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International Conference on Applied Energy

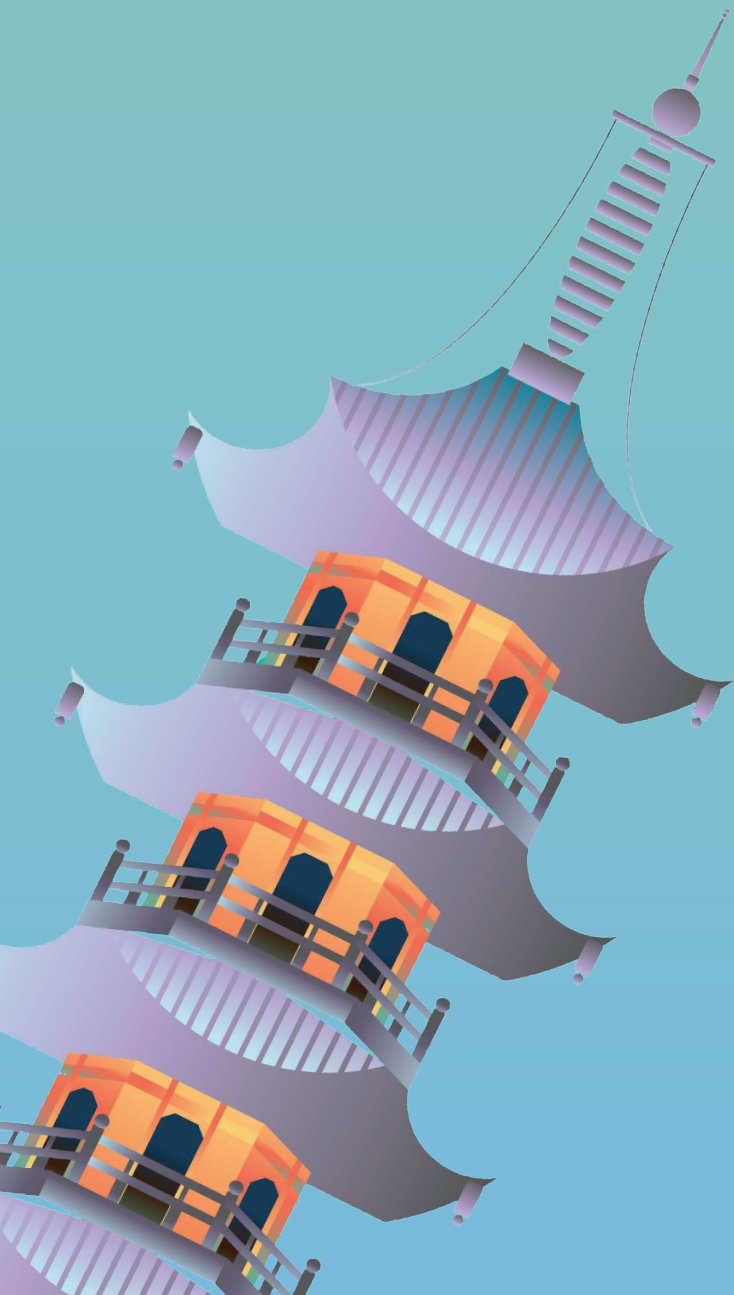
CEN2022: Applied Energy Symposium

CLEAN ENERGY

TOWARDS CARBON NEUTRALITY

April 23-25, 2022

NINGBO, CHINA



- **Welcome to CEN2022**
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Welcome to the CEN2022-Applied Energy Symposium 2022: Clean Energy towards Carbon Neutrality.

Whilst energy has always provided the foundation for social and economic development worldwide, the rapid rise in energy consumption has led to significant pressure on global energy reserves and the environment. There is a growing consensus that the factors of 'clean' and 'sustainable' are becoming increasingly relevant in the energy sector. Hence, there is a global demand for clean, sustainable and cost-effective energy to fuel current and future developments, but not at the expense of the environment. It is a collective effort to meet such targets and it is essential that the energy policy makers are more informed and deliberate now more than ever. With Clean Energy as the main focus of this symposium, the CEN2022 aims to provide a knowledge exchange and transfer platform for international leading researchers, industrial experts and policy makers to share recent advances, experience and expertise in the area of clean energy and its associated studies, and thus fuel the advancement towards a carbon neutral and greener future.

The CEN2022 will be held on April 23-25, 2022 in the city of Ningbo, one of the most vibrant and dynamic cities in China. The three-day event is jointly organized by Applied Energy and the Applied Energy Innovation Institute (AEii), and jointly hosted by the Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute, University of Nottingham Ningbo China and Zhejiang University.

The symposium will include keynotes, invited talks, plenary sessions, oral presentations and poster sessions. Outstanding papers will be considered for full publication in a special issue of Applied Energy (Ranked 1/185 in Engineering, IF of 9.746, CAS Q1, Top Journal, <https://www.journals.elsevier.com/applied-energy>).

For more detailed and updated information on the conference, please visit the official website at www.applied-energy.org/cen2022, or contact the Organizing Chairs Prof. Tao Wu or Prof. Xiang Gao at cen2022@applied-energy.org.

We look forward to welcoming you in Ningbo.

Symposium Co-Chairs

Prof. Tao WU

Vice Provost for China Beacons Institute, University of Nottingham Ningbo, China

Prof. Xiang GAO

Dean of the College of Energy, Zhejiang University

Prof. Jinyue YAN

Editor-in-chief of Applied Energy and Advances in Applied Energy



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 Prof. Xiang GAO (Co-Chair)
 Prof. Jinyue YAN (Co-Chair)

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Dr. Kaiqi SHI	Dr. Kam Loon FOW
Dr. Xiang LUO	Dr. Yang MENG
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 Dr. Zheng WANG
 Dr. Xiang LUO
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 Dr. Yuxin YAN

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 Prof. Jianzhong WU (Co-Chair), Co-Editor-in-Chief, Applied Energy
 Prof. Zita VALE (Co-Chair), Co-Editor-in-Chief, Applied Energy
 Prof. Siaw-Kiang CHOU (Co-Chair), Assoc. Editor, Applied Energy
 Prof. Umberto DESIDERI (Co-Chair), Assoc. Editor, Applied Energy

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H. B. Sun, China	H. G. Jin, China	H. L. Li, Sweden
H. M. Xu, UK	J. Hetland, Norway	J. Milewski, Poland
J. Whalen, Canada	J. Z. Wu, UK	K. Hubacek, The Netherlands
K. Yoshikawa, Japan	L. Kazmerski, USA	M. K. H. Leung, Hong Kong
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R. Span, Germany	S. A. Kalogirou, Cyprus	S. Garimella, USA
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Y. Yamagata, Japan	Z. Y. Luo, China	T. Wu, China
C. H. Pang, Malaysia	X. Gao, China	F. C. Wang, China
E. Lester, UK	G. Zhu, China	L. Chen, China
Y. D. Wang, UK	X. N. Wang, China	



Prof. Zhonglin WANG

Beijing Institute of Nanoenergy and Nanosystems,
Chinese Academy of Sciences, Beijing, China.
Georgia Institute of Technology, Atlanta

Topic:

Triboelectric nanogenerators for harvesting high entropy energy

Abstract:

The triboelectric nanogenerators (TENGs) were invented by us in 2012, which has great potential for distributed energy and self-powered systems, with applications in internet of things, environmental/infrastructural monitoring, medical science, environmental science and security. In this talk, we first present the physics mechanism of triboelectrification for general materials. Our model is extended to liquid-solid contact electrification, reviving the classical understanding about the formation of electric double layers and its possible impact to interface chemistry. We will present the applications of the TENGs for harvesting all kind mechanical energy that is available but wasted in our daily life, such as human motion, walking, vibration, mechanical triggering, rotating tire, wind, flowing water and more. Then, we will illustrate the networks based on triboelectric TENGs for harvesting ocean water wave energy, for exploring its possibility as a sustainable large-scale blue energy. Lastly, we will show that TENGs as self-powered sensors for actively detecting the static and dynamic processes arising from mechanical agitation using the voltage and current output signals.

[1] Z.L. Wang and A.C. Wang “On the origin of contact electrification” (Review), *Materials Today*, 30 (2019) 34-51; <https://doi.org/10.1016/j.mattod.2019.05.016>

[2] S. Lin#, X. Chen#, and Z.L. Wang* “Contact-electrification at liquid-solid interface” (Review), *Chemical Review*; <https://doi.org/10.1021/acs.chemrev.1c00176>

[3] Z.L. Wang “From contact electrification to triboelectric nanogenerators” (Review), *Report on Progress in Physics*, 84 (2021) 096502; <https://doi.org/10.1088/1361-6633/ac0a50>

[4] Z.L. Wang “ On the expanded Maxwell’s equations for moving charged media system – general theory, mathematical solutions and applications in TENG” *Materials Today*; <https://doi.org/10.1016/j.mattod.2021.10.027>

[5] Z.L. Wang* “ Maxwell’s equations for a mechano-driven, shape-deformable, charged media system, slowly moving at an arbitrary velocity field $v(r,t)$ ”; <http://arxiv.org/abs/2202.13768>

[6] Z.L. Wang, “On the first principle theory of nanogenerators from Maxwell’s equations”, *Nano Energy*, 68 (2020) 104272; <https://doi.org/10.1016/j.nanoen.2019.104272>

Short Bio:

Prof. Zhong Lin Wang is the Director of the Beijing Institute of Nanoenergy and Nanosystems, Chinese Academy of Sciences, and Regents' Professor and Hightower Chair at Georgia Institute of Technology. Dr. Wang pioneered the nanogenerators field for distributed energy, self-powered sensors and large-scale blue energy. He coined the fields of piezotronics and piezo-phototronics for the third generation semiconductors. Among 100,000 scientists across all fields worldwide, Wang is ranked #3 in career scientific impact, #1 in Nanoscience, and #2 in Materials Science. His google scholar citation is over 320,000 with an h-index of over 273.

Dr. Wang has received the Celsius Lecture Laureate, Uppsala University, Sweden (2020); The Albert Einstein World Award of Science (2019); Diels-Planck lecture award (2019); ENI award in Energy Frontiers (2018); The James C. McGroddy Prize in New Materials from American Physical Society (2014); and MRS Medal from Materials Research Soci. (2011). Dr. Wang was elected as a foreign member of the Chinese Academy of Sciences in 2009, member of European Academy of Sciences in 2002, academician of Academia of Sinica 2018, International fellow of Canadian Academy of Engineering 2019. Dr. Wang is the founding editor and chief editor of an international journal *Nano Energy*, which now has an impact factor of 17.88. Details can be found at: <http://www.nanoscience.gatech.edu>



Prof. Jesse Zhu

**Nottingham Ningbo China Beacons of Excellence
Research and Innovation Institute
Western University, Canada**

Topic:

Fluidized Beds for Biomass Energy: Pilot or Industrial-Scale Applications

Abstract:

Many industrialized nations are boosting their use of biomass fuels for transportation and electricity generation in order to reduce CO₂ emissions from fossil fuel consumption and to reach Carbon Neutrality in the near future. Biomass is converted to energy through a variety of processes, including combustion, pyrolysis, and gasification, to generate heat, electricity, and biofuels. While researchers are developing these approaches towards successful demonstration or industrial implementation, fluidized bed technology plays a critical role because of its fluid material handling, superior heat and mass transfer characteristics, and versatile reactor configurations. This talk will provide an overview of the working principles of fluidized bed reactor, its hydrodynamics and flow structure, as well as reactor performance, which have led to its widespread use in biomass energy. Some of the most important pilot and industrial-scale applications of fluidized beds for biomass combustion, pyrolysis, and gasification will be reviewed.

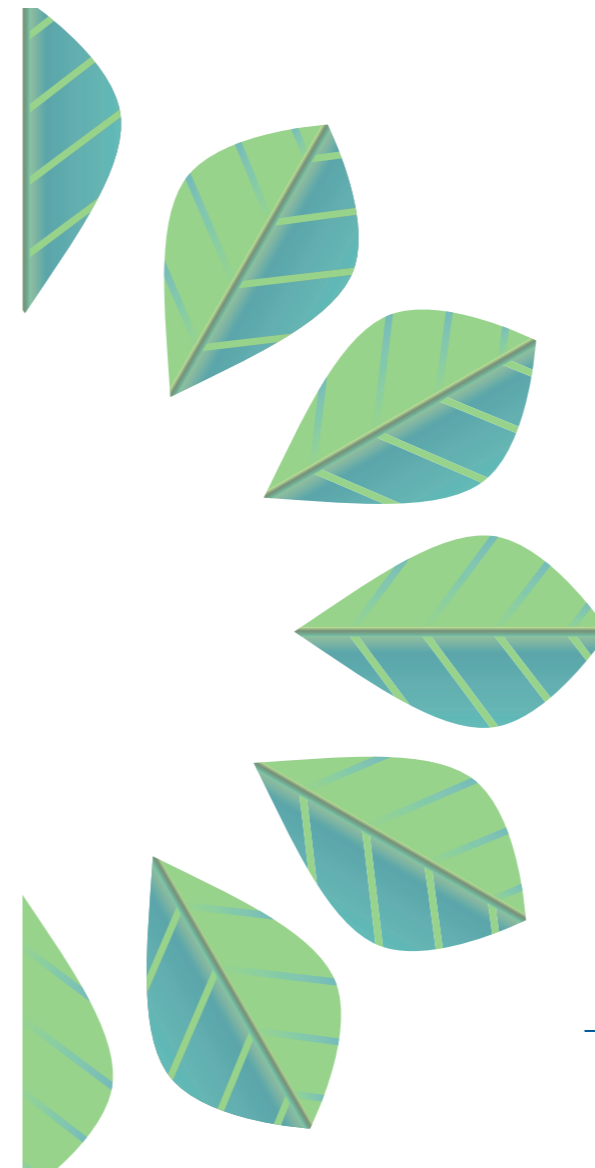
Short Bio:

Dr. Jesse Zhu is a Distinguished University Professor and Canada Research Chair at Western University in Canada. He is also a Fellow of Royal Society of Canada, Canadian Academy of Engineering, Engineering Institute of Canada and Chemical Institute of Canada.

With a B.Eng. from Tsinghua University (1982) where he also worked for 2 years as a Junior Lecturer, and a PhD from the University of British Columbia (1988), he first worked as a Research Scientist for Shell in Europe and UBC for a couple of years. In 1993, he joined Western University where he attained full professorship and established the Particle Technology Research Centre in 1999. As a world leading academic in particle technology, Zhu has 500 referred journal publications, 50 plus

patents, and over 260 graduate students and postdoctoral fellows supervised. In addition to fundamental research, he is particularly active in technology development and transfer, with some commercialized or being commercialized.

Zhu has received many awards including the R.S.Jane Memorial Award (the highest from Canadian Society of Chemical Engineering), the Elsevier Lifetime Achievement Award (the highest particle technology award from American Institute of Chemical Engineers), the Professional Engineers Engineering Medal, and the Hellmuth Prize for Achievement in Research (the highest from Western University).





Prof. Dongxiao ZHANG

Southern University of Science and Technology

Topic:

Intelligent Energy System

Abstract:

In the face of environmental changes, many countries have put forward a timetable for carbon neutrality to realize the sustainable development of mankind. The key to achieving carbon neutrality lies in optimizing the energy structure in an intelligent manner. The high-efficiency and low-cost development of primary energy and the economic and safe operation of secondary energy are the basis of an intelligent energy system. This report introduces the latest research progress of the so called intelligent energy technologies that combine data (AI) and knowledge (model) dual-driven approaches with automatic sensors, and applies them to the forecasting of electricity demand and renewable energy generation, laying the foundation for the safe and reliable operation of clean energy systems.

Short Bio:

Professor Zhang is a Chair Professor at Southern University of Science and Technology (SUSTech). He had held positions as Senior Scientist at Los Alamos National Laboratory, Miller Chair Professor at the Department of Petroleum and Geological Engineering at the University of Oklahoma, Chair Professor at the University of Southern California, Dean of College of Engineering at Peking University, and Provost and Vice President for Academic Affairs at SUSTech. He has authored 2 books and published over 240 peer-reviewed papers. He earned both his Master's degree and Ph.D. in hydrology and water resources in 1992 and 1993, respectively, from the University of Arizona. He is a Member of the U.S. National Academy of Engineering, an Honorary Member of Society of Petroleum Engineers, and a Fellow of Geological Society of America.



Prof. Martyn POLIAKOFF

University of Nottingham

Topic:

Reduce, Reuse, Recycle: Cleaner Approaches to Sustainable Chemistry at Nottingham

Abstract:

Human society is facing a whole series of existential challenges including climate change, dwindling natural resources and an ever expanding population. At the same time, we are becoming increasingly reliant on the products of the chemical industry for our food, our materials and our energy production and storage. This lecture will outline some of the work in progress at the UK campus of the University of Nottingham aimed at making chemically-related activities more sustainable. Specifically, it will describe our carbon neutral laboratories, the first of their kind in the world, and some of our research involving the use of supercritical carbon dioxide as a solvent and the recycling of catalysts.

Short Bio:

Prof. Sir Martyn Poliakoff CBE FRS FREng studied at King's College, Cambridge, B.A (1969) and Ph.D. (1973). After 7 years in the Department of Inorganic Chemistry of the University of Newcastle upon Tyne, he moved to the Department of Chemistry at the University of Nottingham in 1979, becoming Professor of Chemistry in 1991 respectively. He was elected Fellow of the Royal Society (2002), of the RSC (2002) and of the IChemE (2004). He was awarded CBE (2008) for "Services to Sciences", and knighted in 2015 for "Services to the Chemical Sciences". He was made Honorary Member of the Chemical Society of Ethiopia (2008) and Foreign Member of the Russian Academy of Sciences (2011) and Honorary Fellow of the Chinese Chemical Society (2015). In 2012, He was elected a Fellow of the Academia Europaea and, in 2013, Associate Fellow of TWAS, the World Academy of Science and Associate Member of the Ethiopian Academy of Sciences (2014), Honorary Fellow of the RSC (2015), Fellow of the American Association for the Advancement of Science (2016) and Fellow of the Royal Academy of Engineering (2017). He was a Council Member of the IChemE (2009-13) and Foreign Secretary and Vice-President of the Royal Society (2011-16). In 2018, he was appointed Honorary Professor at Beijing University of Chemical Technology and was awarded the 2019 James T. Grady-James H. Stack Award for Interpreting Chemistry for the Public by the American Chemical Society was Winner of 2019 the 2019 International Science and Technology Cooperation Award of the People's Republic of China



Prof. Buxing HAN

Institute of Chemistry, Chinese Academy of Sciences

Topic:

Conversion of CO₂ and Biomass into Chemicals and Fuels

Abstract:

Carbon dioxide (CO₂) is the main greenhouse gas, and it is also a renewable, abundant, and cheap C1 feedstock. Biomass is abundant renewable carbon resource. Use of biomass and CO₂ as carbon source to produce value-added chemicals and fuel is of great importance for the sustainable development of our society. In recent years, we are very interested in catalytic conversion CO₂ and biomass. In this presentation, I would like to discuss some of the recent results in our group on design of green catalysts and their application in conversion of CO₂ and biomass into valuable chemicals and fuels.

Short Bio:

Prof. Buxing Han is Professor at Institute of Chemistry, Chinese Academy of Sciences (CAS); Academician of Chinese Academy of Sciences; Fellow of The World Academy of Sciences (TWAS) for the advancement of science in developing countries; Fellow of Royal Society of Chemistry. He is Chairman of The Interdivisional Committee on Green Chemistry for Sustainable Development, International Union of Pure and Applied Chemistry (IUPAC); Chief Scientist of China Innovation Think Tank; Chairman of Green Chemistry Division, Chinese Chemical Society; President of Beijing Energy and Environment Society; Editor-in-Chief of The Innovation, Associate Editors of Green Chem., Associate Editor of Chinese Sci. Bulletin, Associate Editor of Acta Physico-Chimica Sinica, Associate Editor of Chem. J. Chinese Universities. His research interests include physicochemical properties of green solvent systems and application of green solvents in green chemistry, especially on transformation of CO₂ and biomass into valuable chemicals and fuels.



Prof. Zita VALE

Topic:

Intelligent Decision Making for Energy Transactions and Service Provision in the Scope of Sustainable Energy Communities

Abstract:

Zita Vale is Full Professor in the School of Engineering, Polytechnic of Porto, Portugal. She received her diploma in Electrical Engineering in 1986, her PhD in 1993, and her Habilitation in 2003, from University of Porto. She works in Power and Energy Systems, with special interest in Artificial Intelligence based models and applications. She has been involved in more than 60 funded projects and published the results of her research in more than 200 journal papers. She is chair of the IEEE PES Intelligent Data Analysis and Mining Working Group and President of ISAP – Intelligent Systems Application to Power Systems.

Short Bio:

Energy communities and active citizens participation are emerging in the scope of the huge challenges faced in the power and energy sector and should act as important factors for the efficient use of energy resources and for the intensive use of renewable energy. This talk addresses the approaches to enable efficient operation of energy communities, including the relevant business models and artificial intelligence-based decision making. Models for energy transactions and service provision based on distributed intelligence, aggregation, and local electricity markets will be presented. The proposed models will be illustrated with case studies based on real data and pilots.

Organized by

Applied Energy
Advances in Applied Energy
Applied Energy Innovation Institute

Hosted by

Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute
University of Nottingham Ningbo China
Zhejiang University China

Date

April 23-25, 2022

Time zone

GMT +8

Venue

University of Nottingham, Ningbo China
199, Taikang East Road,
Yinzhou District, Ningbo 315100

New Century Grand Hotel Ningbo
666, Shouan Middle Road,
Yinzhou District, Ningbo 315192
PR China

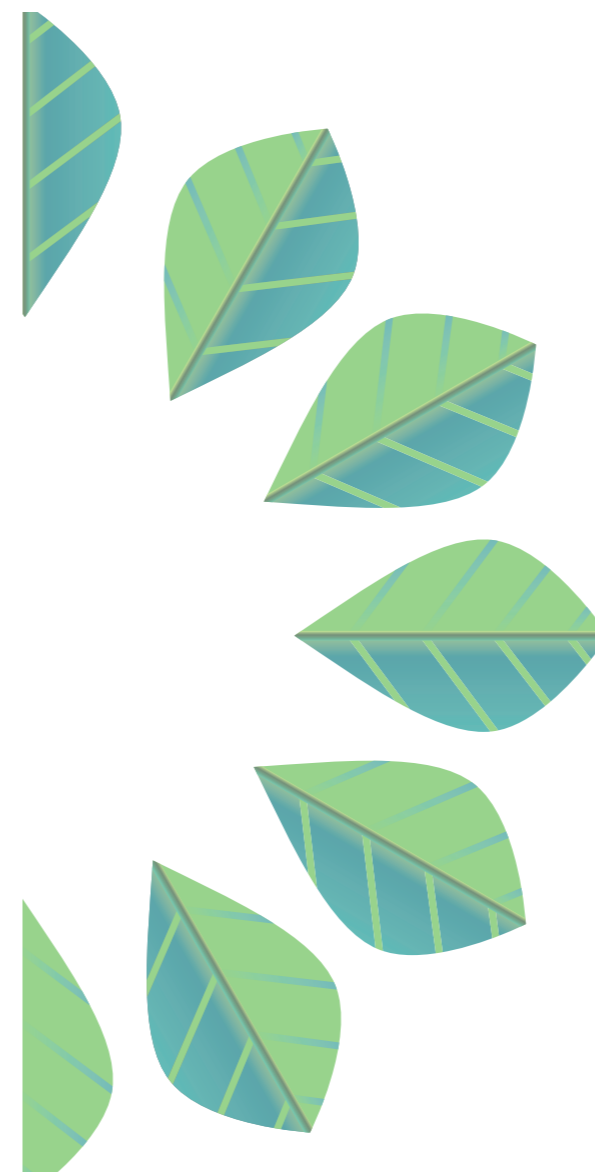
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<http://www.mingduhotel.cn>

Conference participants may book their accommodations in the New Century Grand Hotel Ningbo via the following link <http://en.mingduhotel.cn/rooms.html>

Conference topics include, but not limited to:

- Carbon mitigation technologies and solutions
- Clean energy conversion and storage technologies
- Renewable energy technologies and applications
- Intelligent energy uses and energy efficiencies
- Integrated energy systems
- Emission mitigation technologies
- Energy policies and management



Overall agenda

CEN2022: Applied Energy Symposium CLEAN ENERGY TOWARDS CARBON NEUTRALITY	
(Registration) April 22, 2022	
2:00 pm-5:00 pm	Registration for Onsite Delegates

DAY 1 April 23, 2022			
8:30 am-9:15 am	Registration and Reception Venue: New International Conference Center		
9:15 am-9:30 am	Opening and Welcome Speech Prof. Tao WU		
9:30 am-10:15 am	Keynote 1 Triboelectric Nanogenerators for Harvesting High Entropy Energy Prof. Zhongling Wang		
10:15 am-10:30 am	Tea Break		
10:30 am-11:15 am	Keynote 2 Fluidized Beds for Biomass Energy: Pilot or Industrial-Scale Applications Prof. Jingxu ZHU		
11:15 am-12:00 noon	Keynote 3 Intelligent Energy System Prof. Dongxiao ZHANG		
12:00 noon-1:30 pm	Lunch		
1:30 pm-3:15 pm	Parallel Session A Carbon Mitigation Technologies and Solutions Venue: IEB 122	Parallel Session B Clean Energy Conversion and Storage Technologies Venue: IEB 125	Panel Discussion 1 Advances in Applied Energy Special Session: Smart Energy Transitions towards Net Zero Venue: IEB 131
3:15 pm-3:30 pm	Tea Break		
3:30 pm-4:45 pm	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 122	Parallel Session D Renewable Energy Technologies and Applications Venue: IEB 125	
5:00 pm-5:45 pm	Keynote 4 Reduce, Reuse, Recycle: Cleaner Approaches to Sustainable Chemistry at Nottingham Prof. Martyn POLIAKOFF Venue: IEB 122		

Overall agenda

DAY 2 April 24, 2022			
9:00 am-9:45 am	Keynote 5 Conversion of CO ₂ and Biomass into Chemicals and Fuels Venue: IEB 122 Prof. Buxing HAN		
9:45 am-10:15 pm	Parallel Session A Carbon Mitigation Technologies and Solutions Venue: IEB 122	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 125	Parallel Session G Energy Policies and Management Venue: IEB 131
10:15 am 10:30 pm	Tea Break		
10:30 am-12:00 noon	Parallel Session A Carbon Mitigation Technologies and Solutions Venue: IEB 122	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 125	Parallel Session G Energy Policies and Management Venue: IEB 131
12:00 noon 1:30 pm	Lunch		
1:30 pm-3:15 pm	Parallel Session A Carbon Mitigation Technologies and Solutions Venue: IEB 122	Parallel Session E Integrated Energy Systems Venue: IEB 125	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 131
3:15 pm 3:30 pm	Tea Break		
3:30 pm-4:45 pm	Parallel Session F Emission Mitigation Technologies Venue: IEB 122	Parallel Session B Clean Energy Conversion and Storage Technologies Venue: IEB 125	Parallel Session D Renewable Energy Technologies and Applications Venue: IEB 131
4:45 pm-5:30 pm	Keynote 6 Intelligent Decision Making for Energy Transactions and Service Provision in the Scope of Sustainable Energy Communities Prof. Zita VALE Venue: IEB 122		
5:30 pm-7:00 pm	Dinner		

DAY 3 April 25, 2022				
9:00 am-10:15 am	Parallel Session D Renewable Energy Technologies and Applications Venue: IEB 122	Parallel Session E Integrated Energy Systems Venue: IEB 125		Panel Discussion 2 ADB-ADB Session on Low-Carbon Cooling: Financing and Policies Venue: IEB 131
10:15 am-10:30 am	Tea Break			
10:30 am-12:00 noon	Parallel Session A Carbon Mitigation Technologies and Solutions Venue: IEB 122	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 132	Parallel Session G Energy Policies and Management Venue: IEB 125	
12:00 noon-1:30 pm	Lunch			
1:30 pm-2:30 pm	Parallel Session B Clean Energy Conversion and Storage Technologies Venue: IEB 122	Parallel Session C Intelligent Energy Uses and Energy Efficiencies Venue: IEB 125		
2:30 pm-3:15 pm	Closing Ceremony Prof. Xiang GAO and Prof. Jinyue YAN Venue: IEB122			

DAY 1 April 23, 2022			
Venue: New International Conference Center The University of Nottingham Ningbo China			
8:30-9:15	Registration and Reception		
9:15-9:30	Opening and Welcome Speech Prof. Tao WU		
9:30-10:15	Keynote 1 Triboelectric Nanogenerators for Harvesting High Entropy Energy Prof. Zhonglin WANG		
10:15-10:30	Tea Break		
10:30-11:15	Keynote 2 Fluidized Beds for Biomass Energy: Pilot or Industrial-Scale Applications Prof. Jingxu ZHU		
11:15-12:00	Keynote 3 Intelligent Energy System Prof. Dongxiao ZHANG		
12:00-13:30	Lunch		
ROOM A Venue: IEB 122		Carbon Mitigation Technologies and Solutions Session Chair: Prof. Qinyang LIN and Dr. Mengxia XU	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	93	Chaowei Wang and Sheng Li	The Mechanism of Gas Escaping from Coal Pyrolysis Process to Reduce Energy Consumption of CO ₂ Capture
13:45-14:00	36	Jiahui Yu, Huiwen Zhu, Shu Liu, Zhuoqun Wang, Xinchun Wang and Tao Wu	Improved Performance of Rare Earth Promoted Ni Catalysts for CO ₂ Methanation by Proper Electron Transfer
14:00-14:15	12	Conglin Ye and Dong Liu	Solar-Driven Carbon Dioxide Reduction: Can Photovoltaic-Biased Photoelectrocatalysis Beat Photovoltaic-Powered Electrocatalysis, and How?
14:15-14:30	63	Honglei Zhang and Fengyu Tian	Construction and Application of CdS-MnO ₂ Composites in Photocatalytic CO ₂ Reduction
14:30-14:45	41	Junjie Ren, Xuejian Liu and Zhenyuan Yin	Effect of Sodium Montmorillonite on the Kinetics of CO ₂ Hydrate: A Kinetic and Morphology Study

14:45-15:00	137	Shibiao Zhang, Xiong Zhang, Guangyang Li, Huanhuan Zheng, Jingai Shao, Shihong Zhang, Haiping Yang and Hanping Chen	One-step High Temperature CO ₂ -NH ₃ Modification to Prepare Nitrogen-rich Porous Biochar for SO ₂ Adsorption
15:00-15:15	98	Linbin Yao, Di Wang and Bencan Tang	Mechanistic Studies of Manganese-Catalyzed CO ₂ Hydrogenation to CH ₃ OH Using Density Functional Theory
ROOM B Venue: IEB 125		Clean Energy Conversion and Storage Technologies Session Chair: Dr. Lin GAO and Dr. Kien Woh KOW	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	7	Jianxiang Wang, Shijie Weng, Xuesong Feng, Xiaoli Peng and Yong Xiang	Unsupervised Extraction of Degradation Related Features from Battery Cycling Data via a Conditional Temporal Convolutional Autoencoder
13:45-14:00	35	Xinshuang Chang, Wei Weng, Mengqi Li, George Z. Chen, Kam Loon Fow and Xiayin Yao	LiAlO ₂ Modified Lithium Metal for Li ₁₀ GeP ₂ S ₁₂ -based All-solid-state Lithium Batteries
14:00-14:15	131	Zhao Lu, Ziyuan Liu, Xiyuan Chen, Liyu Zhang, Xingmin Li, Xiaohu Yang and Liwen Jin	Numerical Investigation on the Electrochemical-thermal Characteristics of Li-ion Battery Module with Liquid Cooling Strategy
14:15-14:30	94	Hanxue Yang, Guanhua Zhang and Xiaoyu Yan	Research on the Application of Inorganic Phase Change Cooling Modules in the Thermal Management of Lithium-ion Batteries
14:30-14:45	102	Yiyang Liu, Xiao Li, Hongzhen He, Haobo Dong, Zhiyuan Chen, Paul Shearing, Ivan Parkin, Guanjie He and Dan Brett	Techno-economic Analysis of Aqueous Zn-based Electrochemical Energy Storage Devices
14:45-15:00	49	Pei Lu, Xianglong Luo, Yingzong Liang, Jianyong Chen, Zhi Yang and Ying Chen	Thermo-economic Evaluation and Optimization of Carnot Battery Integrating Low-grade Thermal Energy on Both Charge and Discharge Processes
15:00-15:15	53	Dandan Wang, Chao Ding, Meibo Xing, Haifeng Wu, Ruixiang Wang and Qing Shen	Device Simulations: Reducing Non-radiative Recombination Losses for Achieving >15% Efficient Lead Sulfide Quantum Dot Solar Cells
15:15-15:30	Tea Break		
ROOM C Venue: IEB 122		Intelligent Energy Uses and Energy Efficiencies Session Chair: Dr. Yong REN	

Time	Paper ID	Author(s)	Paper Title
15:30-15:45	146	Wei He, Jifang Zhang and Shenchun Liu	Performance Analysis of Tower-based Water Cooling System for Data Centers with Different Ambient Temperatures and Relatively Humidities
15:45-16:00	13	Qingyang Luo and Xianglei Liu	MgO Induced LiNO ₃ /NaCl Molten Salt Nanocomposite with Synergetic Enhancement in Cp and Solidus Thermal Conductivity
16:00-16:15	17	Zheng Liang, Yingzong Liang, Xianglong Luo, Jianyong Chen and Ying Chen	Process Integration and Heat Exchanger Network Synthesis for a Methanol-reforming Proton Exchange Membrane Fuel Cell
16:15-16:30	147	Aihong Zou and Ercang Luo	Preliminary Study on Supersonic Two-phase Expansion Refrigeration Technology in Liquid Hydrogen Temperature Region
16:30-16:45	21	Morgan Boswell and Yaodong Wang	How to Achieve a Low Emission Home - A Case Study
16:45-17:00		Zhi LI	Intelligent Control and Management of Thermal and Electric Flows in Electric Vehicles
ROOM D Venue: IEB 125		Renewable Energy Technologies and Applications Session Chair: Dr. Xiaohu YANG and Dr. Yimo LUO	
Time	Paper ID	Author(s)	Paper Title
15:30-15:45	127	Zhi Long, Dongfeng Xue and Kenji Miyatake	Sulfonated Poly(arylene Perfluoroalkylene)s-based Proton Exchange Membranes in PEMFCs: a Perspective
15:45-16:00	151	Yulin Wang, Haokai Xu and Hua Li	Effects of Gas Diffusion Layer Degradation on Liquid Transport in Proton Exchange Membrane Fuel Cells by Lattice Boltzmann Method
16:00-16:15	19	Qingying Feng and Dong Liu	Charge Transfer Mechanism for Plasmon-Mediated Photocatalytic Water Splitting On Gold Clusters
16:15-16:30	11	Joseph Wilson and Yaodong Wang	A Techno-Economic Study into a Domestic Renewable Energy System
16:30-16:45	56	Terezija Matijašević, Tomislav Antić and Tomislav Capuder	On the Value of Distribution Network Topology Information in the Identification of End-user Phase Consumption: A Graph Neural Network Approach

16:45-17:00	96	Shao-Chao Ma, Xing Yao and Lei Zhu	The Role of Vehicle-to-Grid on The Power Sector Transitions towards Carbon Neutrality: A Case Study of China
ROOM (Panel) Venue: IEB 131		Advances in Applied Energy Special Session: Smart Energy Transitions towards Net Zero Session Chairs: Prof. Xiaonan WANG, Prof. Zhenyuan YIN and Prof. Yuntian CHEN	
Time	Topic ID	Panelist(s)	Topic
13:30-14:00	1	Prof. Yingru Zhao Xiamen University	RD&D of Integrated Energy Systems
14:00-14:30	2	Prof. Tianfu Xu Jilin University	Reactive Transport Modeling to Address Issues of CO ₂ Geological Sequestration
14:30-15:00	3	Prof. Ruina Xu Tsinghua Univeristy	Supercritical CO ₂ Flow and Heat/mass Transfer in Micro/nano-porous Structures in CO ₂ Geological Utilization and Storage
15:00-15:30	4	Prof. Dr. Tapas Mallick University of Exeter	Net-Zero Building in the UK – Challenges and Opportunities
15:30-16:00	5	Prof. Jinyue Yan, Prof. Dongxiao Zhang and Prof. Tapas Mallick	Panel Discussion on Smart Energy Transitions towards Carbon Neutrality
16:00-16:15	6	Prof. Jinyue Yan	Introduction of ADAPEN and ADAPEN YEB
16:15-16:25	7	Dr. Rui Zhu	ADAPEN YEB on Renewable Energy
16:25-16:35	8	Dr. Xiangkun Cao	ADAPEN YEB on Mitigation Technologies
16:35-16:45	9	Dr. Wenlong Shang	ADAPEN YEB on Sustainability of Energy Systems
Room IEB 122 (Keynote)			
17:00-17:45		Keynote 4 Reduce, Reuse, Recycle: Cleaner Approaches to Sustainable Chemistry at Nottingham Prof. Martyn POLIAKOFF	

DAY 2 April 24, 2022			
Room IEB 122 (Keynote)			
9:00-9:45		Keynote 5 Conversion of CO ₂ and Biomass into Chemicals and Fuels Prof. Buxing HAN	
ROOM A Venue: IEB 122		Carbon Mitigation Technologies and Solutions Session Chair: Prof. Guang ZHU	
Time	Paper ID	Author(s)	Paper Title
9:45-10:00	37	Hongfei Zhao, Wei Zhong, Xiaojie Lin, Jinliang Wang, Liulu Du-Ikonen, Keting Zhang and Xiangqian Wang	Design of Chemical Enterprise Carbon Reduction Scheme Based on Carbon Handprint Method
10:00-10:15	86	Jia Liu and Hongxing Yang	Energy Planning and Feasibility Study of a Net-zero Energy City by 2050 with Mixed Energy Fuels and Hybrid Energy Storage
ROOM C Venue: IEB 125		Intelligent Energy Uses and Energy Efficiencies Session Chair: Dr. Lingjun WU	
Time	Paper ID	Author(s)	Paper Title
9:45-10:00	20	Feiyan Zhao and Lei Zeng	Comparison Study of Energy Efficiency Standards of Household Washing Machines, Washer-dryers and Tumble Dryers in China and Europe
10:00-10:15	139	Yuhao Zhang, Yinkun He and Yuling Fan	Technoeconomic Comparison of Retrofitting Options towards Green Buildings
ROOM G Venue: IEB 131		Energy Policies and Management Session Chair: Dr. Bo LI	
Time	Paper ID	Author(s)	Paper Title
9:45-10:00	148	Juan Li, Zixuan Li and Huiping You	Has Smart City Construction Reduced Corporate Pollution Emissions? New Evidence from Chinese Corporate Pollution Data
10:00-10:15	138	Yanbo Feng, Feng Song and Peilin Chen	Evaluating the Cost Impact to Meet China's Renewable Electricity Portfolio Standard in 2030
10:15-10:30	Tea Break		
ROOM A Venue: IEB 122		Carbon Mitigation Technologies and Solutions Session Chair: Prof. Guang ZHU	
Time	Paper ID	Author(s)	Paper Title
10:30-10:45	124	Dongya Guan, Chao Chen, Jie Lin, Le Yan, Jingchao Xie, Yongxiang Jiao, Gongcheng Li and Peng Yin	The Concept of "semi-centralized" Heating and Low-carbon Campus Heating Model

10:45-11:00	81	Zhenhua Xia, Xiangzhao Meng, Guosheng Jia, Zhendi Ma, Jiawei Wang and Liwen Jin	Carbon Emission Evaluation of Geothermal Energy Heating Systems Using Deep Coaxial Borehole Heat Exchangers
11:00-11:15	47	Ying Ji, Long Jiang and Chunfei Wu	CO ₂ Capture for Low Temperature Heat Utilization Based on Advanced Coconut Shell Biochar
11:15-11:30	64	Maxine Yew, Yong Ren and Kai Seng Koh	Droplet Microfluidic Encapsulation of Monoethanolamine and Graphene Nanoplatelet for High Carbon Capture Performance
11:30-11:45	25	Yuanxin Yao, Daoyi Chen and Zhenyuan Yin	Significance of a Thermodynamic Promoter (1,3-dioxolane) Concentration in Promoting CO ₂ Hydrate: Implication for Hydrate-based CO ₂ Sequestration
11:45-12:00	18	Long Jiang, Wei Liu, Ruiqi Wang and Xuejun Zhang	Analysis on Temperature Swing Adsorption for Carbon Capture Integrated with Heat Pump Technologies
ROOM C Venue: IEB 125		Intelligent Energy Uses and Energy Efficiencies Session Chair: Dr. Juan WANG and Dr. Lingjun WU	
Time	Paper ID	Author(s)	Paper Title
10:30-10:45	31	Hao Zhou, Hong Li, Xingang Li and Xin Gao	Process Evaluation and Optimization of Acetone Refining with Multiple Energy-saving Technologies by the Techno-economic Analysis
10:45-11:00	156	Lu Ding, Yao Xiao and Fuchen Wang	Fe Migration Mechanisms Under Hydrothermal Carbonization of Dyeing Sludge: Effect of Temperature and Addition of HNO ₃
11:00-11:15	114	Yueying Zheng, Fan Wang and Tao Wu	MOF-derived CoSx and Microspherical ZnIn ₂ S ₄ with Enhanced Photocatalytic Hydrogeneration Activity
11:15-11:30	84	Zhuo Wang, Jun Xian Yeoh, Christopher De Sheng Wong, Yang Meng, Tao Wu and Cheng Heng Pang	Fault Detection of Steam Boiler Operation Process with Multi-way Principal Components Analysis
11:30-11:45	104	Dapeng Wang, Zhenqi Jing, Yaqin Wang, Tianyu Liu and Chang Wen	Efficient Hg ₀ Adsorbent by Bimetallic Oxide Copper-manganese Based Metal-organic Frameworks
11:45-12:00	144	Yinkun He, Yuhao Zhang and Yuling Fan	Building Envelope Retrofit Optimization Considering Performance Degradation
ROOM G Venue: IEB 131		Energy Policies and Management Session Chair: Dr. Bo LI	
Time	Paper ID	Author(s)	Paper Title

10:30-10:45	48	Xianya He, Jingzhi Huang, Nianyuan Wu, Jian Lin and Yingru Zhao	Renewable Energy Development Planning Combining LEAP Simulation and Techno-Economic Optimization
10:45-11:00	80	Xiaoyue Zhang, Guohe Huang and Yongping Li	How Volatile Energy Prices Will Affect Electricity System Transition
11:00-11:15	38	Yinchen Liu and Xiaoyu Yan	Life Cycle Assessment (LCA) of Electricity Generation Technologies in China: Overview, Comparability and Limitations
11:15-11:30	67	Xiwang Xiang, Minda Ma and Zhili Ma	Decarbonization of Commercial Building Operations: a Global Retrospection
11:30-11:45	60	Pibin Guo, Xianmei Liu and Xiuli Liu	Identification of Structural Drivers of Energy Transition: Empirical Evidence from China
11:45-12:00	126	Juan Li, Shaoqi Ma and Jiamin Wang	Artificial Intelligence Impact on Energy Efficiency of Firms: Evidence from Firm-level Data in China
12:00-13:30		Lunch	
ROOM A Venue: IEB 122		Carbon Mitigation Technologies and Solutions Session Chair: Prof. Qie SUN and Dr. Kam Loon FOW	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	107	Qi Xin, Yang Yang, Shaojun Liu, Chenghang Zheng, Qingyang Lin and Xiang Gao	Study on Differential Transport of Multi-pollutant Molecules in Titanium-based Nanopore with Molecular Dynamics
13:45-14:00	111	Yanwei Wang, Zhenxue Dai and Li Chen	An Integrated Model for CO ₂ Storage Capacity in Shale Gas Reservoirs Considering Gas Leakage
14:00-14:15	92	Keqi Bei, Xuejian Liu and Zhenyuan Yin	Numerical Modeling of Hydrate-based CO ₂ Sequestration in Deep-sea Sediments: A Case Study Based on Shenhu Area, South China Sea
14:15-14:30	101	Hao Chen, Haizeng Yu and Chenghao Xu	A New Experimental Method for Asynchronous Huff and Puff Development of Tight Oil with CO ₂ Injection in Different Well
14:30-14:45	75	Junan Long, Binbin Yu, Dandong Wang, Hongsheng Ouyang, Junye Shi and Jiangping Chen	Life Cycle Climate Performance Evaluation (LCCP) of Low-GWP Refrigerants for Electric Vehicle Heat Pump Towards Carbon Neutrality
14:45-15:00	118	Qing-Yuan Xu, Jing Luo, Hao-Tian Ju and Run-Xiang Li	Decarbonizing Energy-intensive Industries by Coupling Renewable Energy and Low-carbon Technologies
15:00-15:15	15	Davina Vallabh and Yaodong Wang	Trigeneration with Carbon Capture and Storage Using Digestate
ROOM E Venue: IEB 125		Integrated Energy Systems Session Chair: Dr. Haoran ZHANG and Dr. Zhi LI	

Time	Paper ID	Author(s)	Paper Title
13:30-13:45	39	Chunlin Luo, Shuai Liu, Gang Yang, Peng Jiang, Xiang Luo, Yipei Chen, Mengxia Xu, Edward Lester and Tao Wu	Design and Controlled Synthesis of Cobalt-loaded Multi-walled Carbon Nanotube-magnetite Nanocomposite as Catalysts for Hydrogen Generation via Hydrolysis of NaBH ₄ Under Microwave Heating
13:45-14:00	105	Jiahao Chen, Bing Sun, Yunfei Li, Ruipeng Jing, Yuan Zeng and Zelong Qi	An Island Partition Method Based on Heuristic Algorithm and Prim Topology Generation in Active Distribution Network
14:00-14:15	110	Wei Liao, Xiong Zhang, Shihong Zhang, Jingai Shao, Haiping Yang, Xianhua Wang and Haiping Chen	A Pilot-scale Biomass Gasification Coupled Coal-fired Power Generation System Under Positive Pressure: Experiments and Simulations
14:15-14:30	23	Zaixing Wang, Liliang Feng and Junkui Mao	Thermodynamic Analyses of a 5 KW PEMFC-based CHP System Integrated with Kerosene Steam Reforming
14:30-14:45	120	Yibin Qiu, Qi Li, Tianhong Wang, Liangzhen Yin, Hong Liu and Weirong Chen	Coordinated Scheduling of the Electricity-Gas-Thermal Integrated Energy System with Hydrogen Energy
14:45-15:00	33	Peng Jiang, Mengxia Xu, Xingyu Feng, Kien-Woh Kow, Xiang Luo, Ziqing Zhao, Ran Tao, Wei Meng, Guang Yang and Tao Wu	Advanced Exergy Analysis of Methanol and Power Co-production Based on Gasification of Municipal Solid Waste
15:00-15:15	130	Jinxiao Tan and Biying Yu	Low-carbon Development Pathway of Freight Transportation Under Carbon Neutral Vision in China
ROOM C Venue: IEB 131		Intelligent Energy Uses and Energy Efficiencies Session Chair: Dr. Haitao ZHAO	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	123	Yi Yang, Chao Chen, Caiyun Li, Chunhua Kang and Dongya Guan	Analysis of Electricity Consumption Characteristics of a Large Airport Terminal in Beijing
13:45-14:00	34	Shiyu Yang, H. Oliver Gao and Fengqi You	Model Predictive Control for Price-Based Demand-Responsive Control of PCM-Wallboard-Enhanced Buildings
14:00-14:15	43	Wuxia Zhang, Paige Wenbin Tien, John Kaiser Calautit, Yupeng Wu and Feng Yan	Building Occupancy Prediction Through Machine Learning for Enhancing Energy Efficiency, Air Quality and Thermal Comfort: Review and Case Study
14:15-14:30	58	Fazel Khayatian, Hanmin Cai, Philipp Heer and Andrew Bollinger	Benchmarking HVAC Controller Performance with a Digital Twin

14:30-14:45	28	Zu Wang, Liang Xia, Xinru Wang, Song Pan and Jinshun Wu	Development of a PID Controller with a Double-objectives Tuner for HVAC System Control in an Investigated Metro-station in Beijing, China.
14:45-15:00	51	Rui Yang and Ercang Luo	Theoretical Analysis on Electricity Generation with Oscillatory Plasma
15:00-15:15	59	Jiaxiang Li, John Calautit and Carlos Jimenez-Bescos	Ventilation Performance of a Novel Multi-channel Windcatcher System for Passive Cooling and Dehumidification Device Integration
15:15-15:30	Tea Break		
ROOM F Venue: IEB 122		Emission Mitigation Technologies Session Chair: Prof. Jun HE	
Time	Paper ID	Author(s)	Paper Title
15:30-15:45	42	Ruomiao Yang, Zhentao Liu, Yu Zhang and Jiahong Fu	Application of Machine Learning Methods to Predict NO _x Emissions for Next Generation Zero-Carbon Ammonia/Hydrogen Fueled Engines
15:45-16:00	74	Yihe Miao, Yaozu Wang, Xuancan Zhu, Zhijun He, Wei Chen, Jia Li and Lijun Yu	Minimizing the Effect of Oxygen on Supported Polyamine for Direct Air Capture
16:00-16:15	103	Hongzhe Li, Xinyi Mao, Mingjie Zhang, Yipei Chen and Gang Yang	Manganese Residue Modified Steel Slag to Improve Low-temperature SCR of NO _x
16:15-16:30	116	Gang Yang, Xiang Luo and Tao Wu	Electrolytic Manganese Anode Mud As the Low Temperature NH ₃ -SCR Catalyst: The Effect of K and Pb
16:30-16:45	10	Wenshuo Hu, Yu Zhang, Xiaoxiang Wang, Weihong Wu, Hao Song, Shaojun Liu and Xiang Gao	Mechanistic Assessments of NO Activation on WO ₃ -promoted CeO ₂ Catalysts and Its Consequences for Low-temperature NH ₃ -SCR
ROOM B Venue: IEB 125		Clean Energy Conversion and Storage Technologies Session Chair: Dr. Li CHEN and Dr. Chuang WEN	
Time	Paper ID	Author(s)	Paper Title
15:30-15:45	16	Ji Zhang and Chuang Wen	Integration of Fin Structure and Al ₂ O ₃ Nanoparticles to Enhance Phase Change Material Performance for Latent Heat Thermal Energy Storage

15:45-16:00	89	Bingtao Zhang, Hongchuan Qin, Xi Li, Zhe Cheng, Renjie Zhou, Jian Li and Jianhua Jiang	Long-short Term Full-process Forecasting of Solar Power and Inelastic Load
16:00-16:15	82	Qiliang Wang and Hongxing Yang	An Efficient Hybrid System Integrated Concentrated Parabolic Trough Solar Collector with Solar Photovoltaics
16:15-16:30	62	Zhiyu Zhang, Yunxiao Liang and Yong Ren	Large-sized Nanofilm-constructed Hierarchical Porous G-C ₃ N ₄ /SiO ₂ with Enhanced Visible-light-driven Photoactivity
16:30-16:45	68	Mingkai Li, Samuel Widijatmoko, Zheng Wang and Philip Hall	Characterisation of Dry Milled CIGS Solar Panel
ROOM D Venue: IEB 131		Renewable Energy Technologies and Applications Session Chair: Dr. Jia LIU and Dr. Delin FANG	
Time	Paper ID	Author(s)	Paper Title
15:30-15:45	77	Yoong Xin Pang, Guang Yang, Zihan Wang, Haoliang Hong, Tao Wu and Cheng Heng Pang	A Microscopic Analysis on the Influence of Pyrolysis on Biomass Cell Wall
15:45-16:00	83	Xinyun Wu, Yoong Xin Pang, Yuxin Yan, Tao Wu and Cheng Heng Pang	Effects of Pyrolysis Temperature on Mineral Migration in Biochar: An Investigation via Cellular Studies
16:00-16:15	109	Yabo Wang, Xiaolei Ma, Shixin Lian, Xinxin Ning, Yuting Yang and Junhui Zhang	Comparison of Direct and Indirect Battery Preheating System Performance
16:15-16:30	115	Lingjun Wu, Wei Chen, Zijian Chen, Zixuan Wang, Hao Huang, Haitao Zhao and Xue-Feng Yu	Synthesis Strategies of Lead-free Double Perovskites Nanocrystals
16:30-16:45	14	Chris Atkinson and Yaodong Wang	Techno-Economic Study of a Distributed Renewable Power System for an Island
Room IEB 122 (Keynote)			
16:45-17:30	Keynote 6 Intelligent Decision Making for Energy Transactions and Service Provision in the Scope of Sustainable Energy Communities Prof. Zita VALE		
17:30-19:00	Dinner		

DAY 3 April 25, 2022			
ROOM D Venue: IEB 122		Renewable Energy Technologies and Applications Session Chair: Prof. Cheng Heng PANG	
Time	Paper ID	Author(s)	Paper Title
9:00-9:15	54	Feng Ji and Zhuang Xu	Enhanced Low-Voltage Ride-Through Control Strategy of Grid-Forming Converter Based on Virtual Synchronous Generator
9:15-9:30	61	Zhuang Xu and Feng Ji	Frequency Regulation Using Virtual Synchronous Generator for Thermal Power Plant in Islanding Mode
9:30-9:45	134	Zhikai Yang, Pan Liu, Bo Ming and Qian Xia	Identifying the Resilience of a Large-scale Hydro-photovoltaic Hybrid Power System Responding to Climate Change
9:45-10:00	164	Shiyue Hu	The Application Potential Analysis of Refuse Derived Fuel As an Alternative to Coal - A Case Study of Ningbo, China
10:00-10:15	128	Ruiyuan Zhang, Li Chen and Wen-Quan Tao	Analysis of Carbon Particle Overlap Effects on Oxygen Reactive Transport in Catalyst Layers of Proton Exchange Membrane Fuel Cells
ROOM E Venue: IEB 125		Integrated Energy Systems Session Chair: Dr. Hainam DO	
Time	Paper ID	Author(s)	Paper Title
9:00-9:15	4	Jiapeng Su, Dawei Liu and Anjun Jin	Model and Simulation of Power Utility Matrix for the Smart Distributed Energy Resources
9:15-9:30	9	Moch Zulfikar Eka Prayoga, Hanafi Prida Putra, Ade Sana Ruhayat, Datin Fatia Umar, Mochamad Soleh, Maharani Dewi Solikhah and Hariana Hariana	Comparative Study on Thermal Analysis Using Kinetics Between Bituminous Coal and Sorghum Pellet
9:30-9:45	27	Hafizh Ghazidin, Hanafi Prida Putra, Nur Cahyo, Ardi Nugroho, Rahmat Ranggonang Anwar, Muhammad Hasan Albana and Hariana	Slagging, Fouling, Abrasion, and Corrosion Potential in Cofiring Biomass SRF With Bituminous Coal Blend

9:45-10:00	133	Shitian Xu, Pan Liu and Xiao Li	Deriving Long-term Operating Rules of Wind-photovoltaic-hydro Station Considering Electricity Price
10:00-10:15	57	Mengxia Xu, Peng Jiang, Ruohan Wang, Kien-Woh Kow, Xiang Luo, Yitong Liu, Siyang Liu, Wei Meng, Guang Yang and Tao Wu	Thermodynamic Analysis of a Tri-Generation System Based on MSW Gasification Integrated with Chemical Looping Combustion
10:15-10:30	Tea Break		
ROOM A Venue: IEB 122		Carbon Mitigation Technologies and Solutions Session Chair: Prof. Chenghang ZHENG	
Time	Paper ID	Author(s)	Paper Title
10:30-10:45	50	Qifan Wang, Zhentao Liu, Yu Zhang and Jiahong Fu	Virtual Sensing: Next Generation Intelligent Internal Combustion Engine Performance Prediction Based on Machine Learning
10:45-11:00	24	Zewei Zhong, Yun Zeng and Xiaoli Zhao	Trade-offs for the Economic and Decarbonization Value of Electric Vehicle Smart Charging
11:00-11:15	119	Chunyan Dai, Zhongwei Zhang, Xinyang Han, Xudong Wang, Dan Ye, Yuan Liu and Lianjie Jiang	Construction of Energy System for Carbon-neutral Towns and Practice in China
11:15-11:30	129	Ying Zou, Biying Yu and Baojun Tang	Comprehensive Decarbonization Pathway and Carbon Mitigation Potential for Building Sector
11:30-11:45	65	Fengyu Tian and Honglei Zhang	Lotus Seedpod Inspired Cu ₂ O/g-C ₃ N ₄ P-n Heterojunction for Enhanced Visible-light-driven Photocatalytic H ₂ Generation
11:45-12:00	95	Lanyu Li, Tianxun Zhou, Jiali Li and Xiaonan Wang	A Machine Learning-Based Decision Support Framework Facilitating Energy Storage Selection
ROOM C Venue: IEB 132		Intelligent Energy Uses and Energy Efficiencies Session Chair: Prof. Cheng Heng PANG and Dr. Haitao ZHAO	
Time	Paper ID	Author(s)	Paper Title
10:30-10:45	141	Guo Lingyi, Chen Li and Tao Wen-Quan	Pore-scale Investigation of a Gas Diffusion Layer Model Coupled Mass Transfer and Two-phase Flow: Effects of the Compression Ratio

10:45-11:00	159	Xiangfeng Wu	Prototype and Calibration of Polymer Electrolyte Membrane Fuel Cell Signal Amplification Sensor
11:00-11:15	122	Haoyu Yin and Xiaonan Wang	AI Guided Membranes Materials Development for Hydrogen Evolution and Separation
11:15-11:30	155	Yanqin Li, Enze Wang, Zhicong Wang and Hailiang Cao	Exergy Modeling and Comparison Between Different Approaches of Heat Supply
11:30-11:45	161	Boheng Chen, Zhicong Chen, Lijun Wu, Peijie Lin and Shuying Cheng	Day-ahead Hourly Photovoltaic Power Curve Prediction Based on Multi-data Driven Hybrid Physical and Deep Learning Model
11:45-12:00	158	Zhang Deng, Yixing Chen and Jingjing Yang	AutoBEM: An Urban Building Energy Modeling Tool to Explore Carbon Reduction Pathways
ROOM G Venue: IEB 125		Energy Policies and Management Session Chair: Dr. Philip HALL	
Time	Paper ID	Author(s)	Paper Title
10:30-10:45	72	Li Ding, Lan Xue, Anna Sun and Huilin Liu	Belt and Road Gas Cooperation Evaluation - An Empirical Study on Economic Profits, Governance Mode, and Cultural Values
10:45-11:00	70	Ke Wang and Mei Lu	The Ineffectiveness of Carbon Emission Trading Pilots Under the Energy Conservation and Carbon Abatement Target Responsibility System in China
11:00-11:15	149	Yang Liu, Yuchen Zhang, Rongda Zhang, Xiaoli Zhao and Arash Farnoosh	Identifying Win-win Pathways That Reduce Economic Costs and CO ₂ Emissions
11:15-11:30	150	Jiayi Guo, Mao Wu and Hanhui Zhao	The Role of Digital Economy on Carbon Emissions: Spatially Mediated Mechanism Test And Neural Networks Prediction
11:30-11:45	66	Lucas Desport, Carlos Andrade and Sandrine Selosse	Net-zero Emission Opportunities for the Iron and Steel Industry at a Global Scale
11:45-12:00	142	Xuanyi Jin, Wenrui Jiang and Delin Fang	Energy-water-carbon Nexus and Its Driving Forces in Transnational Agricultural Trade
ROOM (Panel) Venue: IEB 131		ADBI-ADB Session on Low-Carbon Cooling: Financing and Policies Session Chair: Yun Zhou, Senior Environment Specialist, Asian Development Bank (ADB), Philippines	

9:00-9:10	Welcome and introduction by session moderator		
9:10-9:35	1	Bo Shen Research Scientist, Energy Analysis and Environmental Impact, Lawrence Berkeley National Laboratory, United States	Financial Solutions to Invest in Climate-Friendly Cooling and Brief Lessons Learnt from ADB Project in Ningbo: Developing a Climate-Friendly Cooling Sector Through Market and Financing Innovation
9:35-10:00	2	Alfredo Bano Leal Senior Energy Specialist, ADB, Philippines	Promoting Sustainable Cooling Through District Cooling
10:00-10:25	3	Feng An Executive Director, Innovation Center for Energy and Transportation, United States (TBC)	Policy Solutions to Enable Climate-friendly Cooling and Briefly Lessons Learnt from ADB Project in Ningbo: Developing a Climate-Friendly Cooling Sector Through Market and Financing Innovation
10:25-10:50	4	Dina Azhgaliyeva Research Fellow, Asian Development Bank Institute (ADBI), Japan	Green Bonds for Financing Low-carbon Cooling
10:50-11:00	Wrap up and closing by session moderator		
12:00-13:30	Lunch		
ROOM B Venue: IEB 122		Clean Energy Conversion and Storage Technologies Session Chair: Dr. Qibin LIU	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	145	Lingyang Li, Minglei Bao and Hongxin Chen	Evaluating the Hosting Capacity of Distributed PV Considering the Impacts of Mobile Energy Storage System
13:45-14:00	135	Fan Jiao, Buchu Lu, Chen Chen, Taixiu Liu, Yuanlong Qin, Yibiao Long and Qibin Liu	Graphical Exergy Analysis Method for Hydrogen Production in a Two-step Solar Thermochemical Cycle
14:00-14:15	121	Xiaoyuan Li, Zhe Tian and Jide Niu	Stochastic Planning Method for the Building Energy System Considering Loads and Renewable Energy Uncertainties
14:15-14:30	106	Yiwen Hu, Chuang Liu, Jingyue Wang and Zhongchen Pei	Coordinated Control Strategy of Hybrid AC/DC Microgrid with Photovoltaic and Energy Storage System

ROOM C Venue: IEB 125		Intelligent Energy Uses and Energy Efficiencies Session Chair: Dr. Svenja HANSON and Dr. Jiahui YU	
Time	Paper ID	Author(s)	Paper Title
13:30-13:45	108	Wei Hu, Xinyue Zhang, Yibo Su, Xin Zhang, Xianfeng Zhang and Hongbin Yang	Optimal Operation of Wind-Solar-Thermal-Storage System Considering Power Flow Constraints and Security
13:45-14:00	113	Zhi Li	Performance Evaluation of Typical Heat Pump Air Conditioning Systems with Waste Heat Recovery for Pure Electric Vehicles
14:00-14:15	143	Qi Geng, Zheng-Hao Yang, Yang Du and Guang-Yu He	Combustion Performance Analysis of X-type Rotary Engine with Premixing of Hydrogen and Gasoline
14:15-14:30	91	Tingsheng Zhang, Lingji Kong, Hai Li, Zutao Zhang and Jinyue Yan	An Electromagnetic Track Vibration Energy Harvester Inspired by Parallel Design for Railroads
Room IEB 122 (Closing Ceremony)			
14:30-15:15	Closing Ceremony Prof. Xiang GAO and Prof. Jinyue YAN		

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Advances in Applied Energy Special Session: Smart Energy Transitions towards Net Zero

CEN2022 Applied Energy Symposium 2022:
Clean Energy towards Carbon Neutrality

April 24, 2022
13:30 – 16:45 (GMT+8)

Session Chairs: Prof. Xiaonan Wang, Prof. Zhenyuan Yin and Prof. Yuntian Chen

Introduction

Organized by Young Editorial Board (YEB) of ADAPEN as part of the CEN2022 Applied Energy Symposium 2022, this session will focus on Smart Energy Transitions towards Carbon Neutrality. The session consists of three sections: In the first section (13:30 -15:30), four specially-invited renowned professors will present their latest research spanning topics from smart energy, renewable energy to carbon capture utilization and storage (CCUS). In the second section (15:30 -16:00), a panel discussion is organized for the subject matter experts to discuss on the imminent issues and challenges that smart energy transitions and CCUS currently is facing. In the last section (16:00 -16:45), ADAPEN Chief Editor Prof. Jinyue Yan will introduce the journal ADAPEN and the YEB members followed by three YEB members present the three scopes and themes of interest of ADAPEN.

Objectives

- Present the latest research in the field of smart energy transitions and CCUS
- Discuss the challenges that smart energy transitions and CCUS face
- Introduce the scope of ADAPEN from YEB members

Target Participants

- Researchers and Scientists from all universities and research institutions, as well as graduate students and interested members of the public.

Output

- Better understanding of the obstacles to carbon neutrality and how to overcome them
- Detailed introduction to smart energy transition technologies
- Detailed introduction to the scopes of ADAPEN

About ADAPEN

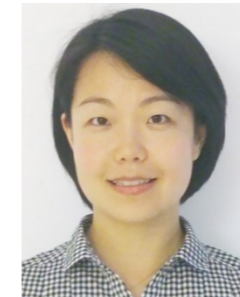
Advances in Applied Energy is an open access journal for publishing cutting-edge applied research on all aspects of energy innovation that bridge the gaps between research, development, and implementation. The journal is a companion journal to the highly regarded journal Applied Energy.

Advances in Applied Energy welcomes work with significant impact and broad readership, on future energy transition topics such as, but not restricted to:

1. New development trends: advances in cutting-edge applied energy areas, including renewable energy, clean energy conversion and utilization, smart and flexible system integration and optimization, energy storage, climate change mitigation, and energy sustainability;
2. Systems characteristics: integrated energy systems such as industry, transport, and buildings; renewable energy; advanced conversion technologies; energy storage; emission mitigations; smart grids and mini/micro grids; distributed energy systems; e-mobility; and sustainability of energy systems;
3. Energy nexus and synergy with other critical global issues: energy-water, energy-emissions, power-to-x, waste-to-energy, flexibility of renewable energy systems.

The journal considers full length articles, reviews, letters, commentaries, perspectives, forums and news & views for publication.

Invited Session Talk 1: RD&D of Integrated Energy Systems



Prof. Yingru ZHAO

Professor in Energy Efficiency Engineering, College of Energy, Xiamen University, Xiamen, China

Abstract:

Integrated energy systems (IES) whereby electricity, heating, cooling, gas and storage optimally interact with each other at various levels is the core framework and physical carrier of Energy Internet, which has complex nonlinear stochastic characteristics and many degrees of uncertainty. IES use multiple fossil fuels and renewable sources to drive various kinds of energy technologies in order to fulfil users' different kinds of energy demand in a highly efficient manner. A series of challenges still exist in the design, operation and management of IES due to its stochastic dynamics and scenario uncertainties. This talk will be focused on the recent research, development and demonstrations of integrated energy systems in terms of demand prediction, system design, optimization and decision-making, etc.

Short Bio:

Dr. Yingru Zhao is Professor in Energy Efficiency Engineering at College of Energy, Xiamen University. She holds a PhD in Theoretical Physics and a Bachelor's degree in Physics both from Xiamen University. Between 2008 and 2011 she worked as a Research Associate at Imperial College London. She has a comprehensive experience in integrated modelling, simulation and optimization of complex energy systems, with particular focus on integrated energy systems, micro-grid and poly-generation, with links to economic and environmental sustainability analyses, etc.

Prof. Zhao was nominated in the Program for New Century Excellent Talents in University by China Ministry of Education in 2011. She is also winner of Fujian Province Outstanding Youth Fund. She serves as Associate Editor for Renewable and Sustainable Energy Transition (Elsevier Journal), Assistant Editor for Applied Energy (Elsevier Journal), Editor for Smart Energy (Elsevier Journal), Editor for Scientific Reports (Nature Journal), Editor for Progress in Energy (IOP Journal), Review Editor for Frontiers in Chemical Engineering, Guest Editor for Frontiers in Energy Research, Guest Editor for Energies (MDPI Journal), and Editor-in-Chief of the Special Issue of an Chinese journal Global Energy Interconnection. She is the Vice Chairman of Fujian Society for Electrical Engineering. She is a Lindau alumna who has received the award for participation in the 58th Meeting of Nobel Laureates (Physics) in Germany.

Prof. Zhao has authored/co-authored over 100 peer-reviewed journal papers and 7 books on model-based methods & applications, organized and chaired a number of international and national conferences. Her current research focus is on how to introduce the multi-scale modeling and mathematical/systems engineering techniques to analyze and optimize energy networks and complex, spatially- and temporally-explicit energy systems.

Invited Session Talk 2: Reactive Transport Modeling to Address Issues of CO2 Geological Sequestration



Prof. Tianfu XU

**Professor, College of New Energy and Environment,
Jilin University, Changchun, China**

Abstract:

One way to reduce carbon dioxide (CO₂) releases to the atmosphere, is to capture it from point sources such as power plants and then inject it into deep geological formations. Understanding water-gas-mineral reactions is the core of assessing the long-term storage and risks in geological sequestration. Because of various limitations of laboratory and field tests, reactive transport modeling has been one important supplementary or independent tool to study the water-gas-mineral reactions at different components of geological sequestration. In this talk, I'll review the applications of reactive transport modeling to several aspects of CO₂ geological sequestration: such as the behavior of CO₂ in storage formation, the storage security issues related to caprock integrity or wellbore cement degradation, and the change of the shallow groundwater in response to the potential leakage of CO₂. Key findings are summarized and further research needs are identified.

Short Bio:

Tianfu Xu is currently a professor at Jilin University of China. He has been working at Lawrence Berkeley National Laboratory (LBNL) of USA for 16 years, in which he joined in 1996, initially as post-doctoral fellow, then become a scientist, and staff scientist. He received a bachelor's degree in 1984 from Jilin University, an M.S. degree in 1993 from Delft University of Technology of The Netherlands, and a Ph.D. in 1996 from University of La Coruña, Spain. For the last 30 years, Tianfu has been working on developing new approaches to modeling multiphase non-isothermal fluid flow and chemical transport in unsaturated and saturated porous media and fractured rock systems. He is the chief developer of LBNL's multi-phase non-isothermal reactive flow and chemical transport simulator TOUGHREACT. The program is widely used nationally and internationally for CO₂ geological sequestration, geothermal energy development, nuclear waste disposal, environmental remediation, and increasingly for petroleum applications. Tianfu has authored and co-authored about 100 peer-reviewed journal papers. His papers have been cited by other researchers more than 6000 times (SCI citation).

Invited Session Talk 3: Supercritical CO₂ flow and heat/mass transfer in micro/nano-porous structures in CO₂ geological utilization and storage



Prof. Ruina XU

**Professor, Department of Energy and Power
Engineering, Tsinghua University, Beijing, China**

Abstract:

CO₂ geological storage and its use to enhance geothermal systems and shale oil/gas recovery are critical technologies for addressing climate change. CO₂ is in a supercritical condition among the above methods. One of the most important challenges in improving recovery efficiency and long-term storage safety is the migration and heat/mass transfer of supercritical fluids in reservoir porous structures. Under the subsurface conditions, micro/nano-scale confinement, interface effect, and rapid changes in supercritical-fluid physical properties all have a significant influence on transport behavior in the porous structure. This talk will be divided into three parts: (1) CO₂/CH₄ adsorption in kerogen nano pores; (2) supercritical CO₂, water, and oil multiphase flow in micro-porous structures; (3) heat transfer characteristics of supercritical CO₂ in rocks.

Short Bio:

Ruina Xu is a full professor of the Department of Energy and Power Engineering at Tsinghua University and Deputy Director of the Key Laboratory for CO₂ Utilization and Reduction Technology of Beijing. She obtained a B.S. in 2002 and PhD in 2007 from Tsinghua University. Her research aims at providing answers to fundamental questions on the dynamics of multiphase flow, heat and mass transfer in micro-/nano-scale and complex porous network, which are applicable to practical low carbon and carbon neutral solutions, for example CCUS, CO₂ enhanced unconventional gas/oil exploitation, and next generation of solar-thermal and geothermal systems. In-situ high pressure visualization experiments and numerical models from atom-, molecular-, pore-, core-scale to field scale are developed in her lab. In addition to providing test platforms for CCS projects in UK, Canada and France, her team is the key technical supporter for the CCS demonstration projects in China. She has been the (co-) author of over 80 peer-review journal papers and has 30 authorized invention patents.

Invited Session Talk 4: Net-Zero Building in the UK – Challenges and Opportunities



Prof. Tapas MALLICK

**Chair in Clean Technologies (Renewables),
Environment and Sustainability Institute (ESI),
University of Exeter, UK**

Abstract:

With the recently concluded COP26, Net-Zero become an imperative solution to our human society. In recent time, the quest for economically viable solar energy conversion technologies has accelerated with the imperative to become far less reliant on fossil fuels. An innovative way to reduce its cost is through the utilisation of concentrating solar energy into smaller area. This lecture outlined the diverse range and scale of potential implementation of concentrating photovoltaic and concentrating solar power systems, particularly in the context of the building integration and its pathway to become Net-Zero. Key technical challenges and advances in such research is discussed. An overview of promising current research directions that should lead to economically viable photovoltaic and concentrated solar power systems is presented. The development of novel low concentrating system suitable for innovative building components and high concentrating point focus system for power generation is also discussed.

Short Bio:

Prof. Dr. Tapas Kumar Mallick is currently the Chair in Clean Technologies (Renewables) within the Environment and Sustainability Institute (ESI) and he leads the Solar Energy Research at University of Exeter. He is also Co-founder and Chief Scientific Advisor to the Build Solar limited, a spin out company from University of Exeter. Prior to joining the University of Exeter, he was at Heriot-Watt University, UK, where he led the “Applied Solar Energy Research”. He has secured research funding (>£15m) as PI and Co-PI of various national, European, International and Industrial funders. Prof. Mallick led several international projects mainly between UK-India and UK-China. In addition to board members of numerous national/international conferences/ seminars, Prof. Mallick was awarded “British Indian Award for his services to Education” – a premier British Indian award in the UK in 2016 and received “Cornwall Sustainability Award-2018”. More recently he has been invited to become Fellow of the World Society of Sustainable Energy Technologies, FWSSET. He has published over 400 research articles and holds two patents on solar technology successfully supervised 27 PhD candidates to completion in wide range of problem associated to Solar Energy.

ADAPEN YEB on Renewable Energy



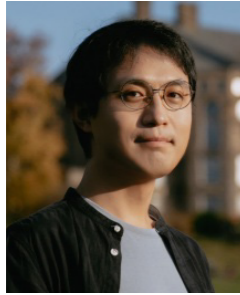
Rui ZHU

**Research Assistant Professor in the Department of
Land Surveying and Geo-Informatics, Hong Kong
Polytechnic University**

Short Bio:

Dr. Zhu is a Research Assistant Professor in the Department of Land Surveying and Geo-Informatics, Hong Kong Polytechnic University. He obtained his BSc from Nanjing Normal University (China), MSc from KTH – Royal Institute of Technology (Sweden), and Ph.D. from the Hong Kong Polytechnic University (Hong Kong SAR) with an exchange study at Université Laval (Canada). After that, Dr. Zhu has worked as a Postdoctoral Associate at MIT Senseable City Laboratory, SMART (Singapore). Dr. Zhu has served as PI/Co-I for many academic projects, funded by the University Grants Committee, Hong Kong. Dr. Zhu’s study in solar cities and smart mobility has been reported by Singapore TV Channel 8, MIT News, Lianhe Zaobao, Topos Magazine, and Portfolio Magazine, etc. Dr. Zhu has also been engaging with several academic journals as guest editors and reviewers and international organizations

ADAPEN YEB on Mitigation Technologies: Negative Emission Technologies for Climate Change Mitigation



Xiangkun (Elvis) CAO

Impact Fellow at the MIT Climate & Sustainability Consortium (MCSC)

Short Bio:

Dr. Xiangkun (Elvis) Cao (<https://www.elviscao.com/>) is an Impact Fellow at the MIT Climate & Sustainability Consortium, and a Postdoctoral Fellow at the Hatton Research Group in the Department of Chemical Engineering at MIT. He is an Early Career Researcher Editorial Board Member for Materials Today Energy and Advances in Applied Energy. His Ph.D. research at Cornell on a scalable solar reactor was featured as an energy breakthrough of the past decade by the World Economic Forum (2020), and Elvis landed on Forbes 30 under 30 in Energy for North America (2019). The commercial partner was named a finalist in the \$20M Carbon XPRIZE (1 of 10 globally) (2016-2021), and the Best CO2 Utilisation Award (1 of 6 globally) (2021).

ADAPEN YEB on Sustainability of Energy Systems: Sustainability of transportation systems



Wen-Long SHANG

Lecturer in the College of Metropolitan Transportation, Beijing University of Technology (BJUT)

Short Bio:

Dr. Wen-Long Shang is currently a Lecturer in the College of Metropolitan Transportation, Beijing University of Technology (BJUT), a recipient of the Youth Project of Beijing High Level Talent Program, and he is appointed as Honorary Senior Research Fellow of Imperial College London. Prior to joining BJUT, he has received the Ph.D. degree from the Centre for Transport Studies, Department of Civil and Environmental Engineering, Imperial College London. He has already published nearly 40 academic articles in peer-reviewed journals and conferences, such as Applied Energy, IEEE Transactions on Intelligent Transportation Systems, and Resources Conservation and Recycling, obtained 2 software copyrights and 1 patent, and participated in the writing of a book Big Data & Mobility-as-a service. He was invited to serve as Lead/Manage Guest Editors and members of editorial board for several international academic journals, such as Applied Energy, Advances of Applied Energy, Renewable and Sustainable Energy Reviews, IEEE T-ITS, Complexity, International Journal of Transportation Science and Technology, Journal of Traffic and Transportation Engineering. He is also the reviewer of more than 40 journals and conferences. His research interests include: intelligent transport system, energy conservation and emission reduction of transport systems, traffic big data, smart city, large scale optimization and so on.





ADBI-ADB Session on Low-Carbon Cooling: Financing and Policies

CEN2022 Applied Energy Symposium 2022:
Clean Energy towards Carbon Neutrality

April 25, 2022
09:00 – 11:00 (GMT+8)

Introduction

Cohosted by the Asian Development Bank Institute and Asian Development Bank as part of the CEN2022 Applied Energy Symposium 2022, this session will spotlight new research on promoting climate-friendly cooling needs in developing Asian countries. The focus will be on viable policy and funding solutions.

Objectives

- Highlight innovative policy and financial measures for enabling low-carbon cooling and investment
- Explain how these approaches could advance the Paris climate agreement and Sustainable Development Goals

Target Participants

- Policy makers and experts from think tanks, universities, and other institutions, as well as post-graduate students and interested members of the public

Output

- Identification of policies and financing solutions for addressing low-carbon cooling technology and funding gaps
- Greater understanding of implementation challenges and benefits for climate change mitigation and sustainable development

Moderator

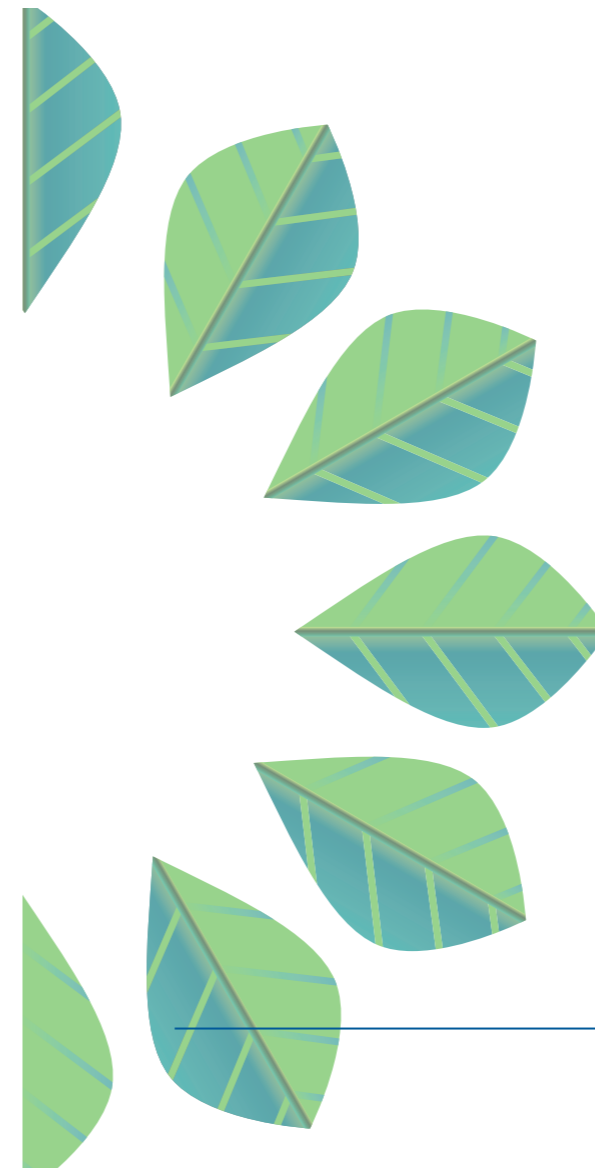


Yun Zhou

Senior Environment Specialist, Sustainable Infrastructure Division, East Asia Department, Asian Development Bank, Philippines

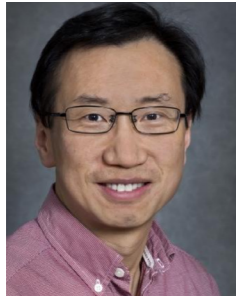
Short Bio:

Dr. Yun Zhou is a senior environment specialist at the East Asia Department of the Asian Development Bank (ADB), mainly focusing on environmental safeguard due diligence of ADB financed projects in China and Mongolia. Prior to joining ADB, she was the Director of International Cooperation Center at the Chinese Research Academy of Environmental Sciences (CRAES), the largest research institution under the Ministry of Ecology and Environment (MEE), where she provided support to different research teams in the implementation of bilateral/multilateral environmental cooperation projects, and conducted research on energy and climate change. She also worked as Deputy Director of the Administrative Office in the Appraisal Center for Environment and Engineering, which is a major technical support institution in the field of environmental impact assessment for MEE.



Paper 1:

Financial solutions to invest in climate-friendly cooling and brief lessons learnt from ADB project in Ningbo: Developing a climate-friendly cooling sector through market and financing innovation



Bo Shen

Research Scientist, Energy Analysis and Environmental Impact, Lawrence Berkeley National Laboratory, United States

Short Bio:

Dr. Shen is an Energy/Environment Research Scientist at the Energy Analysis & Environmental Impacts Division of the Lawrence Berkeley National Laboratory (LBNL). At LBNL, Dr. Shen pursues research on assessing and developing strategies for decarbonizing current energy systems through promoting energy efficiency and other demand-side solutions and advancing renewable energy. His research work covers a wide range of areas including energy efficiency policy and governance, techno-economic analysis of efficiency improvement and pollution reduction measures, energy management system, distributed energy resources, demand response, electricity market, green financing, carbon pricing, and emissions trading.

Paper 2:

Promoting Sustainable Cooling Through District Cooling



Alfredo Baño Leal

Senior Energy Specialist, East Asia Department, Asian Development Bank, Philippines

Short Bio:

Alfredo Baño Leal is a Senior Energy Specialist at the Asian Development Bank (ADB) developing sustainable energy operations in the East Asia region. Previously, he worked at the Independent Evaluation Department of ADB, where he evaluated energy programs and led the evaluation of ADB's 2009 Energy Policy. He has 15 years of experience working on energy infrastructure sectors in Europe and Asia. Before joining ADB, he worked for the International Atomic Energy Agency, he consulted for the World Bank and ADB, and worked for an engineering consulting firm in Spain. He is an electromechanical engineer, with majors in electricity generation and power systems, and holds an MBA in Corporate Finance from the IE Business School.



Paper 3:

Policy solutions to enable climate-friendly cooling and briefly lessons learnt from ADB project in Ningbo: Developing a climate-friendly cooling sector through market and financing innovation



Feng An

Executive Director, Innovation Center for Energy and Transportation, United States

Short Bio:

Dr. Feng An is a world-renowned expert in energy innovation and clean transportation. He founded iCET in California and Beijing to promote policy changes and implementable actions for societal transitions to a sustainable and low-carbon future. Prior to founding iCET, Dr. An served in several national and international institutions with various capacities, including United States (US) Agency for International Development (USAID), US Dept of Energy's Lawrence Berkeley National Laboratory and Argonne National Laboratory, and University of California. In the past decades, He has advised governments in the People's Republic of China, US, EU, Mexico, Brazil, India, Thailand and Saudi Arabia on clean energy and automotive policies. Dr. An received his MS from Tsinghua University and PhD from the University of Michigan, Ann Arbor.

Paper 4:

Green bonds for financing low-carbon cooling



Dina Azhgaliyeva

Research Fellow, Asian Development Bank Institute, Japan

Short Bio:

Dr. Dina Azhgaliyeva is a Research Fellow at the Asian Development Bank Institute (ADBI). Before joining ADBI in July 2019, she worked as a Research Fellow in the energy economics division of the Energy Studies Institute, National University of Singapore. She was also a Research Fellow at the Henley Business School, University of Reading (UK) where she worked on a project 'Kazakh-British Centre for Competitiveness'. She also worked as a leading and chief specialist for the Tax Committee at the Ministry of Finance of Kazakhstan. Her research focuses on energy policy, particularly renewable energy, energy efficiency, and energy storage. Dina has published articles on these topics in journals such as Technological Forecasting and Social Change, Australasian Journal of Environmental Management, Journal of Environmental Management, Energy Policy and Journal of Sustainable Finance & Investment. She is currently a guest editor for the Applied Energy's special issue "Integration of Renewable Energy in Energy Systems, Perspectives on Investment, Technology, and Policy". She earned her PhD and MSc in economics from the University of Essex (UK). She also holds an internationally recognized teaching qualification from the Fellow of Higher Education Academy and a qualification in research career management from the Staff Educational and Development Association. More information is available here: <https://www.adb.org/adbi/about/staff-profiles/dina-azhgaliyeva>

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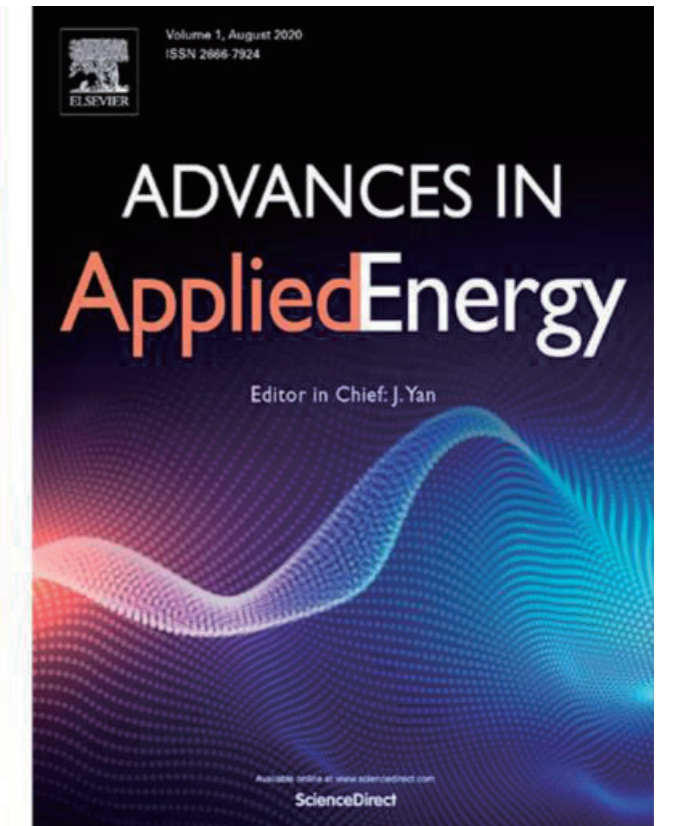
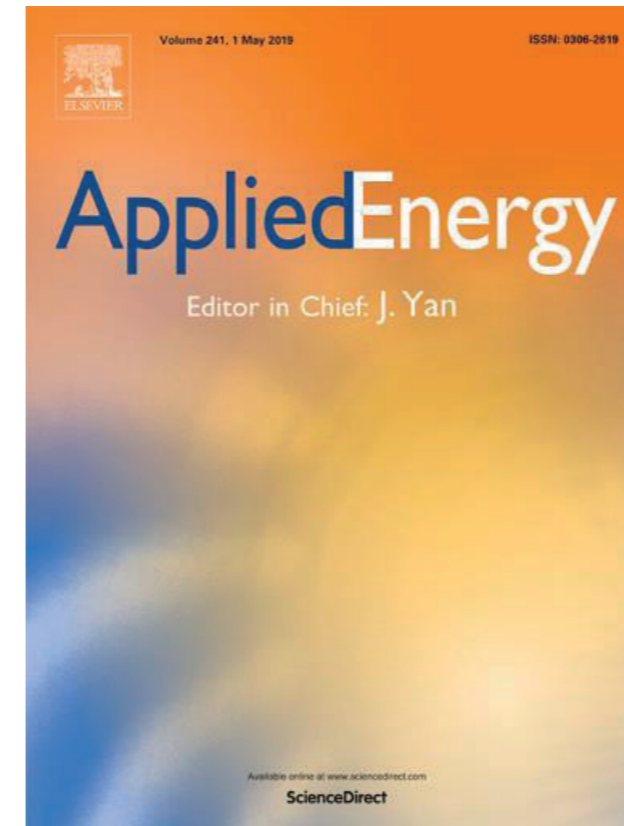
CLEAN ENERGY

TOWARDS CARBON NEUTRALITY

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SUPPORTING JOURNALS



Guodian Beilun Power Station

The Guodian Beilun Power Station is a coal-fired power station in Beilun District, Ningbo with an installed capacity of 5,000 MW. It is the 4th largest thermal power plant in China, and the 7th largest coal-fired power station in the world. It is the first power station in Zhejiang Province to surpass the 1,000 MW capacity, and the first power generation enterprise in China to receive financial support from the World Bank. The power plant has a desulfurization rate of 95.5% whilst the dust removal is 99.8% efficient. The power plant also has its own coal wharf catered for 100,000 tonne ships. The Guodian Beilun Power Station has consistently upgraded its facilities to continuously accommodate the increasing power demands whilst meeting the stringent government policies.

Ningbo Solid Waste Disposal Industrial Park

Ningbo Solid Waste Disposal Industrial Park is one of the first resource recycling bases in China. The industrial park covers an area of 60 acres with three waste-to-energy facilities: (1) kitchen waste disposal plant, (2) food waste disposal plant and (3) municipal solid waste incineration plant. Operated by the Ningbo Kaicheng Food Waste Disposal Co., Ltd, the plant has a daily capacity of 600 tonnes of food waste and 60 tonnes of waste oil to produce 60,000 m³ of biogas and 12 tonnes of oil. The treatment procedures include waste pre-treatment, anaerobic fermentation and biogas purification with auxiliary processes like biogas residue dewatering and odor treatment. The waste incineration plant operated by Mingzhou Environmental Energy Co., Ltd is the largest municipal solid waste incineration project in Ningbo with a processing capacity of 2,250 tonnes per day. This project has received the Luban Award – the most prestigious award in constructional engineering. The state-of-the-art facility features super low emission and deindustrialization design. The incinerator is equipped with a ‘seven-stage’ flue gas treatment to ensure emission level is well below both EU and national standards, particularly with the dioxin emission level averaging around 1/8 that of EU standard. The Ningbo Solid Waste Disposal Industrial Park plays a vital role in the city’s waste management, classification and recovery for energy purposes, and thus accelerating towards carbon neutrality targets of Ningbo.

About Ningbo and the University of Nottingham Ningbo China

Ningbo, one of the most vibrant, dynamic and prosperous cities in China, is a sub-provincial city in the northeast of Zhejiang province. It is a coastal city lying in the south of the populous Yangtze River delta and facing the East China Sea to the east. It covers an area of 9816 km² and has a population of 9.4 million, thus making it one of the most populated cities in the world. Ningbo is also a famous historical city with rich cultural heritage. It is home to the "Neolithic Hemudu Culture" dating back to more than 7,000 years. Since ancient times, Ningbo has always had great respect and emphasis on education, and has an outstanding track record. During the Tang to Qing Dynasties, more than 2400 scholars passed the prestigious examination for imperial scholars, of which more than 10 won first places. Such excellence has also inherited into modern times with many world-renowned first class scholars, scientists and artists originating from Ningbo.

Ningbo is one of the most important port cities in China with Ningbo port being the busiest in the world, thanks to its multi-purpose deep-water port infrastructure. Ningbo has always been known for its crucial role as a trade city along the Silk Road since Tang and Song Dynasties. This has placed Ningbo at the gateway of the import and export of valuable goods, and also the hub for exchanging invaluable knowledge and culture. This, in turn, has fueled Ningbo’s social and economic rapid

advancement. In 2020, the city’s GDP exceeded RMB 1.24 trillion despite the impact from COVID-19, and it is expected to follow a steep rising trend. In the foreseeable future, Ningbo will continue to serve as an important industrial city and foreign trade port in eastern China, whilst being a key chemical/material industrial base in the Yangtze River delta and an economic centre of Zhejiang Province at the same time.

With UNNC strategically positioned in Ningbo, the University of Nottingham, as a whole, has been able to effectively deliver international ground-breaking research to meet local needs and beyond. The University of Nottingham and its international campus, UNNC, have made significant advances and impacts in the area of clean energy development, particularly in the construction of modern energy supply systems, development and optimisation of new energy utilisation, as well as reduction in environmental impacts as highlighted in the action plans of China Energy Development Strategy and the 13th Five-Year Plan for energy development in Zhejiang Province. The University of Nottingham Ningbo China (UNNC), established in 2004 with the full approval of the Chinese Ministry of Education, is the first Sino-foreign university in China. The academic quality of UNNC and the quality of its students are consistent with that of the Nottingham campus in the UK as highlighted in the official Quality Assessment report released

by the British Higher Education Quality Assurance Agency (QAA). UNNC has continued to develop into an international hub with excellence in research, innovation and knowledge exchange.

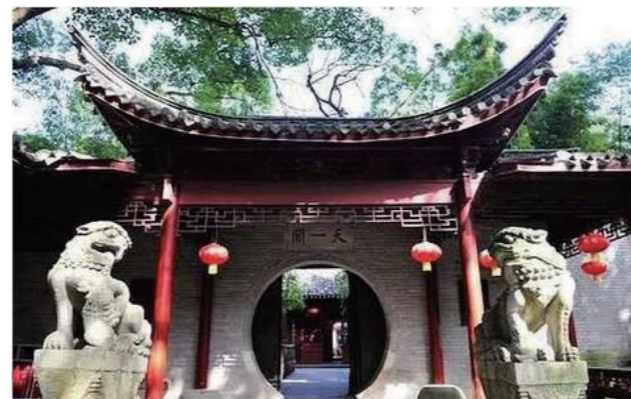
In 2020, the Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute (also known as 'the China Beacons Institute') was jointly established by the Ningbo Municipal Government and the University of Nottingham with a vision to lead the frontiers of (1) green chemicals and energy, (2) life science and healthcare, and (3) intelligent manufacturing, with the integration of advanced technology research, outstanding talent cultivation and research knowledge transfer to transform ideas and concepts into world-class applications. The China Beacons Institute leverages the unique "Ningbo-based and global-oriented" values by serving as an international scientific and technological innovation platform catalyzing original research and cutting-edge new technology development, while driving the industrial development of Ningbo.



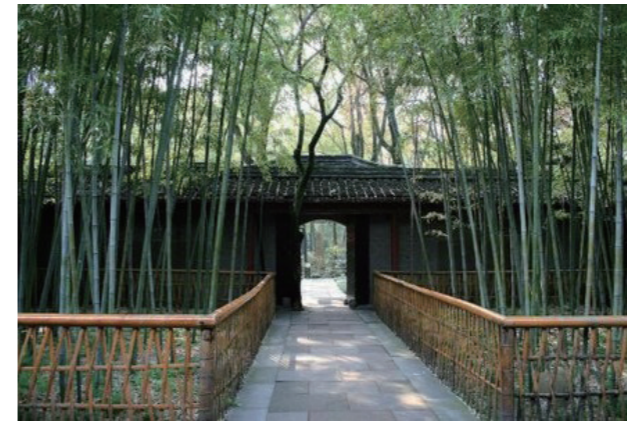
Tourism in Ningbo

Tian Yi Pavilion: China's Oldest Library

It is the oldest existing library in China founded in 1561 by Fan Qin during the Ming dynasty. In its heyday, it boasted a collection of 70,000 volume of antique books. Fascinating documents, manuscripts and steles are on display, with many more available for viewing in the reading room. Take some time to appreciate the time-worn building, full of signs of the history chronicled in its collection of books, and don't forget to enjoy the landscape.



The Centre for Sustainable Energy Technologies (CSET) in UNNC is the first zero-carbon building in China. It was officially opened in September 2008 and accommodates research laboratories as well as teaching and administrative facilities.



Dongqian Lake: "East Lake"

Dongqian Lake is a natural lake lying in the southeast of Yinzhou District, Ningbo in the Zhejiang province of eastern China. It is the largest natural freshwater lake in Zhejiang province with a water surface area of 20 km², approximately four times larger than the West Lake in Hangzhou. Since ancient times the Lake has been a famous scenic spot in Eastern Zhejiang. October is one of the best seasons of the year to enjoy a boat ride overlooking the sunset.



The Old Bund: Laowaitan

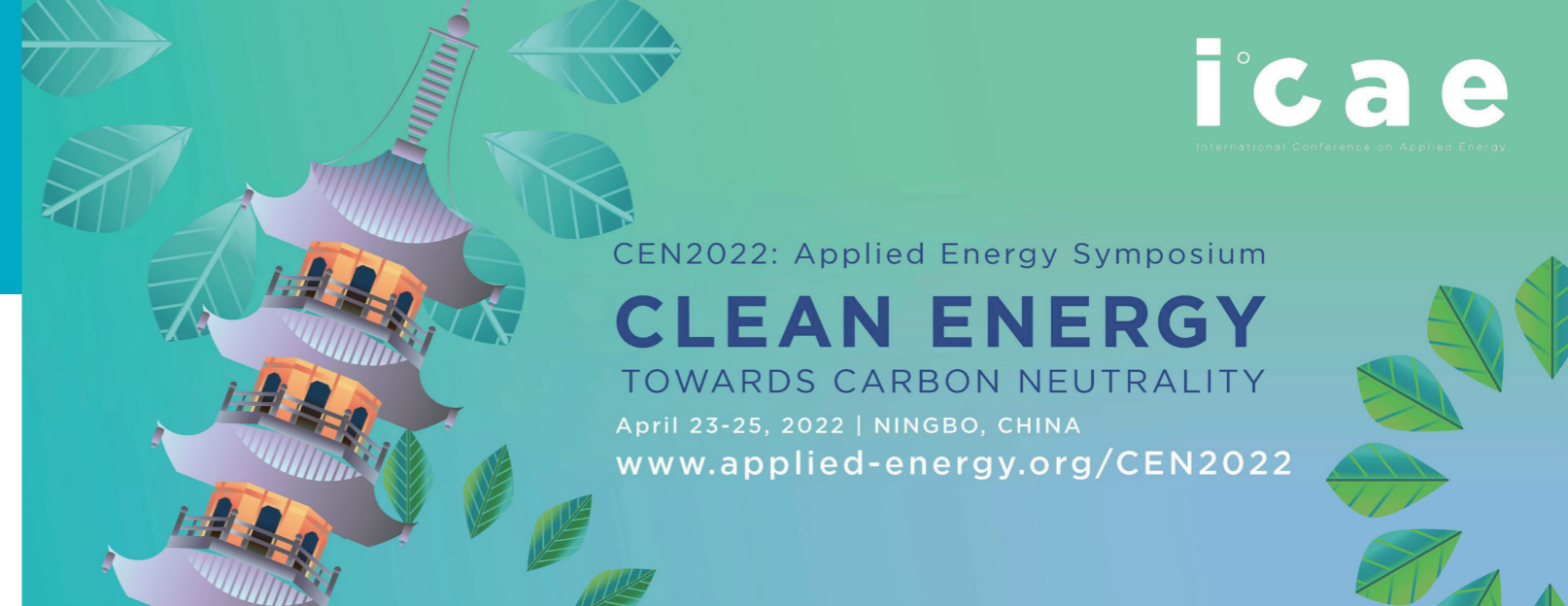
Ningbo's Old Bund used to be the place where ancient British and Dutch traders lived and you can still see remaining architectures as you walk along the brightly lit street. The swooped lines of Chinese-style buildings are replaced by old stone buildings with western-inspired details. Also known as Laowaitan, the area is now a lively street full of bars and restaurants with east-meets-west fusion dishes and drinks.



Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute

The Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute (hereinafter referred to as "the China Beacons Institute") was jointly established by Ningbo Municipal Government and University of Nottingham in April 2020. The establishment of the China Beacons Institute is a combination of a world-class university with its advanced science and innovation and national development strategies and local social and economic development, as well as an important project and accelerator for the UNNC strategic development.

The China Beacons Institute will leverage the unique "Ningbo-based and global-oriented" advantages of UNNC. By introducing the key international technological and innovative resources of the Beacons of Excellence from the UK, the intention is to attract global technology innovation resources. This will allow the China Beacons Institute to focus on original research and cutting-edge new technology development, the aim being to establish a world-class scientific and technological innovation platform with innovative research, research achievement transformation, technology transfer and talent cultivation, in order to support and drive the industry development of Ningbo.



Vision

To create a Sustainable Innovation Eco-system with the integration of advanced technology research, outstanding talent cultivation and research knowledge transfer to turn ideas and dreams into reality

Mission

- To attract and cultivate outstanding researchers internationally
- To develop the most transformative and innovative research
- To unlock the best commercial potential of advanced technology
- To accelerate local innovation and enhance its global impact

Research Areas



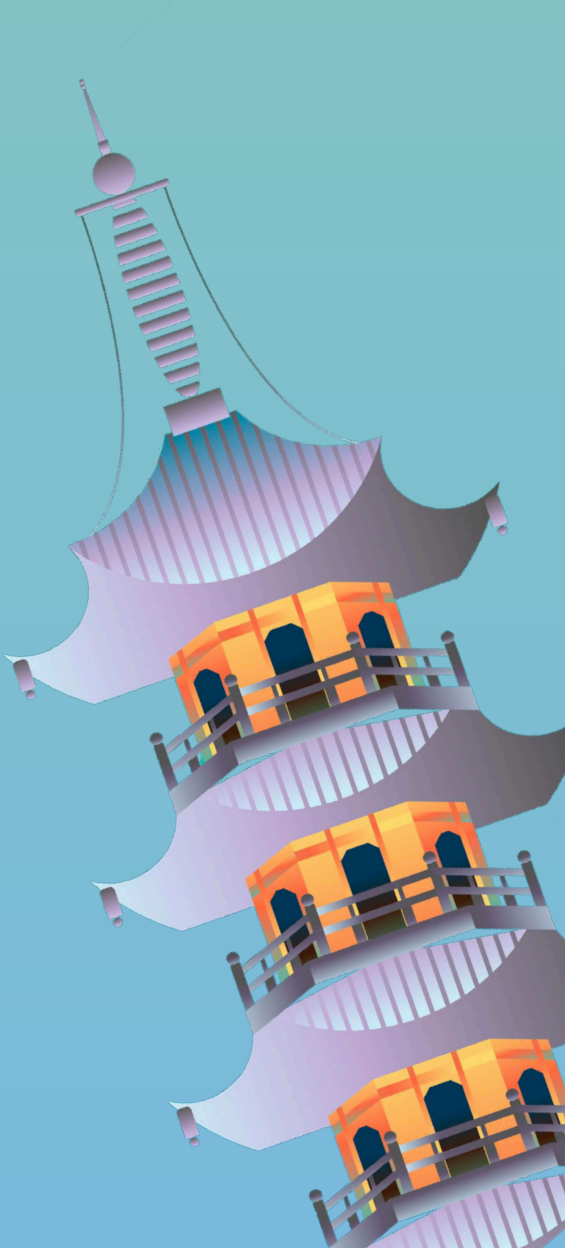
Intelligent Manufacturing



Green Chemicals and Energy



Life Science and Healthcare



CONTACT US

Should you have any inquires please feel free to contact us at cen2022@applied-energy.org