement system (WAMS) to enable real-time voltage stability monitoring, thereby augmenting the situational awareness of system operators and facilitating informed decision-making. In order to effectively address the intricate dynamics associated with non-stationary time series data from WAMS, an adaptive weight update strategy is seamlessly integrated into the AI-ELM framework. The robustness and applicability of the proposed AI-ELM are thoroughly validated using both a classical test system and a practical power grid. The outcomes of the experimental investigations underscore the commendable efficiency and reliability of the proposed algorithm, thereby substantiating its considerable promise for practical, real-world applications. |
| Presentation 3<br>14:00-14:15<br>OJ1005-A | Measurement-Based Voltage Stability Estimation and Enhancement Considering Wind Energy Generation Systems<br><br>**Jian-Hong Liu**<br>National Taiwan University of Science and Technology, Taiwan<br><br>*Abstract*—As environmental consciousness continues to grow, the primary focus of energy development has shifted towards energy conservation and carbon reduction. A prevailing trend involves harnessing renewable energy sources like wind energy, solar energy, and biomass energy to meet energy demands. Among these renewable options, wind energy generation technology is the most advanced and promising for future exploitation. However, wind power generation inherently exhibits intermittent power fluctuations, posing a potential risk to the power grid during contingencies such as N-1 line outages. Therefore, ensuring the safety and stability of the power grid hinges on the precise monitoring of voltage |

stability when implementing large-scale wind power generation.

Broadly, wind energy generation systems can be categorized into two main types: fixed-speed and variablespeed systems. Fixed-speed wind enegy generators, like fixed-speed induction generators (FSIGs), must absorb reactive power to establish the excited stator voltage required for stable power output. Conversely, variable-speed wind power generators, such as doubly-fed induction generators (DFIGs), incorporate power electronic devices to regulate either the stator voltage or rotor excitations, enabling controlled power flow. As wind energy generators typically consume reactive power for real power generation, this can potentially undermine the voltage stability of the power grid, underscoring the need for more precise voltage monitoring technologies.

Voltage stability assessment (VSA) technologies can be categorized into two main types: model-based approaches and measurement-based approaches. Model-based methods are grounded in fundamental power flow models that incorporate various physical constraints. Prominent model-based approaches, such as the continuation power flow method and the direct method, are commonly employed for voltage stability assessment.

Although model-based approaches offer more accurate voltage stability estimations, they are constrained by computational complexity. In contrast, measurement-based approaches alleviate these computational challenges. Leveraging reliable communication networks, voltage and current phasor measurements from all available buses can be collected using phasor measurement units (PMUs) for subsequent analysis in voltage stability assessment.

An essential technology for managing these measurements in voltage stability assessment is the indicator known as the L-index, derived from the coupled single-port model. The conventional L-index is defined as the ratio of the system's equivalent Thevenin impedances to the equivalent load impedance, and it serves to determine whether maximal power transfer is achieved.

However, when wind energy generation systems are included in power grid, conventional L-index derived from existing coupled single-port models becomes inapplicable. Since wind energy generation systems and reactive power injection are included and treated as another types of buses, voltage stability estimation based on conventional L-index become inaccurate. In the article, the existing coupled single-port models will be extended as enhanced ones through including new types of buses which are defined from wind energy generation systems and reactive power injections. Accordingly, the improved L-index can be reformulated. Furthermore, in order to improve the voltage stability under the penetration of wind energy systems, the reactive power ratio compensation is considered for the enhancement of the voltage stability. Each compensator will be effectively dispatched according to the ratio occupying in the total L-index value of all compensators in order to achieve the voltage stability enhancement. Simulations on the typical IEEE-14 bus system are conducted to verify the accuracy of the improved L-index.

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| Presentation 4<br>14:15-14:30<br>OJ5007-A | Suggestion from A Plant Biologist-Plant Energy Regulatory Systems to Inspire Electrical Microgrids Models<br><br>**Nobuhiro Suzuki**<br>Sophia University, Tokyo, Japan<br><br>*Abstract*—In the current situations in which energy supply can be severely impacted by natural disasters, the establishment of power supply systems that are flexible and resilient to environmental changes is required. Plants, unlike animals, maintain their lives by responding flexibly to severe climate change by modulating energy homeostasis. In other words, plant energy control, the key for adaptation to the environment, is a so-called "almost perfect" system that is equipped with the characteristics required for the new power supply system for human society, which can efficiently generate, store, and distribute optimal amounts of energy, as well as flexibility according to the situation. Plant cells possess multiple sources to generate energy as well as energy storage systems. In addition, it is well known that hubs to adjust the operation of systems depending on energy status exist in plant cells. Functions of these hubs are integrated with the mechanisms which monitor status of environment and inside the cell. Furthermore, bi-directional interactions between cells or proteins via energy and signals also contribute to flexible fine-tuning of the various mechanisms of energy homeostasis in response to fluctuating environment. Drawing inspiration from these natural systems, I propose a novel concept: replicating the mechanisms intrinsic to a plant cell's energy balance to develop a new model for a reliable, efficient, and resilient smart grid. |
| Presentation 5<br>14:30-14:45<br>OJ1009-A | Three-part Tariff Electricity Pricing Scheme Considering Renewable Energy and Prosumer'S Preferences<br><br>**Yu-Chung Tsao**, Ho Thi Thu Ai and Chia-Hung Chen<br>National Taiwan University of Science and Technology, Taiwan<br><br>*Abstract*—The implementation of renewable-based power generation substantially enhances the greenness of the power supply market. Persistent concerns regarding pricing policies and widespread renewable energy industries have given rise to economic conflicts among stakeholders, notably between power companies and different groups of prosumers. This study aims to further promote renewable power generation by examining the impacts of three-part tariff (3PT) and peer-to-peer (P2P) energy trading on electricity pricing decisions at power companies, residential and industrial prosumers. Considering a Stackelberg game approach, this research seeks to maximize the stakeholders' profits by determining the optimal electricity prices for power companies and distinct prosumer groups participating in the renewable power trading platform. The findings reveal that a comprehensive strategy encompassing 3PT, P2P, and buy-back mechanisms allows the power company to maximize overall profit when prosumers exhibit a preference for motivational renewable electricity trading. Both residential and industrial prosumers would obtain a win-win situation, in which residents are pursued with extra profit and industries can access renewable electricity at a lower price through the P2P platform. Moreover, understanding |

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| | the prosumers' preferences would provide a flexible and reliable power supply alternative for different of prosumers. |
| Presentation 6<br>14:45-15:00<br>OJ5032-A | Investigation of Solar Panels Developments in Tainan City Using Satellite Imagery<br><br>**Chin-Chieh Chang, Tsz-Kin Lau**, KaiHsiang Huang<br>National Kaohsiung University of Science and Technology, Taiwan<br><br>*Abstract*—Due to the severity of global warming, green energy has become one of the most important mitigation strategies. Solar energy is one of the most popular green energy sources, with renewable and clean characteristics. Solar panels (SP) convert solar radiation into electronic energy with a relatively small carbon footprint and no greenhouse gas emissions. Due to the advantages of SP, SP has been widely used and installed all over the world, including Taiwan. This study investigates the development of SP in Tainan City and presents the development trend of SP in the past five years (2018 to 2022). This study uses Landsat images for surface observation and spatial and temporal analysis. Calculate the Normalized Difference Vegetation Index (NDVI) and Built-up Index (NDBI) in different years based on the above images to observe the differences in NDVI and NDBI between SP and other land covers. The results show that SPs can be easily classified using the above indicators. The SP areas in different years were further calculated based on the classification results. The results show that the SP area increased from 2018 to 2022, which was 15 times that of 2018. The results not only present the SP development in Tainan, but also the SP development in Taiwan and around the world. Then, land cover changes are further observed and analyzed. From 2018 to 2022, SPs were mainly installed in water bodies, followed by built-up areas and open areas, and finally green areas. This result reflects, to a certain extent, Taiwan's policy of encouraging people to install SP in fisheries, lakes, ponds and other water bodies. Although SP helps reduce carbon emissions and energy supply, balancing the development of other types of land use land cover is also necessary. Therefore, this study presents the comprehensive development of SP in Taiwan in the past five years, and also indirectly presents the policies for SP development in Taiwan. Based on the above results, related planning efforts can be further reflected to create sustainable cities and environments. |
| Presentation 7<br>15:00-15:15<br>OJ5024 | Mathematical Simulation of Plat-Pin Fin Heat Sink Installed Under the Solar Panels<br><br>P. Satuwong, P. Vengsungnle, P. Khantikomol and. **B. Krittacom**<br>Rajamangala University of Technology Isan, Nakhon Ratchasima, Thailand<br><br>*Abstract*— Mathematical simulation of plat – pin fin heat sink installed under solar panels was conducted. Based on the problem of heat accumulation inside the solar panel, the electricity generation efficiency become reduced with a higher heat. Thus, the objective was to design and simulate plate and pin cooling. Two shapes of pin consisting of plate and cylindrical pin were studied. The investigated process was divided into two stages. The design and calculation of the heat sink fin was the first stage. The process of simulating solar panels with fins attached and without fins using the SOLIDWORKS program was the second stage. Three factors were considered: the direction of the panel installation (S, SE |

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| | and SW), the inclination angle ( θ ) of the solar panel, and the style of installation (Transvers and longitude fins). The appropriated condition for reducing the temperature of solar panels was discussed. The results showed that the minimal temperature of the solar panel was obtained at the southeast direction (SE) with an inclination angle ( θ ) of 20o . Heat dissipation was achieved by the transvers fins in which a maximum temperature reduction gave 6.39 C . |

## Session 2: Environmental Pollution Analysis, Environmental Protection, and Environmental Health

## 13:30-15:15 GMT+9 | January 20, 2024 (Saturday)

## Venue: ミーティングルーム 2E（2nd floor）

## Chaired by: Prof. Akira Kondo, Osaka University, Japan

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| Presentation 1<br>13:30-13:45<br>OJ5009-A | The Association between Environmental Noise and Hearing Loss in Children<br><br>**Wen-Tzu Huang**, Wen-Chi Pan, Chun-Ting Lu, Tai-Ling Chen, Yu-Lin Yu, Chen-Wei Chang, Chia-Huang Chang<br>Taipei Medical University, Taiwan<br><br>*Abstract*—Introduction: With rapid urbanization and life style changes, loud noise is omnipresent and has become a part of life. Noise is the second most harmful environmental factor to health, preceded only by air pollution. Public transportation, aviation, and construction sounds are actually part of environmental noise. Noise can adversely affect children's performance in school, including declines in memory, motivation and reading skills. Thus, this study aimed to determine the association of exposure to environmental noise and hearing loss in children.<br>Method: A cross-sectional study based on hearing tests was conducted. This study enrolled 356 children aged 6-12 years from elementary school. Children's past and current exposures were established by their home and school addresses, then using data from Environmental Protection Agency (EPA) noise monitoring stations and land-use regressions to established it. The Statistic methods were using Kruskal-Wallis to analyzed continuous variables, and fisher exact tests were used to analyze categorical variable. P values < 0.05 represent significant differences.<br>Results: Among the 356 participants, 58 children had hearing loss. In the background noise value, it can be found that among the children with normal hearing, the background noise value at home was 58.35 dB(A), 56.57 dB(A), 54.93 dB(A) in the morning, evening and night, and the background noise value at school was 54.46 dB(A) in the morning. There was no significant difference between children with hearing loss in the morning, evening and night at home (58.53 dB(A), 56.49 dB(A), 54.85 dB(A)) and at school in the morning (58.09 dB(A)). After classifying the degree of hearing loss, it was also found that environmental noise did not affect the severity of hearing loss. Also find out that whether there was a loud noise environment such as a factory around, was not the main cause of hearing loss in children. Conclusion: Based on preliminary results, it was found that environmental noise and hearing loss appear to be unrelated. Given the importance of environmental noise and the subsequent development of hearing loss in children, further research is needed to confirm the association |

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| Presentation 2<br>13:45-14:00<br>OJ5022 | Integrated Flood Modeling for Klang River Basin using HEC-HMS and Radar Rainfall Input<br><br>**O. N. Shazwani**, T. Wardah, C. K. Nursalleh<br>MARA University Technology, Selangor, Malaysia<br><br>*Abstract*— Flooding is one of the most frequent natural disasters in Malaysia, causing billions of ringgits in damages and numerous deaths. One of the key strategies to lessen the impact of the disaster is by flood modelling, which is especially beneficial in flood risk management and decision making. This paper focuses on flood modelling and simulation for a river basin using HEC-HMS software with alternative data input from rainfall data produced by weather radar (QPE). Radar QPE has the advantage of providing an areal representation of rainfall, but it is only an indirect measurement of the values. HEC-HMS is an innovative hydrologic modeling software with the advantage of a moderate processing time compared to the more sophisticated hydrodynamic models yet being reasonably accurate. The study methods include the collection and preparation of data required, such as DEM, land use, and soil type for study area of Klang River basin, Malaysia. Initially, the hydrologic model performed a calibration process using the rain gauge data in an effort to generate the best-quality hydrologic simulations. Subsequently, the rainfall inputs from the mean gridded pixel radar QPE values were then used to rerun the models. After model calibration, the result shows that the coefficient of determination, R2, for the rain gauge input is higher (0.8) compared to the radar QPE input (0.6). It is concluded that to produce more accurate results, it was recommended that radar QPE calibration was necessary to enhance the data. |
| Presentation 3<br>14:00-14:15<br>OJ5033-A | The Environmentally Relevant Concentration of Triclosan Induces $CO_2$ Emission and Microbial Metabolism in Marine Sediment<br><br>**Chi-Wei Huang**, Jai-En Cai<br>National Kaohsiung University of Science and Technology, Taiwan<br><br>*Abstract*—The emerging contaminants in urban areas might accumulate in estuary sediment through household and hospital wastewater discharge. During the pandemic, the use of disinfectants such as triclosan was increased, which might result in the higher accumulation of disinfectants in the estuary sediment and affect the microbial activity. Herein, this study aims to investigate the effects of environmentally relevant concentrations of triclosan (0.01 and 1 mg/kg wt) on microbial activity and corresponding greenhouse gas emissions. The results showed that the $CO_2$ flux was largely increased in 0.01 mg/kg TCS-spiked sediment (3.48 mg $h^{-1}$) compared with 0 mg/kg (1.10 mg $h^{-1}$) at day 7. The $CO_2$ flux in the high concentration of TCS (1 mg/kg) was similar to 0 mg/kg before day 14, but the $CO_2$ flux was significantly induced by 1 mg/kg TCS at day 14, indicating the longer adaptation periods needed for TCS. Similarly, TCS at the examined concentrations (0.01 and 1 mg/kg) substantially induced microbial activity in estuary sediment after 14-day exposure. In addition, the microbial community analysis showed that the most abundant microbe in the sediment sample was *Methanolobus* sp., and its relative abundance was increased in the TCS-spiked |

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| | sediment. Our study suggests that the environmentally relevant concentration of disinfectant TCS induces microbial activity and $CO_2$ emission in the estuary sediment, which might be associated with the increased abundance of *Methanolobus* sp. The results from the present study provide information about the emerging contaminant accumulated in estuary sediment, which might be the greenhouse gas sources and related changes of microbial community. |
| Presentation 4<br>14:15-14:30<br>OJ5023-A | Sustainability Characteristics of Regions of the Protected Areas in China: Based on the Spatiotemporal Assessment and Decoupling Analysis Between Environmental Pressure and Comprehensive Human Development Degree<br><br>**Xi He,** Zening Gao, Youbo Zhuang<br>Tsinghua University, Beijing, China<br><br>*Abstract*—Biodiversity conservation and achieving sustainable development are both important challenges nowadays, especially for the regions of the Protected Areas (PA). The Ecological Civilization Development Policy widely carried out in communities affected by PA has contributed to China's farewell to "absolute poverty" in 2020, marking a new stage of "Ecological prosperity". PA regions are recognized as having the need and urgency to go green first. However, the performance of ecological development practice and its sustainability have not been evaluated quantitatively. Research on the sustainability assessment of regional development patterns will help clarify the current state of sustainable development thereby stabilizing the efforts of ecological development. This paper takes 501 counties that are affected by 5 national parks and 477 national nature reserves in China as study areas, and collects their spatial and socioeconomic statistical data from 2015 to 2020. Using the comprehensive index method, this research constructs index frameworks for the county-level environmental pressure index (EPI) and comprehensive human development index (HDI). With the use of spatial analysis and decoupling model, the distribution maps of relative ecological prosperity and development patterns' sustainability assessment of PA regions are created. Based on this foundation, the spatial and temporal distribution features, as well as the driving factors of county development patterns, were scrutinized through cluster analysis and regression methods. The analysis indicates that: i) almost 90% of the PA counties in China have developed quickly in the past 5 years, but still 27 counties facing high risks of relative poverty; ii) nearly 80% of PA counties have achieved a win-win situation of ecological conservation and comprehensive human development, but with 136 PA counties facing challenge of a slight increase in environmental pressure; iii) In terms of sustainability assessment, 71% of the PA counties are sustainably developing with absolute decoupling in environmental pressure, however, some counties still in the state of consumption growth or even recession, which mainly locate in Northeast and Western China; ⅳ) in terms of the driving factors, those counties with low performance of sustainable development due to the increase of population density accompanied by degradation of vegetation quality, as well as the lagging social dimension development and unsustainable production practices. The results offer a valuable reference for decision makers in formulating targeted policies and measures for areas affected by PA to facilitate sustainable development strategies. |

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| Presentation 5<br>14:30-14:45<br>OJ5005-A | The Association of Bisphenol A and Paraben Exposure with Oxidative Stress and Sensorineural Hearing Loss in Children<br><br>**Chia-Huang Chang**, Chun-Ting Lu, Tai-Ling Chen, Wen-Tzu Huang, Chen-Wei Chang, Yu-Lin Yu<br>Taipei Medical University, Taiwan<br><br>*Abstract*—In early childhood development, hearing is critical to speech and language development, communication, and learning. In vitro and in vivo, bisphenol-A (BPA)/parabens (PBs) exhibited neurotoxicity through elevated levels of oxidative stress. BPA also has the potential to be an ototoxicant. Therefore, this study aimed to determine the association of exposure to BPA/PBs with oxidative stress and sensorineural hearing loss in children.<br>This cross-sectional study enrolled 433 children aged 6-12 years from elementary school. Urinary BPA and PB concentrations were analyzed by using liquid chromatography–tandem mass spectrometry. Four urinary oxidative stress biomarkers included urinary 8-hydroxy-2-deoxyguanosine (8-OHdG), 8-nitroguanidine (8-NO2Gua), 4-hydroxy nonenal mercapturic acid (HNE-MA), and 8-isoprostaglandin F2α (8-iso-PGF2α) were measured concurrently by high-performance liquid chromatography-electrospray ionization mass spectrometry. Hearing test was conducted by an audiologist in qualified hearing rooms and further confirmed by an otolaryngologist. The severity of hearing loss based on the threshold for any frequency (250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz) was classified as slight hearing loss (16 decibels hearing level (dB HL)-25 dB HL), mild hearing loss (26 dB HL to 30 dB HL), moderate hearing loss (31 dB HL to 50 dB HL), severe hearing loss (51 dB HL to 70 dB HL), and profound hearing loss (hearing loss was worse than 71 dB HL). Logistic regression models were employed to determine the association of BPA/PB exposure with sensorineural hearing loss.<br>There were 61 children with sensorineural hearing loss and the incidence of sensorineural hearing loss was approximately 15 %. No children with noise-induced hearing loss were identified (4000 Hz notches in the audiograms). Children with sensorineural hearing loss had higher BPA concentrations than normal-hearing children (0.52 ng/ml vs. 0.01 ng/ml, p=0.03) and the risk reached 1.27-fold (95% CI: 1.00-1.64) when BPA concentrations increased by 1 log10 after adjusting for covariates. No significant differences in oxidative stress existed between normal hearing and hearing loss children. Besides, the risk of slight hearing loss reached 1.88-fold (95% CI: 0.95-3.74) and 1.40-fold (95% CI: 1.00-1.96) when children had a tenfold increase in ethyl paraben (EP) and propyl paraben (PP) concentration. This study clarifies the role of exposure to BPA/PBs in sensorineural hearing loss in children |
| Presentation 6<br>14:45-15:00<br>OJ5028 | Quantification of rare earth elements in Australian and imported rice samples from different origins using ICP-MS<br><br>**Maryam Imran**, Ai Nguyen, Yasmina Sultanbawa<br>University of Queensland, Brisbane, Australia<br><br>*Abstract*—Rare earth elements (REEs) are also known as lanthanides and are |

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| | comprised of seventeen elements including lanthanum to lutetium in the periodic table. Despite their increased utilization, little attention is given to them as emerging environmental contaminants and their associated health risks. The concentration of these elements in urban and agronomic soil may trigger bioaccumulation in plants and may enter the food chain. Also, the consumption of fertilizers in agricultural practices on a larger scale is a significant challenge. The REEs enriched fertilizers are a risk factor for contamination in soil and food. However, there is very limited data in the literature regarding the occurrence of these elements in a staple food such as rice. Thus, this study is aimed at quantification of rare earth elements in Australian and imported rice samples from different countries by using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The developed analytical method was validated by using two certified reference materials (CRMs) for precision and accuracy. The method was applied for analysing rice samples (including polished, brown, and parboiled) imported from different countries and sourced locally and consumed by the Australian population. The average concentration of REEs in Australian, Thailand and Vietnamese rice samples were quantified as 0.013–2.974 µg/kg, 0.012–3.113 µg/kg, 0.009–0.919 µg/kg respectively and were lower than other countries. The highest average concentrations of REEs were found in Pakistan (0.299–128.2 µg/kg), India (0.063–20.574 µg/kg), and Sri Lankan (0.022–11.522 µg/kg) rice samples imported to Australia. Scandium and yttrium were found in the range of 107.463–85.961 µg/kg. The pattern of Light rare earth elements (LREE) was more abundant than heavy rare earth elements (HREE). This study did not include field experiments to find the translocation factors of REEs from soil to different parts of plant bodies, thus cannot establish the correlation between fertilizers and REEs concentration in rice grains. However, this study presented the general interpretation of REEs quantification in rice grains from different Countries. The outcome of this study includes filling the subsequent knowledge gaps in analysing REEs in rice. This study indicated the need to establish a monitoring program for this type of staple cereals, aiming at promoting public health. |
| Presentation 7<br>15:00-15:15<br>OJ5031-A | A Real-time Air Pollution Emission Detection and Analysis System for Vehicles<br><br>**Chi-Chun Chen**<br>National Chin-Yi University of Technology, Taiwan<br><br>*Abstract*—The term "mobile pollution sources" refers to pollutants released during various activities, with automobile emissions being a major contributor. The combustion process in vehicles releases a range of pollutants, including nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM2.5), which adversely affect both air quality and human health. This study involved the development of a device capable of real-time detection of vehicular exhaust emissions. It integrated On-Board Diagnostics II (OBDII) information to explore the impact of different driving styles on vehicle emissions. The system comprised an air pollution sensor module, a vehicle OBDII data acquisition device, a mobile app, and a backend database. The pollution sensor module detected NOx, COx, and PM2.5 and transmitted pollution data to the OBDII data acquisition device via 2.4G communication. The OBDII device acquired vehicle driving data through the CAN 2.0 interface and transmitted it to the mobile app via Bluetooth |

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| | communication. The mobile app integrated all the data and sent it to the backend database for storage through 4G/5G communication. This system facilitated comprehensive big data collection, analysis, and application related to pollution source emissions and driving behavior. Results showed that different driving behaviors indeed have a significant impact on vehicle emissions. Therefore, this system held significant practical value. It provided real-time information on pollution source emissions, which is crucial for environmental protection and policy formulation. Additionally, by studying the impact of different driving styles on emissions, the system can provide relevant suggestions to drivers, encouraging eco-friendly driving behavior. |

## Session 3: Green Energy, Energy Storage, and Energy-Saving Technologies

## 15:35-17:35 GMT+9 | January 20, 2024 (Saturday)

## Venue: カンファレンスルーム 2B（2nd floor）

## Chaired by: Prof. Jihyun Hwang, Korea Institute of Energy Technology, South Korea

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| Presentation 1<br>15:35-15:50<br>OJ6005 | Ground-Source Direct Radiant Cooling System Using Existing Overhead and Underground Water Storage Tanks for South Asian Weather<br><br>**Antash Najib** and M. Ahmed Memon<br>National University of Science & Technology, Islamabad, Pakistan<br><br>*Abstract*—Various research projects are increasingly focused on achieving net-zero operations by minimizing building energy consumption. Radiant cooling systems can help reduce energy consumption, but they are often complex and expensive. This study evaluates the performance of a low-cost ground-source direct radiant floor cooling system for a four-story residential home in Karachi. The system uses cold water from an existing underground concrete storage tank commonly found in South Asia, which is supplied to the radiant floor system covering half of the top floor. The water then flows up to an existing overhead storage tank where it can be used to supply building water needs. The system supplements existing air-air split air-conditioning units without requiring extensive modification. The study used an infrared thermometer to measure the temperature of the water in the underground tank and the air temperature of the floor between 1 PM to 5 PM for several days. A mathematical model based on Engineering Equation Solver (EES) was used to estimate the cooling capacity of the system and potential energy savings. The results show that when the air temperature is maintained at 25°C, the radiant system can provide an average cooling capacity of 12 $Wm^{-2}$. Compared to the existing air-conditioning system, the system would save 319 W of electricity, with less than 3 W of additional pumping power due to pressure loss in the radiant pipes. Developing detailed models of building load and underwater tank heat transfer and validating the results using an experimental setup may lead to further insights. |
| Presentation 2<br>15:50-16:05<br>OJ5026 | Effect of the Addition of Hydrotalcite in the Pyrolysis of Unutilized Wood on Gas Production<br><br>**Miyuu Arai**, Akie Ri, Yua Kodama, Yuko Katako and Naoyuki Morita<br>Tokyo Metropolitan High School of Science and Technology, Tokyo, Japan<br><br>*Abstract*—Reduction of carbon dioxide emissions from the use of fossil fuels is taking place in many countries. In addition, thermal power generation is damaging the environment. Japan has declared that it will reduce its emissions of greenhouse gases, including $CO_2$, to zero by 2050. Japan is a forest-resource-rich country, and more than 70% of its land area is covered by forest. In recent years, however, Japan's forestry industry has decreased owing to the increase of imported timber and the increase in concrete construction. In this study, |

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| | synthetic hydrotalcite ($Mg_{1-x}Al_x(OH)_2(CO_3)_{x/2}\cdot mH_2O$) was added to unused cedar wood during pyrolysis and gasification at low temperature, and its effect on the production of combustible gases, $CH_4$, $C_2H_4$, $C_2H_6$, $C_3H_6$ and $C_3H_8$, was investigated. A mixture of cedar wood, which was undistributed after being cut in Japan, and a predetermined amount of synthetic hydrotalcite was placed in a metal reactor and subjected to pyrolysis under a nitrogen atmosphere at temperatures up to 500 °C. The mixture was then heated to a temperature of 500 °C. The components of the gas produced by pyrolysis were $CH_4$, $C_2H_4$, $C_2H_6$, $C_3H_6$, $C_3H_8$, and $CO_2$. The amount of synthetic hydrotalcite addition during pyrolysis affected the amounts of the combustible gases produced. |
| Presentation 3<br>16:05-16:20<br>OJ5048-A | Influence of Osteoporosis on the Blood Lead Levels in Postmenopausal Women Aged over 50 Years: Data from the Korea National Health and Nutrition Examination Survey<br><br>**Hyejin Park, Kisok Kim**<br>Dongduk Women's University, Seoul, Republic of Korea<br>Keimyung University, Daegu, Republic of Korea<br><br>*Abstract*—**Background**/Aim Lead, a major environmental pollutant, is emerging as a significant risk factor for osteoporosis. In adults, roughly 80- 90% of absorbed lead accumulates in bones. These deposits of bone lead are released into the bloodstream during periods of enhenced bone resorption, such as menopause, serving as a potential source of endogenous lead supply. Postmenopausal women are at a higher risk for bone lead release because of hormonal and age-related changes in bone metabolism. The objective of this study was to evaluate the association between blood level of lead and prevalence of osteoporosis in postmenopausal women.<br>**Methods** This study included 1,301 women aged 50 years or older who were recruited using stratified random sampling of Korean census blocks. Demographic characteristics and medical history of osteoporosis were collected from participants by questionnaire, and lead levels were determined by an analysis of blood samples.<br>**Results** We found that demographic factors such as body mass index, education, income, and smoking were important covariates determining blood lead concentration. In addition, age and education were important demographic variables affecting the prevalence of osteoporosis. After adjusting for demographic factors, blood lead concentrations were negatively associated with prevalence of osteoporosis [odds ratio (OR), highest vs. lowest tertile=0.55; 95% confidence interval (CI), 0.35-0.86; p for trend < 0.001].<br>**Conclusions** Lead body burden and osteoporosis prevalence vary across demographic characteristics, and incidence of osteoporosis was related to a decreased blood level of lead in postmenopausal women. The findings suggest that osteoporosis-related bone mass loss in postmenopausal women may trigger the mobilization and excretion of accumulated heavy metals from the bones, resulting in a reduction in blood lead levels. |

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| Presentation 4<br>16:20-16:35<br>OJ1002 | Performance Assessment of a Thermoelectric Heat Pump Heat Recovery Ventilator<br><br>**Erik Ridings**, Stephen Harrison and Lucio Mesquita<br>Queen's University, Kingston, Canada<br><br>*Abstract*—Heat recovery ventilators (HRVs) are used to conserve energy by transferring heat between exhaust and intake ventilation airstreams in buildings. While conventional HRVs use "fixed-plate" heat exchangers, the addition of thermoelectric modules (TEMs) to act as compact solid-state heat pumps can increase heat transfer between the airstreams. For this study, a TEM-based heat recovery ventilator (TEM HRV) was tested to quantify its performance at a range of operational conditions typical of residential installations. Conventional heat pump Coefficients of Performance (COPs) were calculated for each test and increased significantly with decreasing applied current. However, as total heat transfer across the TEM HRV is due to conduction, as well as the thermoelectric-driven heat transfer, the thermoelectric input factor (TEIF) was found to be a more representative indicator of TEM HRV performance improvement. |
| Presentation 5<br>16:35-16:50<br>ISG003 | Design and Comprehensive Optimization of a Serpentine Forced Convection Flow Field Structure for PEMFC Bipolar Plate<br><br>**Peijian Lin**, Yang Zhao, Dehui Yang, Hongyu Wang and Juncai Sun<br>Dalian Maritime University, Dalian,China<br><br>*Abstract*—Proton exchange membrane fuel cell (PEMFC) has received wide attention in the field of green energy due to its high efficiency and environmental friendliness. Bipolar plate plays an important role in the allocation of reactant gases and removal of products in PEMFC. The acts of maintaining the membrane electrode assembly, collecting electrons, and conducting heat are all carried out in the fuel cell by the bipolar plates. The flow field design of bipolar plate directly affects the heat and mass transfer capability and fuel cell output performance. Among the flow fields, setting blocks in a single straight channel has been proven effective. However, higher pressure drop can lead to adjustments in the strategy of blocking the serpentine flow channel. In recent studies, serpentine flow field channels with added blocks are proposed. The influence of block setting on flow field performance and mass transfer has been numerically studied. The results indicate that a balanced block size is required. Selecting blocks with larger volume and a height equal to the channel will severely limit the benefits of forced convection generated by the novel flow field. The optimized block can significantly improve mass transfer and drainage capacity in the serpentine flow field straight channel section. |
| Presentation 6<br>16:50-17:05<br>ISG005 | Information Security Risk Assessment of Smart City in China Based on AHP-GA and Triangular Fuzzy Number<br><br>Pengcheng Xiang, **Yiting Wang** and Simai Yang<br>Chongqing University, Chongqing, China |

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| | *Abstract*—Rapid urbanization and population growth has led to drastic degradation of urban ecosystem regulation services (ERS) and thus, preparation of measures to respond to them has been urgently needed. However, improving urban ERS are difficult in highly urbanized areas because it is almost impossible to create new, large green spaces. Consequently, relatively small green infrastructure including pocket parks, green roofs, and street trees are gaining attention as measures that can increase the functions of urban ERS. This study delineated applicable areas small green infrastructure by applying geographic information system (GIS) spatial analysis. The improvements of urban ERS including carbon storage capacity (CSC), flood-risk mitigation capacity (FMC), and heat stress reduction capacity (HSRC) due to additional small green infrastructure were analyzed. The study was applied to vulnerable areas of urban ERS in city of Suwon. The results show that applicable area of pocket parks in the study area is 873m2. Applicable areas of rooftop greening were determined to be 94,489m2, which is about 50% of the total area of rooftops in the city. In addition, the results also found that street trees could be planted on sidewalks with an area of 21,618m2. The variations of curve number (CN), carbon storage capacity (tC), and average evapotranspiration index were investigated to identify the improvement effects on the urban ERS. These results concluded that introducing additional small green infrastructure led to improved effects of 8.72% on CSC, 2.68% on FMC, and 23.03% on HSRC. Through such a case study, the effects of expanding small green infrastructure in an actual location was analyzed in detail. With the growing need to improve urban ERS due to rapid climate change, the study results can be utilized to establish spatial alternatives that reduce urban ERS vulnerability and enhance the function of urban ERS. |
| Presentation 7<br>17:05-17:20<br>OJ1011 | Slovenia in 2055 on Renewables<br><br>**Andrej Senegačnik**<br>University of Ljubljana, Ljubljana, Slovenia<br><br>*Abstract*—Slovenia's desired green transition by 2055 is discussed. Europe should in 2055 achieve climate neutrality with near zero greenhouse gas emissions. The starting point of the research is the energy balance of Slovenia for 2019. The possibilities and potentials of Slovenia for the use of RES resources are presented. Photovoltaic modules with system seasonal energy storage in the form of potential water energy are selected as the main, technologically mature, RES technology. In the analysis, an increase in food self-sufficiency to 80% and complete energy self-sufficiency without fossil fuels and nuclear energy are predicted. The obtained results show the technical impossibility of such politically imposed ideas. |
| Presentation 8<br>17:20-17:35<br>ISG006-A | Strengthening the Bedrock of Smart Cities: Key Risk Management for Cross-Regional Intercity Railway Infrastructure Based on SNA<br><br>Pengcheng Xiang **Simai Yang** and Yiting Wang<br>Chongqing University, Chongqing, China<br><br>*Abstract*—Smart city requires extensive new infrastructure to support its development as a novel stage in urban evolution. Cross-regional intercity railway |

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| | infrastructure (CIRI) is a crucial component in the new infrastructure framework, facilitating interconnectivity between cities. The demand for CIRI is increasing, with a focus on incorporating smart development initiatives. Its role in promoting smart city growth is vital, but its cross-regional nature has triggered competition among regions. Unlike traditional transportation infrastructure, CIRI often involves the delicate balance of interests, coordinated development, and social equity among local governments. These distinctive characteristics amplify the complexity of risks associated with CIRI, while the risk interactions further compound the challenges in controlling key risks. Existing studies on CIRI risks have been deficient in considering the perspective of risk interactions and have lacked investigation into the cross-regional dynamics of the subject matter. Hence, this study adopts a perspective of risk interactions and, through literature review and case studies, identifies 35 risk factors based on external threats and internal vulnerabilities. Subsequently, employing Social Network Analysis (SNA), it unveils the risk landscape within the whole network and ego network, while exploring the key risks associated with CIRI. The findings reveal that key risks influencing CIRI include governmental fragmentation, unregulated competition among regions for development resources, and imbalanced economic development within the administrative regions traversed by the project. The cross-regional nature of CIRI profoundly impacts the evolution of overall risks, with external threat-related risks outweighing internal vulnerability-related risks. The development of CIRI necessitates focused attentions on the political relationships, economic disparities, environmental variations, and social competition among regions, emphasizing the need for enhanced regional collaborative governance. This study develops a systematic approach for analyzing the key risks of CIRI, effectively considering the intricate interplay between risks. Consequently, this study contributes to optimizing risk management strategies pursued by various stakeholders involved in CIRI, thereby promoting its high-quality development and further empowering the smart city. |

## Session 4: Waste Utilization, Resource Recovery, and Sustainable Development

## 15:35-17:20 GMT+9 | January 20, 2024 (Saturday)

## Venue: ミーティングルーム 2E（2nd floor）

## Chaired by: Prof. Kokyo Oh, Center for Environmental Science in Saitama, Japan

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| Presentation 1<br>15:35-15:50<br>OJ0001-A | Study on the Effects of Paddy Field Use Patterns During Non-irrigated Seasons on Soil Water and Snails in Japan<br><br>**Kokyo Oh**, Tetsushi Yonekura, Yugo Isobe and Makoto Miwa<br>Center for Environmental Science in Saitama, Saitama, Japan<br><br>*Abstract*-Paddy fields are ecosystems with abundant biodiversity. Paddy field use patterns in Japan are generally mono-cropping fields and double-cropping fields. However, few studies so far have investigated the effects of the paddy field use patterns on aquatic organisms during the non-irrigated season in Japan. In this study, we investigated the dynamic changes of soil moisture and the survival of snails in the soil during the non-irrigated season in the mono-cropping paddy fields and rice-wheat double cropping fields.<br>Ten mono-cropping paddy fields and eight rice-wheat double-cropping paddy fields of the same farmer in Kazo City, Saitama Prefecture, Japan were surveyed. After the rice harvest, the population of snails was quantitatively investigated in each study paddy field using a square frame sized 50 cm x 50 cm. Changes in soil moisture content over time were monitored with a SMEC300 sensor (Spectrum Technologies Inc., USA).<br>Snails were detected in all mono-cropping paddy fields, while only in two rice-wheat double-cropping paddy fields. Regarding the snail species, the Cipangopaludina chinensis malleata (Japanese Ministry of the Environment Red List 2020: Endangered species II) were detected in one mono-cropping paddy field and the Sinotaia quadrata histrica in the other paddy fields. It was found that the average population density of snails in the mono-cropping paddy fields was significantly higher than that in the rice-wheat double-cropping paddy fields. Soil moisture content tended to be higher in mono-cropping paddy fields than that in double-cropping paddy fields. We also found that the population density of snails tended to be higher in the fields with higher soil moisture content. Our study showed that the lower soil moisture content in the rice-wheat double-cropping paddy fields compared to the mono-cropping paddy fields possibly strongly affected the survival of snails during the non-irrigated period. (The authors are sincerely thankful to Dr. N. Yasuno for his guidance and cooperation in this study, and Hayakawa Farm Ltd. for providing the survey fields and management information) |
| Presentation 2<br>15:50-16:05<br>OJ5046-A | Recycling Solid Recovered Fuel's Ashes to Produce Pavement’s Binder<br><br>**Ying-Chu Chen**<br>National Taipei University of Technology, Taiwan |

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| | *Abstract*—Pavements are critical assets of transportation infrastructure. Construction of pavements requires energy-intensive processes and materials with adverse impacts on the environment. Sustainable pavements are highly dependent on selection of appropriate materials. Recycled concrete aggregates composed of ages concrete aggregates, bricks, glass, gypsums, and ceramic have been widely applied as backfilling materials. Wastes like glass, plastic, and rubbers as binder or bitumen modifiers, or aggregate replacement in civil engineering. The demand of binder modifiers/additives is helpful for boosting the performance of pavement structure.<br>In 2011, the European Union (EU) introduced new standards for a renewable energy derived from solid recovered fuel (SRF). The SRF is exclusively produced from non-hazardous solid waste, including mixed municipal solid waste (MSW) and/or industrial wastes. SRF is increasingly being regarded as a potential fuel rather than as waste, and several nations, including Italy, France, Germany, the United Kingdom, Austria, Spain, Finland, India, South Korea, and Taiwan, have established their own specifications, classes, and final uses for SRF. To filling the research gap, this study collected ashes from SRF factories in Taiwan to produce binders to connect surface bricks and concretes. The surface area of road was ca. 532.8 $km^2$ equals to 1.5% land area of Taiwan. The results of this study support the circular economy goal of recycling ashes produced from SRF into civil and environmental applications. |
| Presentation 3<br>16:05-16:20<br>OJ5025 | Effects of Hydrotalcite on the Recovery of Metals by Pyrolysis of Epoxy Resin Glass-coated Substrates<br><br>**Chisato Inaba**, Miyuu Arai, Kei Masuda, Shina Momiyama and Naoyuki Morita<br>Tokyo Metropolitan High School of Science and Technology, Tokyo, Japan<br><br>*Abstract*—Approximately 22.18 million units of electrical and electronic equipment have been shipped in Japan, whereas only 11.7 million home appliances were collected under the Home Appliance Recycling Law. Although precious metals can be recovered from such devices, this recovery is rarely practiced in the case of small home appliances. This situation is problematic because the disposal of printed circuit boards in landfills can result in the leaching of heavy metals and bromine-based flame retardant chemicals into groundwater. Unfortunately, the thermoset resins employed in these units are not readily recycled and may require special pre-treatment. The work reported herein added a synthetic hydrotalcite to epoxy resin glass-coated substrates prior to pyrolysis to allow the safe recovery of useful metals and the capture of toxic bromine compounds. This hydrotalcite was found to promote substrate decomposition through a catalytic effect together with hydrolysis. Bromine-based byproducts were also captured by the hydrotalcite. |
| Presentation 4<br>16:20-16:35<br>OJ5003-A | Studying the Impact of Extracellular Polymeric Substances (EPS) on the Interaction Between Biofilms and Corrosion of Marine Steel Contributes to Achieving Sustainable Goals in Recycling<br><br>**Hsin-Yi Wen**, Fu-Chuan Pan<br>National Kaohsiung University of Science and Technology, Taiwan |

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| | *Abstract*—In recent years, the global increase in trade and services has led to a significant rise in demand for air and sea transportation. Taiwan, with its strategic geographical location, has followed this trend driven by market demand. However, ships face various harmful factors in the ocean during transportation, such as biofouling and corrosion, which can damage the hull and increase transportation costs. Therefore, the application of protective coatings on ships has become crucial to mitigate these risks.<br>Utilizing marine bacterial biofilms to protect marine materials from corrosion is a promising strategy. However, the mechanisms behind this attractive anti-corrosion method are not well understood. In this study, the effects of Vibrio alginolyticus, a marine bacterium, on the corrosion behavior of SS400 steel plates were investigated. Electrochemical analysis revealed a decrease in corrosion current with bacterial growth, indicating significant anti-corrosion protection by extracellular polymeric substances (EPS). Furthermore, the anti-corrosion performance of EPS was closely related to its ability to form a biofilm, with factors such as nutrient substances and dissolved oxygen in seawater directly affecting biofilm growth. To further investigate the anti-corrosion mechanisms induced by marine biofilms, bacterial cultures of Vibrio alginolyticus (ATCC® 17749) were grown using Glutamic acid, Carboxymethyl cellulose, Humic acid, Thymine, and Alginic acid as bacterial nutritional components. These cultures were then added to a 3.5wt% NaCl aqueous solution for biocorrosion testing. The results demonstrated that EPS could inhibit corrosion, indicating the crucial role of seawater nutrient substances in the anti-corrosion protection provided by biofilm EPS. This research has positive implications for the overall environment. Constructing EPS coatings for （Sustainable Development Goals, SDGs）environmentally friendly sustainable development, carbon steel paint anti-rust and anti-fouling system, and salinity sensing will be notable developing technologies. |
| Presentation 5<br>16:35-16:50<br>OJ5027 | Effect of Hydrotalcite Addition on Gasification During the Pyrolysis of Food Waste<br><br>**Yuko Katako**, Miyuu Arai, Chisato Inaba, Shina Momiyama and Naoyuki Morita<br>Tokyo Metropolitan High School of Science and Technology, Tokyo, Japan<br><br>*Abstract*—Approximately 1.3 billion tons of food waste, or one-third of the food produced globally, is generated annually, which is enough to feed 2 billion people. Food waste is generated throughout the supply chain, during the procurement of raw materials for products, manufacturing, sales, and consumption. Furthermore, food waste is one of the most significant environmental problems. Although reductions in carbon dioxide emissions are being made around the world and are attributed to the use of fossil fuels, food waste involves the loss of various resources that are necessary elements in the production process and the release of greenhouse gases that contribute to climate change. In this study, synthetic hydrotalcite ($Mg_{1-x}Al_x(OH)_2(CO_3)_{x/2}\cdot mH_2O$) was added to simulated food waste (cooked rice), and its effect on the production of combustible gases ($CH_4$, $C_2H_4$, $C_2H_6$, $C_3H_6$, and $C_3H_8$) during pyrolysis at 500 °C was examined. Changing the concentration of synthetic hydrotalcite affected the yield of combustible gases. |

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| Presentation 6<br>16:50-17:05<br>OJ5040 | A Study on Conservation for Regional Landscape and Cultural Heritage through Smart Tourism: Case Studies from Barcelona, Amsterdam, and Venice<br><br>**Youkang Seo**<br>Seoul National University, Seoul, Seoul, Republic of Korea<br><br>*Abstract*—This research investigates the implementation and impact of smart tourism strategies in Barcelona, Amsterdam, and Venice. It focuses on how these strategies contribute to protecting local landscapes and cultural heritage, a critical aspect given tourism's growing challenges. In Barcelona, the study explores the effective use of IoT technology for managing tourist flow and mitigating overcrowding. This approach has enabled a deeper understanding of tourist behaviors and movements, facilitating more efficient urban planning and management.<br>In Amsterdam, the research highlights the innovative use of AR and VR technologies. These digital tools have been instrumental in creating virtual experiences of historical places, thus reducing physical visitation pressure and preserving cultural heritage. They provide educational and engaging tourist experiences while protecting physical sites from over-tourism.<br>Venice's case study reveals how smart technologies like Wi-Fi trackers, GPS data, and CCTV have been employed for real-time monitoring of tourist patterns, assisting in diverting tourists from congested areas to less crowded ones. This strategy not only alleviates overcrowding in popular areas but also aids in the protection of the city's historic districts.<br>The findings suggest that smart tourism strategies can significantly contribute to sustainable urban development and cultural preservation. These strategies are essential in understanding and managing tourist behavior, innovating traditional tourism management, and enhancing tourist experiences while safeguarding cultural heritage. The research provides valuable insights for city managers and policymakers, emphasizing the practical application of smart technology in tourism. It also underscores the need for further studies in diverse regional contexts to understand the broader implications and sustainability of smart tourism strategies. |
| Presentation 7<br>17:05-17:20<br>OJ5037 | Towards a Disaster Resilient City through Coastal Flood Analysis: Study Case of Semarang<br><br>**Tia Rizka N. Rachma**, Raldi Hendro T. Koestoer and Chotib<br>Universitas Indonesia, Jakarta, Indonesia<br><br>*Abstract*— The Semarang coastline faces a growing threat from natural disasters, with coastal floods becoming increasingly common due to a combination of natural occurrences and human activities. This has raised significant concerns for both communities and the coastal ecosystems, necessitating a comprehensive understanding of the situation. This research has a dual focus: firstly, to assess the impact of coastal flooding on Semarang's settlements, and secondly, to comprehend the local community's responses to improve coastal management strategies. Utilizing satellite imagery, topographic maps, interviews, and location |

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| | coordinates, the study revealed that affected residential areas were distributed across various sub-districts. Interestingly, not all coastal communities were impacted, indicating the need for tailored protective measures. The research also highlighted community efforts in the past decade, particularly substantial mangrove reforestation, contributing to the long-term resilience of coastal ecosystems. The study concludes that most residents have improved their infrastructure and received assistance from various entities to mitigate the consequences of coastal flooding, providing valuable insights for enhancing the effectiveness and sustainability of coastal management in Semarang. |

## Poster Session

## 17:35-17:50 GMT+9 | January 20,2024 (Saturday)

## Venue: カンファレンスルーム 2B（2nd floor）

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| OJ1004 | Bayesian Optimization-Enhanced Deep Learning for Wind Speed Forecasting<br><br>**Chia-Ching Lai** and Heng-Yi Su<br>National Taiwan Ocean University, Taiwan<br><br>*Abstract*—This study aims to address the challenges posed by international net-zero carbon emission initiatives and the growing environmental awareness. The increasing share of clean energy sources in the energy grid brings forth a series of technological and stability risks. Accurate prediction of the electrical characteristics of clean energy and a comprehensive understanding of the generation patterns and trends in the short term, ranging from minutes to several days, could significantly reduce the uncertainty in system operation. This paper utilizes a Bayesian optimization algorithm based on deep learning neural networks for the development of an hourly wind speed prediction model in wind power generation. The algorithm is capable of optimizing both the model architecture and hyperparameters of deep learning neural networks. It is particularly well-suited for optimizing hyperparameter factors in regression and classification models that are non-continuous, non-differentiable, and computationally intensive. This optimization process aims to enhance the accuracy of clean energy prediction while reducing the time-consuming procedures typically associated with traditional hyperparameter exploration methods. To demonstrate the effectiveness and versatility of the Bayesian optimization algorithm employed in this paper for wind power generation prediction, the study will utilize hourly wind power generation data from ten wind farms in Australia spanning from 2012 to 2013. The prediction target will be the wind speed at a height of 100 meters, and various types of model performance validations will be conducted. |
| OJ1006 | Enhancement of System Resilience for Islanded Microgrid with Clean Energy<br><br>**Cheng-I Chen**, Guo-Hao Zhu, Shin-Kuan Chen, Chung-Hsien Chen and Jui-Ying Chen<br>National Central University, Taiwan<br><br>*Abstract*—Enhancement of system resilience of microgrid is important when the system is operated in the islanded mode. The commonly used clean energy in microgrid is the intermittent renewable energy which would deteriorate the system resilience of microgrid. To solve this problem, the residual energy pre-served in the energy storage system is introduced in this paper to extend the time duration of fundamental load demand when the power outage is present. The experiment is implemented in the demo system in the campus of National Central University to verify the performance of proposed management strategy. |

## Note