15th International Green Energy Conference (IGEC-XV)

in-person & online

Glasgow, United Kingdom, July 10-13, 2023

Conference Programme

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Welcome Message

On behalf of the Local Organizing Committee, we are pleased to welcome you to the 15th International Green Energy Conference. We are very excited to host the 2023 conference in Glasgow, United Kingdom. Welcome to Scotland's largest city!

Since the 1st International Green Energy Conference in Waterloo, Canada, in 2005, this gathering has developed into a leading international multi-disciplinary conference on energy systems and technologies with no/reduced environmental, economic and social impact, and provides a forum for the exchange of technical information, for the dissemination of high-quality research results, and for the debate and shaping of future directions and priorities in energy sustainability and security.

This year's conference features 7 invited plenary talks and 10 invited keynote talks. Our technical program includes 196 contributed presentations across 24 technical sessions and 5 special sessions on focused research topics. Prizes will be awarded for the best paper, the best student papers and the best student presentations.

In addition to the scientific exchange, there will be ample opportunity for networking during the conference, especially its social events. On Monday, 10th of July, we are invited to a Civic Reception by the Lord Provost of Glasgow in Glasgow City Chambers famed for its lavish Italianate style interior and exterior decorations. On Wednesday, 12th of July, you will have the opportunity to experience the Scottish bagpipes before the Gala Dinner in the University of Glasgow's Bute Hall. On the last day of the conference, bus tours will take place in which you can discover the rich culture and technical achievements of Scotland.

We would like to thank everyone who helped organise and coordinate this conference, particularly the Lord Provost of Glasgow, Glasgow City Council, Glasgow Convention Bureau, the Events and Conference Department and the James Watt School of Engineering of the University of Glasgow.

We would also like to express our gratitude to all our invited plenary and keynote speakers, special session organisers, presenters, reviewers, our International Organizing Committee, Technical Committee and, last but not the least, the International Association for Green Energy (IAGE), who made this conference fascinating and a great success!

We wish you an enjoyable and productive conference and a pleasant visit to Glasgow and Scotland!

Zhibin Yu

On behalf of the Local Organizing Committee

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We gratefully acknowledge support by the IGEC-XV sponsors:

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Best paper award

Award of $1,000 sponsored by *International Journal of Green Energy* publisher **Taylor & Francis**

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Best student presentation award

Three awards of £300 each sponsored by *Frontiers in Thermal Engineering* publisher **Frontiers**

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Programme Information

Day 0: Monday, July 10, 2023

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<tr><th>UK Time Zone (UTC+1)</th><th>IJGE and IAGE Board Members</th><th>Conference Delegates</th></tr>
<tr><td>09:00 – 10:00</td><td></td><td rowspan="8">Registration
James Watt South Building</td></tr>
<tr><td>10:00 – 11:00</td><td></td></tr>
<tr><td>11:00 – 12:00</td><td rowspan="2">IJGE Editorial Board Meeting
Venue: James Watt South Building, 530</td></tr>
<tr><td>12:00 – 13:00</td></tr>
<tr><td>13:00 – 14:00</td><td></td></tr>
<tr><td>14:00 – 15:00</td><td rowspan="2">IAGE Board Meeting
Venue: James Watt South Building, 530</td></tr>
<tr><td>15:00 – 16:00</td></tr>
<tr><td>16:00 – 17:00</td><td></td></tr>
<tr><td>17:00 – 18:00</td><td></td><td></td></tr>
<tr><td>18:00 – 19:00</td><td colspan="2" rowspan="2">Civic Welcome and Drinks Reception hosted by the Lord Provost of Glasgow
Venue: City Chambers, George Square, G2 1DU</td></tr>
<tr><td>19:00 – 20:00</td></tr>
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Day 1: Tuesday, July 11, 2023

UK Time Zone (UTC+1)	Day 1: Tuesday, July 11, 2023				
09:00 – 09:20	**Opening Session** (Chairs: Zhibin Yu and Xianguo Li)				
09:20 – 10:00	**Plenary Lecture: Progress in fuel cell and hydrogen technologies for the low carbon energy transition** **Speaker: Nigel Brandon, Imperial College London, UK** Chair: Zhibin Yu Venue: 293; Zoom ID: 8380 8821 705				
10:00 – 10:40	**Plenary Lecture: Electrochemical energy conversion using non-precious metal catalysts** **Speaker: Piotr Zelenay, Los Alamos National Laboratory, USA** Chair: Xianguo Li Venue: 293; Zoom ID: 8380 8821 705				
10:40 – 11:05	**Coffee Break (Venue: 220)**				
	Session S1: Advanced materials for energy systems #1	**Session S2: Energy systems modelling and optimization #1**	**Session S3: Hydrogen and fuel cells #1**	**Session S4: Energy, exergy, environmental and economic analysis #1**	**Session S5: Energy conversion and management #1**
Session Chairs	Chuang Wen; Xiaoya Li	Shunmin Zhu; Guopeng Yu	Ronghui Qi, Lei Xing	Yiji Lu; Zhi Li	Jian Song; Xiangkun Cao
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331
11:05 – 11:20	IGEC2023-151 **High-performance 2D MoS2 cathode for aqueous Al-ion batteries** Wending Pan; Dennis Leung	IGEC2023-022 **Effects of visualizing energy consumption on occupants' energy savings and indoor air quality using augmented reality** Dahyun Jung et al.	IGEC2023-121 (online) **Anion exchange membrane electrolyser with highly active oxygen evolution reaction self-support electrode: Sulfidation of CoCuOx/NF with heterostructure and oxygen vacancies** Shuo Zhao et al.	IGEC2023-176 (online) **A multi-index evaluation method of supercritical carbon dioxide Brayton cycle for nuclear power plants design** Na Zhang; Yongfeng Cheng; Guopeng Yu	IGEC2023-053 (online) **Theoretical study on the performance of a standing-wave thermoacoustic refrigerator under various boundary conditions** Wenpeng Sun et al.
11:20 – 11:35		IGEC2023-133 **The challenge of rural energy decarbonisation of heat in the UK** Samir A Soares	IGEC2023-125 (online) **Size effect of catalyst particles on Co-N-C cathode catalyst layer for PEMFC** Shilin Ling et al.	IGEC2023-043 **A Malaysian perspective on lithium-ion batteries recycling** Fadzli Irwan Bahrudin et al.	IGEC2023-094 (online) **Waste heat recovery and thermal management of automotive engine through a split-flow organic Rankine cycle with composition matching capability** Bowen Lu et al.

UK Time Zone (UTC+1)	Day 1: Tuesday, July 11, 2023				
11:35 – 11:50	IGEC2023-231 **Phase change behavior of supercritical carbon dioxide (sCO2) in transonic flows** Hongbing Ding; Yu Z hang; Yuanyuan Dong; Yan Yang; Chuang Wen	IGEC2023-040 **Economic, environmental and human health impact assessment according to the structure type of apartment** Kyungseok Oh et al.	IGEC2023-127 (online) **Quaternized polymers of intrinsic microporosity as anion exchange ionomers** Yang Xiao et al.	IGEC2023-112 **Energy and exergy analyses of a solid oxide fuel cell-engine organic Rankine cycle power generation system with methanol for ship application** Chengjie Li et al.	IGEC2023-185 (online) **Optimizing air-conditioner target temperature and fan mode for energy conservation based on long-short term memory and particle swarm optimization** Somporn Sirisumrannukul; Nattavit Piamvilai; Tosapon Intaraumnau
11:50 – 12:05	IGEC2023-230 **Working fluid selection and thermo-economic analysis of thermal integrated-pumped thermal electricity storage system for waste heat recovery and energy storage** Ding Wu; Ji Zhang; Chuang Wen	IGEC2023-141 **Performance exploration and operation analysis of a dual heat source driven distributed trigeneration system based on methanol reforming PEMFC** Zheng Liang et al.	IGEC2023-157 **Prediction of temperature field in a T-junction based on deep learning** Yuang Jiang ; Ziliang Zhu; Mei Lin; Qiuwang Wang	IGEC2023-195 **Sustainable redox flow battery operation: finite-time exergy analysis** Thomas Paterson; Leo Lue; Jun Li	IGEC2023-104 **Thermodynamic assessment of high-parameter transcritical cycle enabled by CO2-SO2 mixture** Xingyan Bian
12:05 – 13:35	**Lunch Break (Venue: 220)**				
13:35 – 14:15	**Plenary Lecture: Key challenges of thermal energy storage: a dive into the roadmap** **Speaker: Luisa F. Cabeza, Universitat de Lleida, Spain** Chair: Yongliang Li Venue: 293; Zoom ID: 8380 8821 705				
14:15 – 14:55	**Plenary Lecture: Green energy solutions with hydrogen: challenges, opportunities and future directions** **Speaker: Ibrahim Dincer, Ontario Tech University, Canada** Chair: Samaneh Shahgaldi Venue: 293; Zoom ID: 8380 8821 705				
14:55 – 15:20	**Coffee Break (Venue: 220)**				
	Session S6: Advanced materials for energy systems #2	**Session S7: Energy storage #1**	**Special Session SS5: Advances on Chemical Energy Storage: Hydrogen and Carbon Reduction**	**Session S8: Renewable and clean energy #1**	**Special Session SS2: Advances in green refrigeration and cold storage technologies**
Session Chairs	Jian Song; Muhammad Wakil	Yasser Mahmoudi; Zhi Li	Kui Jiao; Baowen Wang	Geng Chen; Mousami Prasad	Yongliang Li; Vincenza Brancato
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331

UK Time Zone (UTC+1)	Day 1: Tuesday, July 11, 2023				
15:20 – 15:35	IGEC2023-061 **Application of a hydrophilic nano-coating to indirect evaporative cooling** Yi Chen; Huaxia Yan	IGEC2023-033 **Investigation of nanoparticle effect in phase change material balls for solar energy conversion and storage systems** Oguzhan Kazaz et al.	IGEC2023-351 (invited) **Microenvironment design strategies for enhanced CO2 electroreduction with a 60% full-cell energy efficiency** Qian Fu et al.		IGEC2023-321 (invited) **Development and characterizations of salt hydrates based composites for adsorption cooling** Y. Zhang et al.
15:35 – 15:50	IGEC2023-032 **A comparison of performance of a latent thermal energy storage unit using three PCM macro-encapsulations** Omais Abdur Rehman et al.	IGEC2023-099 **Melting solidification behaviour of a form stable green phase change biochar composite for thermal energy storage** Dudul Dr. Das; Manosh C. Paul	IGEC2023-352 (invited) **Data-driven assisted functionally graded design of proton exchange membrane fuel cells** Lei Xing	IGEC2023-047 **Unraveling India's solar power success in the last decade and its implications for the next decade** Mousami Prasad et al.	IGEC2023-322 (invited) **Formstable phase change materials based on hybrid salt hydrates for cold storage** Muhammad Maqbool; Boyang Zou; Yulong Ding
15:50 – 16:05	IGEC2023-120 **Perovskite solar cells with tunable bandgaps for beam-splitting photovoltaic-thermal system** Yu Gao et al.	IGEC2023-058 **Gold as a Dopant for Robust Structural Properties of LiFePO4 Cathode Material for Lithium-Ion Battery Application** Shahrul Izwan Ahmad et al.	IGEC2023-353 (invited) **Structure design to boost the power density of proton exchange membrane fuel cells** Guobin Zhang; Zhiguo Qu	IGEC2023-036 (online) **Gas-solid flow simulation during thermal runaway of lithium batteries** Yuqi Huang ; Pengfei Zhang; Yiji Lu	IGEC2023-323 (invited) **Innovative strategies for materials development for low-temperature thermochemical energy storage** Emanuela Mastronardo et al.
16:05 – 16:20	IGEC2023-124 **Nanostructured anodic WO3 films for photoelectrochemical water splitting** Mingyu Xia	IGEC2023-187 (online) **Estimation of latent heat and vapor pressure of ethanol-gasoline blends using machine learning and thermodynamic relations** Manan Bansal; Rajneesh Kashyap; Kaushik Saha	IGEC2023-354 (invited) **Experimental and numerical investigation of spatially resolved catalyst support degradation during start-up and shut-down of PEM fuel cells** Yuze Hou; Johannes Schall; Dietmar Gerteisen	IGEC2023-019 **Numerical study of a natural convection cooling loop system for floating photovoltaic panels** Bayu Sutanto et al.	IGEC2023-324 (invited) **Aging issues on novel composite materials for low temperature thermochemical energy storage applications** Luigi Calabrese; Emanuela Mastronardo
16:20 – 16:35	IGEC2023-192 **Performance analysis of high-vacuum insulation for mid-temperature heat delivery pipes** Fabio Capolupo et al.	IGEC2023-189 **High-vacuum flat plate collectors' dynamic analysis for dry saturated steam production through a flash vessel and kettle reboiler comparison** Alessandro Levrano et al.	IGEC2023-355 (invited) **Time series health diagnosis system for polymer electrolyte membrane fuel cell based on convolutional neural networks** Bowen Wang; Zhichao Gong; Kui Jiao	IGEC2023-025 **Comparison analysis of cooling systems (EHP & fabric duct) based on thermal comfort and CO2 concentration for stair-type lecture room using CFD analysis** Se Eun Ajin Choi er al.	IGEC2023-325 (invited) **Nanoconfined salt in anisotropic graphene aerogel matrix for thermochemical energy storage** Waseem Aftab; QiQiu Huang; Yongliang Li
16:35 – 16:50	IGEC2023-216 (online) **Experimental study on the influence solution concentration and nano-additives on cold storage performance of Tetrabutylammonium Bromide** Xiao Yang; Kao Yan Zhang; Bin Liu; Fei Ma	IGEC2023-119 **The Mechanical and Piezoelectric Properties of La-doped ZnO** Oskar H Hassan et al.	IGEC2023-144 **Multi-objective self-optimisation of a CO2 capture process via enhanced weathering in response to flue gas fluctuations and intermittent renewable energy supply** Oliver J Fisher; Lei Xing; Jin Xuan	IGEC2023-034 **Computational analysis of the influence of bio-based phase change material slurry on the thermal performance in a volumetrically heated solar system** Oguzhan Kazaz et al.	IGEC2023-326 (invited) **Dynamics of water vapour adsorption for heat conversion systems: comparative study of loose adsorbents grains and consolidated layers** Svetlana Strelova; Marina Solovyeva; Larisa Gordeeva
16:50 – 17:00	**Room Change Break**				

UK Time Zone (UTC+1)	Day 1: Tuesday, July 11, 2023
17:00 – 18:00	**Workshop: Meet the Editors** Chair: Zhibin Yu Venue: 293; Zoom ID: 8380 8821 705

Day 2: Wednesday, July 12, 2023

UK Time Zone (UTC+1)	Day 2: Wednesday, July 12, 2023				
	Session S9: Energy conversion and management #2	**Session S10: Energy storage #2**	**Session S11: Energy systems modelling and optimization #2**	**Session S12: Hydrogen and fuel cells #2**	**Special Session SS4: Energy for Buildings**
Session Chairs	Yiji Lu; Muhammad Imran	Huizhi Wang; Xiaoya Li	Shunmin Zhu; Guopeng Yu	Ronghui Qi, Muhammad Usman	Shuli Liu
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331
09:00 – 09:25	**Keynote: Opportunities of smart grid and hydrogen production** Nilson Henao, University of Quebec at Trois-Rivieres, Canada	**Keynote (online): Study and application of storage technology in the "generation-grid load-storage" type integrated systems with its energy management method** Ming-jia Li, Beijing Institute of Technology, China	**Keynote: Building a circular economy for net zero manufacturing of chemicals and materials** Jin Xuan, University of Surrey, UK	**Keynote: Decarbonization with Efficient Green Hydrogen Production from Water Electrolysis** Feng-Yuan Zhang, University of Tennessee, Knoxville (UTK), USA	**Keynote: A study of an indirect expansion solar-assisted air source heat pump with hybrid thermal energy storage for space heating in North China: efficient-economic-environmental analysis** Shuli Liu, Beijing Institute of Technology, China
09:25 – 09:40	IGEC2023-196 (online) **Investigation of energy efficiency road map of industrial facility** Mehmet Ziya Söğüt; Tahir Hikmet Karakoc	IGEC2023-209 (online) **Impact of renewable and non-renewable energy consumption and ICT on economic growth and environmental degradation: evidence from Asia-Pacific Economic Cooperation countries** Rameesha Zahur Khan et al.	IGEC2023-086 (online) **Location optimisation of EVC point of coupling for minimising voltage harmonic levels of a UK based LV power distribution network** Graham P Gissing; Jin Yang; Nand Meena	IGEC2023-129 (online) **Design of ZIF derived microporous Layers for improving water management of PEMFC** Jie Yao et al.	IGEC2023-342 (invited) **Multi-level scale-up research on distributed clean building heating using heat thermal storage of PCM and solar energy** Kongxiang Fei
09:40 – 09:55	IGEC2023-197 (online) **Assessment of difficulty of green transition of airports based on entropy management** Mehmet Ziya Söğüt; Tahir Hikmet Karakoc	IGEC2023-126 **Tuning electronic and magnetic properties of Zn-Ni-Co ternary spinel oxides for supercapacitors electrode** Nur Hamizah Mohd Zaki et al.	IGEC2023-210 (online) **Dynamic response characteristics of S-CO2 Brayton cycles for energy conversion of Generation IV nuclear reactors** Xin Wen; Guopeng Yu; Xuan Wang	IGEC2023-102 (online) **Research on control strategy of PEMFC air supply system under dynamic conditions** Xi Chen; Bin Gu	IGEC2023-343 (invited) **Energy and Environmental Assessment of a Shared Workspace in UK Educational Buildings During the Winter Season** Thara Al-Mindeel, Mahroo Eftekhari, Eftychia Spentzou
09:55 – 10:10	IGEC2023-114 **Design and experiment of a single-loop organic Rankine cycle absorbing engine coolant and exhaust heat** Jinwen Cai	IGEC2023-041 **The influence of thermal energy storage on the performance of a concentrated solar power plant** Fatma Alfailkawi; Saud Alqabandi; Bashar Abdulrahman; Ayman Al-Qattan	IGEC2023-188 **Experimental analysis and numerical optimization of the stratification efficiency in a commercial stratified thermal storage** Alessandro V Anacreonte et al.	IGEC2023-174 (online) **Two-phase flow in the gas diffusion layer with different perforation of proton exchange membrane fuel cell** Tianshu Li et al.	IGEC2023-344 (invited) **A solar powered PCM heat exchanger to stabilize indoor temperature for winters in Pakistan** Abdur Rehman Mazhar; Aurang Zaib; Muhammed Inshal; Tariq Talha

UK Time Zone (UTC+1)	Day 2: Wednesday, July 12, 2023				
10:10 – 10:25	IGEC2023-227 (online) **Emission and fuel consumption characteristics of aircraft propulsion systems for regional aircraft** Murat Ayar; Selcuk Ekici; Tahir Hikmet Karakoc	IGEC2023-218 **Thickness Effect of TiO2 Active Layer on Energy Conversion Efficiency of Dye-sensitized Solar Cells** Sang-Hun Nam; Jin-Hyo Boo	IGEC2023-213 **Study on different refrigerants for organic Rankine cycle and vapor compression refrigeration cycle combined by a single rotor compander** Saif F Alshammari	IGEC2023-110 (online) **Optimal design of cooling network management system for high power fuel cell stack** Xi Chen; Yan luo	IGEC2023-345 (invited) **Experimental investigation of natural ventilation characteristics of a solar chimney coupled with earth-air heat exchanger (SCEAHE) system in summer and winter** Yongcai Li
10:25 – 11:00	**Coffee Break (Venue: 220)**				
11:00 – 11:15	IGEC2023-115 **Dynamic analysis of hybrid electric vehicle coupled with waste heat recovery system under different road conditions** Xuanang Zhang; Hua Tian; Xuan Wang	IGEC2023-233 **Progress and prospects of heat transfer enhancement for latent thermal energy storage by integrating adjustable external fields** Zhi Li; Xiaoli Yu; Yiji Lu	IGEC2023-056 **Elementary Reaction Kinetic Model of An Ammonia Protonic Ceramic Fuel Cell** Zheng Li; Meng Ni	IGEC2023-106 **Material development to enhance reversible solid oxide cells for hydrogen production and power generation** Ubong A Essien; Dragos Neagu	IGEC2023-346 (invited) **Experimental investigation of Earth-air ventilation system ventilation systems in low-energy buildings** Abdullahi Ahmed, Mohammed Fad, Shuli Liu
11:15 – 11:30	IGEC2023-171 **Experimental investigation of a diesel engine run on simulated gaseous fuels under varying compression ratio** Samar Das; Shayaram Basumataray; Pankaj Kalita	IGEC2023-178 **Experimental studies on lab-scale prototype of slag-blended calcium aluminate cement concrete module for high-temperature thermal energy storage application** Aswin Karthik Chandrasekaran; Muthukumar Palanisamy; Biranchi Panda	IGEC2023-080 **Low-grade heat driven water desalination driven by ejector enhanced ORC system** Fahid Riaz et al.	IGEC2023-100 **One-pot synthesis of Pt-Co nanoparticles on high surface carbon material as an efficient bifunctional catalyst** Xin Zeng; Sushanta Mitra; Xianguo Li	IGEC2023-347 (invited) **Heat storage and the discharge performance of a phase change material (PCM) storage tank** Juan Zhao
11:30 – 11:45	IGEC2023-148 **Pore-scale simulation of turbulent convective heat transfer in metal foam** Waleed Sarhan Alruwaili; Mohammad Jadidi; Amir Keshmiri; Yasser Mahmoudi Larimi	IGEC2023-051 **Establishing PEM fuel cell simulation platform for structure design: from cell to stack** Biao Xie; Kui Jiao	IGEC2023-072 **Machine learning assisted performance investigation of a novel sustainable cooling system** Muhammad Ahmad et al.	IGEC2023-065 **Enhanced hydrogen storage in Mg catalysed by CuNiCoFe Multi Component Alloy** Anshul Gupta et al.	IGEC2023-071 **Thermal performance simulation of regenerative indirect evaporative cooler for marine air-conditioning** Huaxia Yan; Yi Chen
11:45 – 12:00	IGEC2023-093 **Glycerol-assisted co-electrolysis in solid oxide electrolyzer cell (SOEC) for green syngas production: a 2D modelling study** Chen Wang	IGEC2023-242 **Numerical simulation on a short PEM water electrolyzer stack based on a three-dimensional CFD model** Boshi Xu et al.	IGEC2023-184 **A thermodynamic analysis of integrated supercritical water gasification and supercritical CO2 Brayton cycle: a novel approach for power generation from real-world wet biomass** Robert Sait-Stewart	IGEC2023-167 **High-performance H2O2 paper fuel cell benefited from dual-electrolyte and a sandwiched hydrogel** Shijing Luo et al.	IGEC2023-105 (online) **A rational exergy management approach for minimum CO2 emissions responsibility at the district scale in Glasgow** Birol KILKIŞ; Şiir Kılkış
12:00 – 13:30	**Lunch Break (Venue: 220)**				

UK Time Zone (UTC+1)	Day 2: Wednesday, July 12, 2023				
13:30 – 14:10	**Plenary Talk: Predicting Design Evolution (InterPore's Kimberly-Clark Distinguished Lecture)** **Speaker: Adrian Bejan, J.A. Jones Distinguished Professor, Duke University, USA** Chair: Jin Xuan Venue: 293; Zoom ID: 8380 8821 705				
14:10 – 14:50	**Plenary talk: Development of physical model based fuel cell system simulator for multi-purpose application** **Speaker: Shigeki Hasegawa, Kyoto University & Toyota Motor Corporation, Japan** Chair: Huizhi Wang Venue: 293; Zoom ID: 8380 8821 705				
14:50 – 15:20	**Coffee Break (Venue: 220)**				
	Session S13: Advanced energy systems #1	**Session S14: Energy conversion and management #3**	**Session S15: Energy education, security, policy and planning**	**Session S16: Hydrogen and fuel cells #3**	**Special Session SS3: Fuel cells and electrolyzers**
Session Chairs	Qian Fu; Xi Chen	Yasser Mahmoudi; Yuesen Wang	Bing Xu; Mousami Prasad	Sambhaji Kadam; Hongxia Li	Samaneh Shahgaldi
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331
15:20 – 15:45	**Keynote (online): Batteries for sustainability** Xiaolei Wang, University of Alberta, Canada	**Keynote (online): Decarbonizing electric grid and industrial heat through thermochemical energy storage** Like Li, Mississippi State University, USA	**Keynote: Monetizing energy storage** Oliver Schmidt, Imperial College London, UK	**Keynote (online): Progress in the design and fabrication of membraneless air-breathing microfluidic fuel cells for electronic applications** Mohamed Mohamedi, INRS, Canada	**Keynote (online): Membrane electrode assembly for proton exchange membrane fuel cells** Samaneh Shahgaldi, University of Quebec, Canada
15:45 – 16:00	IGEC2023-217 **Effect of ZnSn(OH)6 scattering layers with various shapes on the power conversion efficiency of dye-sensitized solar cells** Ang-Hun Nam; Jin-Hyo Boo	IGEC2023-224 (online) **Sustainable aviation fuel utilization effects on thermodynamic sustainability, environmental impact, and cost formation of a turboshaft engine used on helicopter** Alper Dr Dalkıran; Özgür Balli; Selcuk Ekici; Tahir Hikmet Karakoc	IGEC2023-236 **Social impact of Covid-19 electricity subsidy on the lifeline citizen's welfare in Ghana: Sharp regression discontinuity design** Ewurasi Boafowa Mensah; Shinji Kaneko	IGEC2023-149 **Renewable energy conversion using novel engineered materials for solid oxide cell** Chinyere Adaora Ekperechukwu; Dragos Neagu	IGEC2023-331 (invited) **Recent development in oxygen reduction reaction electrocatalyst** Mohammad Soleimani Lashkenari

UK Time Zone (UTC+1)	Day 2: Wednesday, July 12, 2023				
16:00 – 16:15	IGEC2023-205 (online) **Application of machine learning algorithms to model advanced anaerobic digestion of pulp and paper sludge coupled with thermal hydrolysis** Maryam Ghazizade Fard; Ehssan Koupaie	IGEC2023-222 **Global warming and air pollution-driven energy transition in South Asia** Naeem Abas; Muhammad Shoaib Saleem; Mashawar Javeed Kalair	IGEC2023-228 (online) **Social justice in the green economy: carbon tax and kerosene tax** Filiz Ekici et al.	IGEC2023-152 **A one-dimensional model for Pt degradation and Pt band formation in proton exchange membrane fuel cells** Yueqiang Zhu; Zhiguo Qu; Guobin Zhang	IGEC2023-332 (invited) **Energy management of fuel cell vehicles: from the stack behavior to the hybrid power source integration** Loïc Boulon
16:15 – 16:30		IGEC2023-088 **Simulation of hydrogen-fired reheat furnace in the steel industry** Ophelie P Lesage Fongue; Cecile Devaud; Eric Croiset	IGEC2023-016 **Using the International Governmental Panel on Climate Change (IPCC) Interactive Atlas in the Classroom** Sadie Alley Ferreira	IGEC2023-057 **Exploring the conductivity landscape of notable ceramic electrolytes under varying ambient conditions** Idris T Bello; Meng Ni	IGEC2023-333 (invited) **Ultra-thin metallic bipolar plates of PEMFCs: manufacturing methods and common defects** Hossein Talebi-Ghadikolaee
16:30 – 16:45	IGEC2023-039 **The performance of a heat pump assisted integrated cooling and dehumidification system for zero emission vehicles** Nan Zhang	IGEC2023-021 **Designing cleaner energy mixes for domestic electricity supply: a case study in Jakarta and West Java, Indonesia** Diyono Diyono	IGEC2023-118 (online) **Spatio-temporal and weather characterization of road loads of electrified heavy-duty commercial vehicles across U.S. interstate roads** Amy M Moore; Adam Siekmann; Vivek Sujan	IGEC2023-199 (online) **Design and analysis of hydrogen fuel cell propulsion systems for aerospace applications** Shams Anwar; Xianguo Li	IGEC2023-334 (invited) **Investigate the role of cellulose acetate and oxidized carboxymethyl cellulose polymer electrolytes in LIBs** Amir Rezvani-Moghaddam
16:45 – 17:00	IGEC2023-136 (online) **Integrated power generation and energy storage system with solar and coal energy** Danlei Yang	IGEC2023-221 **Load and loss estimation in energy-deficient polygeneration utilities** Muhammad Shoaib Saleem; Naeem Abas; Mashawar Javeed Kalair	IGEC2023-075 **A market-based assessment of incremental wind energy development in the Midcontinent electricity markets of the United States** Raymond Li; Raymond Li	IGEC2023-208 **Membranes of ZIF-90 in polyetherimide dense and spongy matrices for efficient hydrogen purification from CO2** Muhammad Usman	IGEC2023-335 (invited) **Anion exchange membrane fuel cells for green energy conversion** Ramesh Kumar Singh
17:00 – 17:15	IGEC2023-190 **Modelling and performance analysis of high vacuum flat plate hybrid photovoltaic-thermal collectors** Paolo Strazzullo et al.	IGEC2023-113 **Designing CO2 mixtures for transcritical CO2 power cycle with preheater and recuperator via the CAMD method** Jingyu Wang; Xuan Wang; Hua Tian	IGEC2023-175 **Customized Assessment and Adoption of Carbon Dioxide Hydrate Refrigeration System Technology** Behrouz Arabi et al.	IGEC2023-015 **The development and deployment of solar-powered "nanogrids" in rural Philippines and Madagascar – IMPHORAA project** Guy Lewis, George Liaptsis, P. Ian Nicholson	IGEC2023-024 **Modelling of near-isothermal liquid piston gas compressor employing porous media for compressed air energy storage systems** Lee Haney; Robert Prosser; Alexander Lanzon; Yasser Mahmoudi Larimi
17:15 – 18:30	**Break**				
18:30 – 19:30	**Happy-hour networking and live bagpipe music performance with drinks (Venue: Cloisters)**				
19:30 – 22:00	**Gala Dinner (Venue: Bute Hall)**				

Day 3: Thursday, June 13, 2023

UK Time Zone (UTC+1)	Day 3: Thursday, July 13, 2023				
09:00 – 09:40	**Plenary talk: Peer to peer energy trading to facilitate the net zero transition** **Speaker: Jianzhong Wu, Cardiff University, UK** Chair: Kui Jiao Venue: 293; Zoom ID: 8380 8821 705				
09:40 – 09:45	**Room Change Break**				
	Session S17: Green buildings	**Session S18: Energy systems modelling and optimization #3**	**Session S19: Renewable and clean energy #2**	**Session S20: Energy systems modelling and optimization #4**	**Special Session SS1: Advances in Thermoacoustic Technology**
Session Chairs	Sarath Babu Kaki; Wending Pan	Ahsan Ul Haq Qurashi	Yasser Mahmoudi; Peter E. Akhator	Kaushik Saha	Geng Chen; Jingyuan Xu
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331
09:45 – 10:00	IGEC2023-052 (online) **Energy savings owing to insulation: mid-rise commercial buildings** Mohammad Azim Rasuli; Shuichi Torii	IGEC2023-060 (online) **Research on solar-assisted ejector-enhanced air source heat pump cycle with dual-pressure condensation** Yan Zhu; Youcai Liang; Kai Ye	IGEC2023-139 (online) **Numerical study on tab layout optimization of lithium-ion battery based on a three-dimensional electrochemical-thermal coupling model** Ziyi Zhou et al.	IGEC2023-177 **Performance and emissions analysis of four-stroke SI engine using propanol-gasoline blend as an alternative fuel** Muhammad Kashif Jamil et al.	IGEC2023-365 (invited) (online) **Recent advances and future directions of thermoacoustic energy conversion systems** Kai Wang
10:00 – 10:15	IGEC2023-150 (online) **Optimal sizing capacities of solar photovoltaic and battery energy storage systems for grid-connected commercial buildings in** Malaysia Jahangir Hossain et al.	IGEC2023-204 (online) **Investigation on heat generation in fast charging of lithium batteries: effect of charging rate and battery component thickness** Deyong Lei; Yun Wang; Yachao Wang; Jing Shi	IGEC2023-142 (online) **A novel omni-directional augmentation device for cross-axis wind turbine** Christopher Clement Rusli et al.	IGEC2023-168 (online) **Prediction of transport properties of methanol-octane blends at different temperatures and pressures using molecular dynamics simulation** Rajneesh Kashyap; Kaushik Saha; K.A. Subramanian	IGEC2023-368 (invited) (online) **Thermoacoustic conversion with wall mass transfer** Rui Yang
10:15 – 10:30	IGEC2023-193 **The role of hydrogen in decarbonizing the steel industry: upstream and downstream in the UK and Ontario** Elise D Steward; John Quigley; Jennifer Roberts; Andrew Sherlock	IGEC2023-096 **Process simulation of biomass integrated with molecular distillation for sustainable fuel production** Pamela M Iwube; Edward Brightman; Jun Li	IGEC2023-055 (online) **To develop an eco-friendly cold nuclear thermal power plant by considering iron-56 as a fuel** Seshavatharam UVS; Lakshminarayana S	IGEC2023-130 **Complex Power Loss Allocation in Unbalanced Power Distribution Networks** Fangxintian Yu; Jin Yang	IGEC2023-366 (invited) (online) **The principles and ways of achieving high performance on heat-driven thermoacoustic refrigerator/heat pump** Kaiqi Luo

UK Time Zone (UTC+1)	Day 3: Thursday, July 13, 2023				
10:30 – 10:45	IGEC2023-232 **Analysis of heat transfer through thermal storage tank in a flexible heat pump** Zahra Hajabdollahi Ouderji; Zhibin Yu; Ozcan Recep Sahsuvar	IGEC2023-103 **Grid optimization and demand side management for electric vehicles penetration in remote areas** Yixiao Zhang; Ning Li; Yin Kwee Ng	IGEC2023-064 **Generation of synthesis gas via co-electrolysis of water** João F. Gomes et al.	IGEC2023-186 **Theoretical analysis of plasma gasification for waste treatment in India** Kaushik Saha; Ramesh Narayanan; Purva Mathur; Uppu Navya Rashmika	IGEC2023-371 (invited) (online) **Synchronization of Taconis oscillations under external forcing: results of CFD and low-order modeling** Peng Yang
10:45 – 11:15	**Coffee Break (Venue: 220)**				
11:15 – 11:30		IGEC2023-095 (online) **Techno-economic assessment of a hybrid renewable energy system with hydrogen storage** Huizhi Wang; Eva Angeli	IGEC2023-162 **Simulation validation of moment balancing method for drag-dominant tidal turbines** Yixiao Zhang; Shivansh Mittal; Yin Kwee Ng	IGEC2023-137 (online) **System efficiency optimization of vanadium redox flow battery by using genetic algorithm and full zero-dimensional modeling** Fahimeh Nazari; Mohammad Kermani; Mohammadmahdi Abdollahzadehsangroudi	IGEC2023-369 (invited) (online) **Investigation of thermoacoustic Stirling engine loaded with a liquid column** Shu-Han Hsu
11:30 – 11:45	IGEC2023-108 **Experimental investigation on the stability of biocomposite phase change materials for building applications** Urbashi Bordoloi; Pankaj Kalita	IGEC2023-046 **Study of the defrosting operation of a flexible heat pump cycle with a sensible heat storage** Miryam Essadik; Andrew McKeown; Zahra Hajabdollahi Ouderji; Zhibin Yu	IGEC2023-237 **Advanced functional nanomaterials for clean energy applications** Ahsan Ul Haq Qurashi	IGEC2023-030 **Comparison of different configurations of CO2 refrigeration systems** Ebraheem Alanazy et al.	IGEC2023-364 (invited) (online) **Improving Energy Efficiency and low heating temperature of a thermoacoustic cooler driven by a thermoacoustic engine with varying length of regenerators** Irna Farikhah
11:45 – 12:00	IGEC2023-037 **A review on the life cycle assessment of PCM-based thermal energy storage systems in residential applications** Raman Safaee; Phil Ward; Yulong Ding; Adriano Sciacovelli	IGEC2023-206 **O2-assistant rechargeable aluminum-CO2 battery** Yingguang Willow Zhang	IGEC2023-131 **Comparative analysis of solar-assisted cogeneration systems with Stirling engine prime movers** Shunmin Zhu et al.	IGEC2023-159 **Numerical analysis of two-phase flow using 2-D axisymmetric approach for an effervescent atomizer** M Venkata Koti; Kaushik Saha	IGEC2023-361 (invited) **Efficient energy harvesting with multi-stage thermoacoustic engines: A comparative analysis based on linear and CFD modelling** Armando Di Meglio
12:00 – 13:30	**Lunch Break (Venue: 220)**				
	Session S21: Advanced energy systems #2	**Session S22: Renewable and clean energy #3**	**Session S23: Hydrogen and fuel cells #4**	**Session S24: Hydrogen and fuel cells # 5**	**Special Session SS1: Advances in Thermoacoustic Technology**
Session Chairs	Andy Pearson; Tao Ma	Sambhaji Kadam, Mingjia Li	Dudul Das; Hongxia Li	Zahra Hajabdollahi	Geng Chen; Jingyuan Xu
Venue	226	255	293	256	466
Zoom ID	8862 5555 959	8925 9685 211	8380 8821 705	8168 2040 896	8561 7448 331

UK Time Zone (UTC+1)	Day 3: Thursday, July 13, 2023				
13:30 – 13:45	IGEC2023-226 (online) **A decision-making mechanism for component selection and design prioritization: a case study for UAS** Murat AYAR; Tahir Hikmet Karakoc; Selcuk Ekici	IGEC2023-048 **Optimal Operation of Soft Open Point Integrated with Energy Storage in Active Distribution Networks** Mohammed Alshehri; Jin Yang; Chengwei Lou; Liang Min	IGEC2023-078 **Techno-economic analysis of PEM electrolyzers and renewable hydrogen generation** Thorin J Daniel; Jin Xuan; Qiong Cai; Lei Xing	IGEC2023-225 (online) **Review on gas turbine and fuel cell hybrid systems** Enes Gunaltili; Selcuk Ekici; M. Zeki Yilmazoglu; Tahir Hikmet Karakoc	IGEC2023-362 (invited) **Stability analysis of thermoacoustic engine with unconventional stacks** Elio Di Giulio
13:45 – 14:00	IGEC2023-017 **Photovoltaic-thermoelectric generation system integrated with phase change materials: Role of PCM arrangement and numerical investigation** Dongxu Ji	IGEC2023-077 **FeCo2Se4 counter electrode for application in DSSC: synthesis parameter, structural, electrochemical and efficiency studies** Puteri Najihaj Megat Zakaria et al.	IGEC2023-161 **Life cycle greenhouse gas emissions of hydrogen supply chains via offshore wind farms utilizing compressed gaseous hydrogen, liquefied hydrogen, and ammonia: a case study of China** Menghua Liu, Weizhe Zhang, Shuang Li, Yixiang Shi, Ningsheng Cai	IGEC2023-123 **Experimental study of Graphene-coated nickel foam as flow field in low-platinum catalyst fuel cells** Chasen Tongsh	IGEC2023-179 (online) **Finite time exergy economic analysis of thermoacoustic engine considering irreversibility factors** Qing E
14:00 – 14:15	IGEC2023-229 **Development of carbon-based catalysts for upgrading biogas to low carbon fuels** Haitian Chen; Tosin Somorin; Jun Li	IGEC2023-180 **Modeling and application of fully coupled mechanical-electrical models for offshore wind turbines: a comprehensive review** Lingte Chen; Jin Yang; Chengwei Lou	IGEC2023-165 **Degradation characteristics of proton exchange membrane fuel cell with different cathode loading** Zixuan Wang; Bowen Wang; Kui Jiao	IGEC2023-135 **Identifying the carbon deposition mechanisms of solid oxide fuel cells based on total harmonic distortion analysis** Yinan Wang et al.	IGEC2023-367 (invited) (online) **On the transition from R&D to a product** Kees de Blok
14:15 – 14:30	IGEC2023-031 **Design of thermal storage systems using neural networks and artificial intelligence** Edgar F. Rojas Cala; Carles Mateu; Ramon Bejar; Luisa F. Cabeza	IGEC2023-182 **Effect of substrate mixing ratio on anaerobic co-digestion of cattle dung and vegetable waste with and without biochar addition** Shayaram Basumataray; Harrison Hihu Muigai; Pranab Goswami; Pankaj Kalita	IGEC2023-245 (online) **Characterization of ionic conductivity in ion exchange membranes** Linhao Fan	IGEC2023-181 **A photocatalysis system splits moisture for hydrogen production using 2D Znln2S4 nanosheets hydrogel** Liu Zhen; Ronghui Qi	IGEC2023-370 (invited) **Revisit Thermoacoustic Mixture Separation** Yuki Ueda
14:30 – 14:45	IGEC2023-128 **Polymeric photocatalyst fragmentation leading to robust carrier dynamics with single-walled carbon nanotubes for CO2 photoreduction** Xiaolong Zhao	IGEC2023-239 **Defective ZnIn2S4/NiO z-scheme heterostructure for high-performance photocatalytic water splitting** Keda CHEN; Lei Ran; Michael K. H. Leung	IGEC2023-246 (online) **Insights into oxygen transport in PEMFC catalyst layers using molecular dynamics simulations** Linhao Fan	IGEC2023-247 (online) **Experimental investigation of the ordered gas diffusion layer performance in PEMFC under various operating conditions** Bai Fuqiang; Zhi Liu	IGEC2023-363 (invited) **Solid-state Thermoacoustics: A New Paradigm of Thermoacoustic Research** Haitian Hao, Carlo Scalo, Fabio Semperlotti
14:45 – 15:15	**Coffee Break (Venue: 220)**				

UK Time Zone (UTC+1)	Day 3: Thursday, July 13, 2023				
15:15 – 15:30	IGEC2023-076 (online) **Levelized cost of carbon abatement (LCCA) study on low carbon versus conventional ammonia production for use as fertilizer and hydrogen carrier** Soukaina Skribbe; XiaoYu Wu	IGEC2023-200 (online) **Hydrogen production from fossil fuels integrated with carbon capture, utilization, and storage (CCUS)** Shams Anwar; Xianguo Li; Yahui Zhang	IGEC2023-070 (online) **Zeolitic imidazolate frameworks derived nickel-cobalt phosphides as bifunctional electrocatalysts for overall water splitting** Taiwo O Ogundipe et al.	IGEC2023-091 **Development of hydrogen liquefaction, storage and transportation technology：A review** Caizhi Zhang et al.	
15:30 – 15:45	IGEC2023-035 **Design analysis of a new suspended radiant ceiling panel with segmented and concave surface** Minzhi Ye	IGEC2023-214 **Design and analysis of a finned heat sink for a novel dual concentrated photovoltaic system** Fahid Riaz; Fahid Riaz; Jawad Sarvar; Muhammad Imran	IGEC2023-146 (online) **Comparing cathode liquid water removal mechanisms for pin-type and conventional PEMFC flow field designs** Duy Khang Dang; Biao Zhou	IGEC2023-202 **Development of non-spherical platinum catalyst with functionalized carbon supports for proton exchange membrane fuel cells** Mark Lim; Mohmmad Khalid; Samaneh Shahgaldi; Xianguo Li	
15:45 – 16:00	IGEC2023-164 **CFD analysis of combustion of gasoline, hydrogen and hcng blends in internal combustion engine** Kaushik Saha et al.	IGEC2023-116 **Impact of biomass-coal blending on flow dynamics in a dual fluidized bed gasification system** Rabindra Kangsha Banik; Hirakh Das; Pankaj Kalita	IGEC2023-223 **Steam reforming of syngas with biochar supported perovskite catalyst for hydrogen generation** Morgen Mukamwi; Tosin Somorin; Jun Li; Francisc Garcia-Garcia	IGEC2023-235 **Mass transport analysis of fractal flow field plate in PEMFC** Abdelhakim Merdjani; Natalia Kizilova	
16:00 – 16:15	IGEC2023-028 **A Technical Review on the Implementation of Lithium-ion Batteries Waste Recycling Methods** Muhammad Zharfan Mohd Halizan et al.	IGEC2023-201 **Renewable energy perspectives: brazilian case study on green hydrogen production** Gustavo Henrique Romeu da Silva; Nazem Nascimento; Andreas Nascimento	IGEC2023-203 **A review of bipolar plate and flow field designs for proton exchange membrane fuel cells** Xianguo Li	IGEC2023-238 **Thermodynamic analysis of metal hydride-based polygeneration system for high temperature energy storage and cooling application** Sarath Babu Kaki; E. Anil Kumar; Sambhaji Kadam; Zhibin Yu	
16:15 – 16:20	**Room Change Break**				
16:20 – 16:50	**Closing Ceremony and Awards** Session Chair: Zhibin Yu Venue: 293; Zoom ID: 8380 8821 705				

Day 4: Friday, July 14, 2023

Day 4: Cultural / Technical Tours			
UK Time Zone (UTC+1)	**Stirling Castle Tour**	**UK Time Zone (UTC+1)**	**Whitelee Wind Farm Tour**
09:30 – 10:00	Assemble for bus departure at Wolfson Medical School on University Avenue	09:30 – 10:00	Assemble for bus departure at Wolfson Medical School on University Avenue
10:00 – 11:00	Bus travel to Stirling Castle	10:00 – 10:45	Bus travel to Whitelee Wind Farm
11:00 – 15:00	Self-guided tour of Stirling Castle and City of Stirling	10:45 – 14:00	Self-guided tour of Whitelee Wind Farm
15:00 – 16:00	Return bus travel to University of Glasgow	14:00 – 14:45	Return bus travel to University of Glasgow

Workshop: Meet the Editors

Join us for the “Meet the Editors” Workshop!

Time: 5:00 – 6:00 PM, July 11th, 2023

Participation: Plenary Session (hybrid mode)

Venue: Hunter Hall East (Plenary Venue, East 293)

Zoom ID: 8380 8821 705

Objective

This workshop provides essential guidance to early career researchers and students on publishing high-quality papers. We will cover procedures, “dos” and “don'ts” of academic publishing, empowering participants to confidently submit their work to top-tier journals.

Part 1 (30 minutes)

Brief presentations by esteemed editors sharing their knowledge and experiences.

Part 2 (30 minutes)

Panel discussion and interactive session to address questions from the audience.

Panellists (in alphabetic order)
Luisa F. Cabeza *(Editor in Chief, Journal of Energy Storage)*
Ryan Davies *(Manager, Frontiers in Thermal Engineering)*
Ros Daw *(Editor in Chief, Communications Engineering, Nature)*
Kui Jiao *(Editor in Chief, Energy and AI)*
Xianguo Li *(Editor in Chief, International Journal of Green Energy and Frontiers in Thermal Engineering)*
Jianzhong Wu *(Editor in Chief, Applied Energy)*
Jin Xuan *(Editor in Chief, Digital Chemical Engineering)*

Session Chair
Zhibin Yu *(University of Glasgow)*

Abstracts of Invited Plenary Lectures

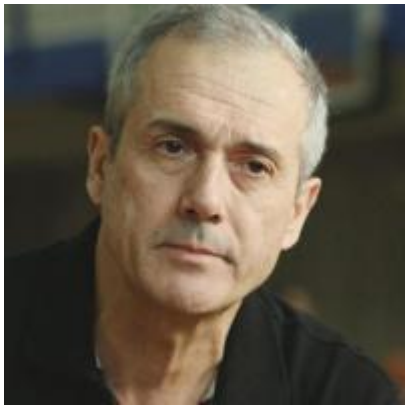
Predicting Design Evolution

ADRIAN BEJAN, J.A. JONES DISTINGUISHED PROFESSOR, DUKE UNIVERSITY, USA

Abstract

Porous materials are usually thought of as amorphous mixtures of two or more things, solids, fluids, and voids. The research field started that way, and so did my own activity in it. Along the way, I was drawn to the part of nature (the physics) that was missing from the amorphous view: the structure, flow, configuration, drawing (design), purpose, and evolution. The lecture is pictorial. It begins with defining the terms, because words have meaning: vascular, design, evolution, and prediction (theory). Next, the lecture shows that vascular (tree shaped) architectures flow more easily than parallel channels with only one length scale (the wall to wall spacing). Transport across channels is facilitated when the spacing is such that the channel flow length matches the entrance (developing) length of the flow. The tendency to evolve with freedom toward flow configurations that provide greater access is universal in nature, bio, and non-bio. This tendency is the Constructal Law, which empowers us to predict the evolution toward flow access, miniaturization, high density of heat transfer, and the scaling up (or down) of an existing design. Multiscale vasculatures occur naturally because they flow more easily than their counterparts with a few length scales. The future of evolutionary design everywhere points toward vascular, hierarchical flow architectures that will continue to morph with freedom and directionality.

Biographical Sketch



Adrian Bejan was awarded the 2018 Benjamin Franklin Medal for "his pioneering interdisciplinary contributions in thermodynamics…and constructal theory, which predicts natural design and its evolution in engineering, scientific, and social systems." He earned all his degrees from the Massachusetts Institute of Technology: B.S. (1971, Honors Course), M.S. (1972, Honors Course) and Ph.D. (1975). He is the J.A. Jones Distinguished Professor at Duke University. Prof. Bejan's research is in applied physics, thermodynamics, theoretical biology, and design and evolution everywhere in nature, bio, and non-bio. He created original methods of theory, modeling, analysis, and design: entropy generation minimization, scale analysis, intersection of asymptotes, heatlines, constructal law, vascular and evolutionary design. He is the author of 30 books and 700 peer-refereed journal articles. Google Scholar: h = 108, total citations 86,000. According to the 2019 'citations impact' world rankings, he is 9th among all Engineering authors in the world, all disciplines. He is honorary member of the ASME and member of Academia Europaea.

Progress in fuel cell and hydrogen technologies for the low carbon energy transition

Nigel Brandon, Imperial College London, United Kingdom

Abstract

The presentation will discuss the role that electrochemical technologies such as fuel cells, electrolysers and batteries will increasingly play in the low carbon energy transition, highlighting both progress made, and some of the current research and technology challenges. The speaker will draw on his own experience of spinning out and building companies in this sector.

Biographical Sketch

Professor Nigel Brandon OBE FREng FRS is an electrochemical engineer whose research is focused on the science, engineering and technology of electrochemical devices for the low carbon energy transition, in particular fuel cells, electrolysers and flow batteries. He is a founder of the fuel cell company Ceres Power, now valued at around £1B, and founder and Chairman of RFC Power, a flow battery company spun out from Imperial in 2018. He is Dean of the Faculty of Engineering at Imperial College, and chair of the College's Sustainable Gas Institute. He has been awarded the Royal Academy of Engineering Silver Medal, and the ASME Francis Bacon medal, for his contribution to fuel cell technology. He was elected as an overseas member of the US National Academy of Engineering in 2022.

Key challenges of thermal energy storage: a dive into the roadmap

LUISA F. CABEZA, UNIVERSITAT DE LLEIDA, SPAIN

Abstract

Thermal energy storage (TES) is being recognized as a key technology of the energy transition to support the integration of clean energy sources and enhance the flexibility of energy systems. Main barriers include the low technology readiness (TRL) in some of the emerging technologies, poor knowledge and awareness of TES benefits, and lack of targeted policies. In recent years, research put a lot of effort to overcome those barriers which has led to a rapid increase in the number of publications. Moreover, different roadmaps were published to define the technology target and trends from a market perspective to support both researchers and policymakers. To main aim of this keynote is to dive into those roadmaps and to compare the technology trends and market perspective with the research trends coming from the academic literature to identify the main gaps to be addressed to overcome the actual barriers in the deployment of TES technologies.

Biographical Sketch

Chemical engineer from the Institut Químic de Sarrià in 1992, industrial engineer from University Ramon Llull in 1993, master in industrial business management in 1995 and doctor industrial engineer in 1996 from the same university. Postdoctoral researcher at the Eastern Regional Research Center (ARS, USDA) in Philadelphia. Since 1999 at the University of Lleida, where she created the research group GREA, in 2004 (today GREiA) and with international prestige in the field of thermal energy storage. She has published more than 500 indexed articles and participated in more than 340 conferences. She has edited or co-edited 12 research books and is the author of one, in addition to publishing 24 book chapters. All her research career led her to become a Spanish representative in the Horizon 2020 Energy Challenge Committee 3, in the ECES Implementing Agreement of the International Energy Agency, and she has participated in the drafting of 3 IPCC reports, the last of which, as chapter coordinator.

Green Energy Solutions with Hydrogen: Challenges, Opportunities and Future Directions

IBRAHIM DINCER, ONTARIO TECH UNIVERSITY, OSHAWA, ONTARIO, CANADA

Professor
President, Hydrogen Technologies Association
Editor-in-Chief, Energy Storage
Editor-in-Chief, International Journal of Exergy
Editor-in-Chief, International Journal of Global Warming
Editor-in-Chief, International Journal of Research, Innovation and Commercialisation
Special Issues Coordinating Editor, International Journal of Hydrogen Energy

Biographical Sketch

Ibrahim Dincer is a full professor of Mechanical Engineering at Ontario Tech. University. Renowned for his pioneering works in the area of sustainable energy technologies he has authored/co-authored many books and book chapters, along with many refereed journal and conference papers. Dr. Dincer has chaired many national and international conferences, symposia, workshops and technical meetings. Dr. Dincer has delivered many keynotes and invited lectures. Dr. Dincer is an active member of various international scientific organizations and societies, and serves as editor-in-chief, associate editor, regional editor, and editorial board member on various prestigious international journals. Dr. Dincer currently serves as President for Hydrogen Technologies Association in Turkey and Chair for Energy Working Group in Turkish Academy of Sciences. Dr. Dincer is a recipient of several research, teaching and service awards, including the Premier's research excellence award in Ontario, Canada. During the past nine years he has been recognized by Thomson Reuters as one of the Most Influential Scientific Minds in Engineering and one of the most highly cited researchers. During the past 25 years Dr. Dincer's research and activities have been diverse and primarily focussed on sustainable energy solutions, sustainable communities and cities, district energy systems, green buildings, renewable energy technologies, energy storage technologies, hydrogen energy technologies, and waste to energy technologies. His group has developed various novel technologies for commercialization. He is known for his engineering education related talks as a committed educator.

Development of physical model based fuel cell system simulator for multi-purpose application

SHIGEKI HASEGAWA, KYOTO UNIVERSITY, TOYOTA MOTOR CORPORATION, JAPAN

Abstract

An integrated fuel cell (FC) electric vehicle model is developed, which consists of the 1-D physical models of all the system component such as the FC stack as main engine and subsystems of air, hydrogen, and cooling, and the related controllers. All the codes for the physical models and controllers are implemented on the basic MATLAB/Simulink platform efficiently as white-box models without any additional toolboxes and external functions. It can be converted easily to a variety of FC system application such as railway, marine, aviation, and stationary power generator purposes, as well as automotive of the passenger vehicles, buses, and tracks. The models were validated by the considerable amount of database collected with the state-of-the-arts commercial FCEV, 2nd-generation MIRAI, and users can focus on the system design without the concern about accuracy. The authors expect that a significant cost and effort for manufacturing prototypes and controller calibration can be reduced by introducing it in the design phase before prototyping and evaluation phase.

Biographical Sketch

Graduated from Undergraduate School of Chemical Science and Technology of Kyoto University in 2002, Graduate School of Energy Science of Kyoto University and joined Toyota Motor Corporation (TMC) in 2004. Through 19-year career in TMC, experienced wide range of the technical fields surrounding fuel cell electric vehicle (FCEV) including advanced material development of MEA, fuel cell and stack design, system architecture and controller design, market product quality investigation, and model-based development (MBD). Since 2020, working as project manager in TMC and concurrently affiliated with Kyoto University as a program-specific assistant professor (NEDO FC-Platform Project) to research model-based system engineering (MBSE) process of fuel cell system.
Specialized technical fields: chemical engineering; electrochemistry; numerical simulation; control engineering; and model-based system development (MBD/MBSE).

Peer to Peer Energy Trading to Facilitate the Net Zero Transition

JIANZHONG WU, SCHOOL OF ENGINEERING, CARDIFF UNIVERSITY, UK

Abstract

137 countries have committed to carbon neutrality to tackle the global challenge of climate change. Energy systems will play a crucial enabling role for a green carbon neutral future. However, the Energy Trilemma presents many complex interconnected challenges. Peer-to-Peer (P2P) energy trading represents direct energy sharing and trading between peers, where energy from small-scale Distributed Energy Resources is shared or traded among local energy prosumers and consumers to achieve local balancing. This talk will introduce the background of P2P, and its latest progress on research and development. The concept, key elements and implementation technologies of P2P will be introduced.

Biographical Sketch

Jianzhong Wu is Professor of Multi-Vector Energy Systems and Head of School of Engineering, Cardiff University, UK. He is co-Editor-in-Chief of Applied Energy. He researches on Smart Grid and Multi-Vector Energy Systems. He is one of the first group of researchers who initiated and established the Multi-Energy Systems and Peer-to-Peer Energy Trading research. He is Co-Director of UK Energy Research Centre; Member of the BEIS UK Taxonomy Energy Working Group; Co-Chair of INCOSE UK Energy Systems Interest Group; and member-at-large of the IEEE Technical Committee on Carbon Neutrality. He is Fellow of Energy Institute and the Learned Society of Wales.

Electrochemical Energy Conversion Using Non-Precious Metal Catalysts

PIOTR ZELENAY, LOS ALAMOS NATIONAL LABORATORY, USA

Abstract

Non-precious metal electrocatalysts represent an attractive low-cost alternative to their precious-metal counterparts, especially platinum group metal (PGM) catalysts for several reactions of fundamental importance for electrochemical energy conversion and storage. Of various proposed non-precious metal catalysts, the atomically dispersed transition metal-nitrogen-carbon (M-N-C) materials have been found to be especially promising for oxygen reduction reaction (ORR), as potential replacement for Pt-based cathode catalysts in low-temperature polymer electrolyte fuel cells (PEFCs) and, more recently, as catalysts for electrochemical reduction of carbon dioxide (CO2RR). Possible implementation of non-precious metal catalysts has been also the primary driver for the development of low-temperature water electrolyzers (LTWEs) utilizing anion exchange membranes (MEAs). The non-precious metal catalysts for MEA-LTWEs are typically based on Ni alloys (for the anode and cathode) and perovskite oxides (for the anode). In this presentation, we will summarize recent progress in the development of non-precious metal electrocatalysts for four reactions: of fundamental importance to the three energy conversion devices mentioned above: ORR in PEFCs, CO2RR in CO2 electrolyzers, and oxygen and hydrogen evolution reactions in AEM-LTWEs. The focus of this presentation will be on improvements to both activity and performance durability of electrocatalysts for these reactions.

Biographical Sketch

Dr. Piotr Zelenay received his Ph.D. and D.Sc. ("habilitation") degrees in Chemistry from the University of Warsaw, Warsaw, Poland. He was a faculty member in the Department of Chemistry, the University of Warsaw until 1997, when he accepted research position at Los Alamos National Laboratory (LANL). He has been associated with LANL for the past 25 years. He is currently one of ca. 15 highest-level scientists at LANL, a laboratory of more than 15,000 employees. His research focuses on electrocatalysis of oxygen reduction reaction, methanol and dimethyl ether oxidation in PEFCs, hydrogen and oxygen evolution reactions in water electrolyzers, and electrochemical reduction of CO2 to value-added products. Dr. Zelenay has received numerous awards and recognitions, most recently IAGE Outstanding Researcher Award in 2022 for "outstanding research and advancement of knowledge in fuel cells, electrochemical energy, and green energy systems". He is fellow of Los Alamos National Laboratory, The Electrochemical Society, and International Society of Electrochemistry.

Abstracts of Invited Keynote Lectures

Opportunities of smart grid and hydrogen production

KODJO AGBOSSOU, UNIVERSITY OF QUEBEC, CANADA

Abstract

The emergence of new technologies, offered by smart grid ecosystems, can help deeply decarbonize future power systems. Renewable energy integration, widespread electrification, and energy efficiency improvements are acknowledged as significant pathways towards achieving deep decarbonization under these developments. The pursuit of decarbonization through these paths requires dealing with their inherent challenges and resulting circumstances. Extensive utilization of Energy Storage Systems (ESSs) is needed to address the issues related to large-scale integration of renewable energy resources due to their intermittent and volatile nature. Among different forms of ESSs, hydrogen technologies can offer energy storage solutions with great opportunities to improve the power grid resilience with substantial renewable energy supplies. Hybrid systems that combine hydrogen with other energy storage devices are regarded as promising assets to such an improvement. This speech focuses on the assessment of some technical aspects of such a transformation and, on academia and industry research activities and efforts for production and storage of hudrogen. We introduce specifically some concepts and provide some examples of energy management. Finally, we give a snapshot of recent research works at UQTR and more specifically at the Hydrogen Research Institute.

Biographical Sketch

Kodjo Agbossou, ing., Ph. D., Professor. Areas of expertise: Electrical energy generation and storage systems integration, hydrogen production and distribution, distributed energy systems, renewable energy resources, intelligent demand-side management, electronic instrumentation. Prof. Agbossou has a solid expertise in renewable energy resources integration, hydrogen storage systems, intelligent demand-side management, and transactional energy management. Since 2018, he is Hydro-Québec Research Chairholder on Transactive Management of Power and Energy in the Residential sector. Over the years, he has come up with actual contributions towards residential energy management systems. His research work is internationally recognized (his publications take place among the top 10 worldwide citations in the field of renewable energy resources and hydrogen storage integration according to Scopus and SciVal rankings). He has contributed to more than 315 publications, including five patents, 119 refereed papers, and 49 technical reports. Since 1998, he has been awarded several major individual and group research grants. Prof. Agbossou has been in collaboration with the LTE/IREQ of Hydro-Québec for more than 20 years. He has carried out several projects with the LTE/IREQ of Hydro-Québec, Economic Development Agency of Canada, the Office of Energy Efficiency and Innovation (Ministère des Ressources naturelles du Québec), Natural Resources Canada, FRQNT, and NSERC. Prof. Agbossou is also the head of a research group in the UQTR's Hydrogen Research Institute where he conducts research on the distributed generation, renewable energy resources, and load management systems.

Decarbonizing Electric Grid and Industrial Heat through Thermochemical Energy Storage

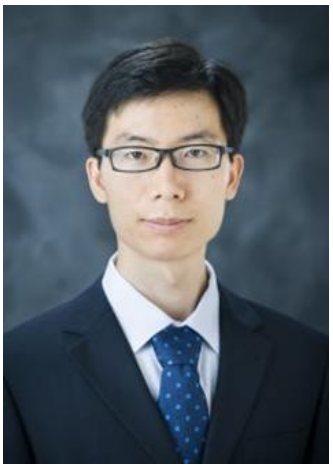
LIKE LI, MISSISSIPPI STATE UNIVERSITY, USA

Abstract

Zero-carbon renewable energy sources such as solar and wind are essential for decarbonizing electricity and industrial heat generation. Thermochemical energy storage (TCES) through reactive material cycling is particularly attractive due to its higher storage density and operating temperatures (can be above 1000°C) compared to sensible and latent heat-based energy storage systems. With abundant renewables as heat input and zero carbon production, TCES has the potential to develop into a transformative technology that offers a combined solution to the depletion of fossil fuels and anthropogenic climate change, thus significantly contributing to the transition to a net-zero carbon economy by 2050. This talk will present an overview of the TCES concept and the major components and processes involved, followed by two particular research projects, with the first one on the development of a solid-state thermochemical fuel for long-duration storage, and the second on an integrated TCES system design and on-sun demonstration as a promising technology candidate for the Generation 3 and beyond (Gen3++) concentrating solar power (CSP) plants. This talk will highlight some of our recent progress on TCES material and reactor development that can be deployed to decarbonize the grid and industrial process heat sectors.

Biographical Sketch

Dr Like Li is an Assistant Professor in the Mechanical Engineering Department at Mississippi State University. He obtained his PhD degree in Mechanical Engineering from the University of Florida in 2013. The research portfolio in his group spans fundamental thermo-fluid sciences with a focus on coupled transport phenomena modeling and particulate flow characterization in multiscale materials/structures/reactors, and engineering applications particularly in solar energy storage through thermochemical reactors design, development and demonstration. Dr. Li's group has several active research projects with funding from the U.S. NSF, DOE Solar Energy Technologies Office (SETO-19, -20, -21 and -22 programs including the most recent $3.89M project with Dr Li as the PI under the SETO-22 program), NASA, and Army Research Laboratory.



Study and application of storage technology in the "generation-grid load-storage" type integrated systems with its energy management method

MING-JIA LI, BEIJING INSTITUTE OF TECHNOLOGY, CHINA

Abstract

The development of a "generation-grid-load-storage" type integrated system with heterogeneous energy flows is necessary to improve the consumption level of renewable energy. Nowadays, the transformation and upgrading process of the energy system is speeding up in China. Compared to the conventional energy system, the new type of integrated system with heterogeneous energy flows is more complex. Besides, the development of stable, reliable and efficient energy storage systems in the microgrid can achieve the goal of flexible access to a high proportion of renewable energy with the implication of peak load shifting. In this study, the "generation-grid-load-storage" type integrated system is introduced primarily. Second, the applied thermal storage technology and electrical energy storage technology are analyzed. Finally, high-efficient energy conversion analysis of the heterogeneous energy flow, dynamic response characteristics of systems under real-time microgrid load, and the optimized energy management method are investigated.

Biographical Sketch

Dr Ming-Jia Li is a professor in the School of Mechanical Engineering, Beijing Institute of Technology. She was awarded international awards and national awards such as the Asian Young Scientist Award etc. She serves as the associate editor of the journal of Applied Thermal Engineering. She is also, amounts other, on the editorial boards of other 5 international journals, and the secretary general of the International Conference on Supercritical CO2 Power Systems. She is the Junior Commission Member of B2 Professional Committee of International Institute of Refrigeration, the deputy director of Youth Committee of Heat and Mass Transfer of Chinese Society of Engineering Thermophysics, and a member of Youth Committee of the 10th Council of Chinese Refrigeration Society. She was granted her bachelor's degree from the University of Liverpool (U.K) and a master's degree from the University of Nottingham (U.K.). She obtained a doctoral degree from Xi'an Jiaotong University with a joint program cooperated by Columbia University (U.S). She mainly focuses on Energy-saving theories & new methods for efficient energy utilization, Supercritical CO2 power system, and Biomass carbon sequestration. As a principal investigator, she hosts many national research programs. She published journal papers in international journals with an h-index of 43. She also delivered more than 30 plenary / invited talks and served as session chair at international conferences.

A study of an indirect expansion solar-assisted air source heat pump with hybrid thermal energy storage for space heating in North China: efficient-economic-environmental analysis

SHULI LIU, BEIJING INSTITUTE OF TECHNOLOGY, CHINA

Abstract

The insufficient heating capacity and low coefficient of performance have always been obstacles that inhibit the application of air source heat pump (ASHP) systems in cold regions. This study proposes an indirect expansion solar-assisted air source heat pump (IX-SAASHP) system to improve the heating performance of ASHP. The IX-SAASHP consists of solar collectors, a hybrid thermal energy storage tank, and a dual-source heat pump. An optimized switching method is proposed to tackle the refrigerant redistribution problem for the dual-source heat pump. An experiment is carried out to study the thermodynamic performance of the IX-SAASHP system. The experimental results indicate that the average COP of solar heat pump mode is increased by 50.0% compared with air source heat pump mode due to the higher evaporating temperature. Based on the experimental results, an efficient-economic-environmental analysis of the IX-SAASHP system for space heating is conducted in six northern cities in China. The IX-SAASHP system has the highest annual average COP of 2.53 in Jinan and realizes the shortest payback period of 5.1 and 5.7 years in Xining and Harbin. In the north region, it is practical to set a subsidy on the additional initial cost to promote the IX-SAASHP system. Applying the IX-SAASHP system in the northwest region is suitable for its better energy and economic performance. The analysis result indicates that the IX-SAASHP system shows great significance for decarbonizing the space heating system in the northeast region.

Biographical Sketch

Shuli Liu is Professor in the School of Mechanical Engineering, Beijing Institute of Technology, China, with about 20 years research experience. She aims to integrate the key strands of: application of renewable energy and sustainable technology; PCM thermal energy storage and Thermal chemical energy storage; building energy performance (materials, construction and lifecycle, etc.) and low carbon behaviors of occupiers and operators, to achieve a smart, Eco home for the future. She has been involved in 13 research projects funded by NSFC, EPSRC, KTP, and industry partners such as Tata Steel, Triton Shower and Orbit House Group Ltd, etc. over £1.7 million. Shuli has over 100 journal and conference publications. She is CIBSE member and fellow of higher education academy, UK. Shuli is also member of World Society of Sustainable Energy Technologies, UK and IBPSA, England.

Progress in the design and fabrication of membraneless air-breathing microfluidic fuel cells for electronic applications

MOHAMED MOHAMEDI, INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE (INRS), CANADA

Abstract

Portable energy sources are under continuous pressure to increase power output and lifetime while decreasing size and weight for meeting the power requirements of the actual and upcoming electronic portable devices. Micro fuel cells appear as an attractive solution and can offer the mobility and freedom sought by the consumer. Furthermore, this technology has important environmental benefits because the fuels can be obtained from sustainable organic sources. Among the different categories of fuel cells, mixed-reactant air-breathing micro fuel cells are new concept of generating electricity. Essentially, in these systems, the fuel and oxidant (oxygen from air) are mixed in a single stream with the use of a selective cathode (inactive towards the fuel). There are a number of advantages associated to the use of mixed-reactant air-breathing micro fuel cells including the no need of a polymer membrane electrolyte, external pumps, reduced weight and volume, simplified manifolding, reduced sealing requirements and, overall, they have simpler designs, implying great potential for low-cost commercialization. The presentation will discuss our progress in the design and fabrication of mixed-reactant air-breathing microfluidic membraneless fuel cells power supply for portable electronics.

Biographical Sketch

Dr Mohamed Mohamedi graduated from the Institut National Polytechnique de Grenoble (INPG), France. He actually works as a research-professor at Institut National de la Recherche Scientifique (INRS), Canada, where he leads the Electrochemistry and Micro Energy Sources Laboratory. His research is focused on the science, engineering and technology of electrochemical devices, in particular energy conversion (fuel cells) and storage devices (metal-air batteries and supercapacitors), implantable biological fuel cells power sources for medical applications and electrochemical sensors for diabetes detection and monitoring. Dr Mohamedi is the recipient of the Tajima Prize from the International Society of Electrochemistry (ISE), the Electrochemistry Communications Award, the Research fellow of the Japan Society for the Promotion of Science (JSPS), the Research Fellow of the 21st Center of Excellence at the Center for Practical Nano-Chemistry of Waseda University (Japan), the Research Fellow of the New Industry Creation Hatchery Center of Tohoku University (Japan), and the Research Fellow of the New Energy and Industrial Technology Development Organization (NEDO) Japan.

Monetizing Energy Storage

OLIVER SCHMIDT, IMPERIAL COLLEGE LONDON / STORAGE LAB, UNITED KINGDOM

Abstract

Energy systems around the world have started going through rapid and profound transformations. Electric vehicles are breaking into the mainstream, and millions of wind and solar farms are replacing fossil fuel power plants. Both developments create fundamental challenges for the security of electricity supply. Energy storage could resolve these and drive cost-effective deep decarbonization. As a result, the storage industry is projected to grow to hundreds of times its current size in the coming decades. However, assessing the economic case for energy storage and the future roles it will play is complicated by rapidly falling investment costs, the wide range of technologies, and the vast array of use cases for energy storage. This keynote lecture will present insights that make the fundamental challenges for the energy system tangible and introduce innovative methods to assess how the benefits of energy storage stack up against its costs. It provides insights on future prices based on historic cost-reduction trends and translates these future prices into application-specific lifetime costs of the various energy storage technologies. This enables an assessment of the competitiveness and potential profitability of each technology in each application. The lecture concludes by introducing an online tool that allows to conduct the presented analyses individually with custom data.

Biographical Sketch

Oliver is the founder of Storage Lab, which supports companies in the renewable energy industry with insights on the economics of energy storage. He is also a visiting researcher at Imperial College London and co-leads Power Swarm, a cross-sectoral network of academics, policymakers, and professionals in the cleantech industry. Oliver holds a Ph.D. from Imperial on the future cost development and value of energy storage. He has previously worked on energy transition topics as energy analyst at the International Energy Agency and as a management consultant at E.ON and Apricum – the cleantech advisory. His background is in mechanical engineering and renewable energy from Imperial College London and the Swiss Federal Institute of Technology in Zurich. Oliver lives in Berlin. Beyond his work in renewable energy, he enjoys going to the lakes in summer and discussing topics that really matter in the pub.

Membrane Electrode Assembly for Proton Exchange Membrane Fuel Cells

SAMANEH SHAHGALDI, UNIVERSITY OF QUEBEC, CANADA

Abstract

The current energy reliance on fossil fuels is predominantly responsible for the release of green house gases (GHGs) and their increasing concentration in the atmosphere, which are already having a cataclysmic impact on the environment, human health, and the economy. In order to mitigate the unremittingly rising levels of GHGs in the atmosphere, Canada's current energy paradigm urges a radical transformation. Development of an at-scale, clean hydrogen economy is a strategic priority for Canada, required to diversify our future energy systems, generate economic gains, and achieve net zero emissions by 2050. Proton exchange membrane (PEM) fuel cells generate electricity using hydrogen and oxygen through a catalyzed electrochemical reaction at low temperature and are a compelling option for clean mobility and power generation. PEM fuel cells offer a broad range of advantages for the environments and our nation's energy security. However, durability and cost are the two main challenges in the mass production and commercialization. These two interrelated issues are greatly impacted by various parameters, mainly associated with the membrane electrode assembly. This presentation will discuss the role of MEA manufacturing techniques on catalyst utilizations and also will discuss the important role of each component on the cell performance and durability.

Biographical Sketch

Dr Samaneh Shahgaldi is an Associate Professor at the University of Quebec and an Adjunct Associate Professor at the University of Waterloo. She holds the Canada Research Chair (CRC) at proton exchange membrane fuel cells and electrolyzer. She is an award-wining researcher and a member of the editorial board of the International Journal of Green Energy. She was also a Senior Research Scientist at Cummins/ Hydrogenics dealing with different Fuel Cell and Water electrolyzer projects. She published more than 50 articles with over 1790 citations on hydrogen storage, production, fuel cells, nanomaterials, etc. Currently, her team are working on different fuel cells and electrolyser components such as membrane electrode assembly, catalyst, catalyst layer, and bipolar plates.

Batteries for Sustainability

XIAOLEI WANG, UNIVERSITY OF ALBERTA, CANADA

Abstract

Rechargeable lithium-ion batteries (LIBs) are playing a dominant role in various application including electric vehicles, portable electronics and medical tools, as highly efficient power sources. LIBs are usually regarded as clean energy technologies, since they realize the conversion between chemical energy and electric energy in a "green" manner without greenhouse gas emission. On the one hand, many transition metal elements (e.g., Ni, Co, Mn) are utilized in electrode materials, which have significant environmental impact. A variety of chemicals (e.g., precursors for electrode materials, organic solvents for electrolyte) are consumed during battery fabrication, which makes them not "green" and exacerbates the environmental deterioration. On the other hand, the uneven distribution of lithium and transition metals reserves globally leads to the high cost of LIBs, while the highly active nature of lithium and the use of volatile organic electrolyte brings huge safety issues. Both high cost and safety concerns make LIBs not only challenging in electric vehicle application as a power battery technology, but also impracticable at all for large-scale electric energy storage as storage battery technology. In order for batteries to make real and essential contributions to sustainability, two possible solutions are as follows: (i) realizing recycling and upcycling of batteries, particularly LIBs, to create close-loop of essential materials towards circular economy; and (ii) developing next-generation alternative battery technologies to LIBs with much lower cost and higher reliability. In the first solution, research focus has been concentrated on the recycling of LIBs electrode (particularly cathode) by regenerating or upgrading the electrode materials. Moreover, upcycling primary batteries into rechargeable batteries has also been studied. In the second solution, rechargeable aqueous batteries, particularly zinc-ion batteries have been investigated. Both anode and cathode materials have been explored, while electrolyte has been engineered. In addition, practical feasibility has also been studied by investigating ultrahigh-loading electrode, ultrafast-charging and discharging operations, and extreme temperature adaptability.

Biographical Sketch

Prof. Xiaolei Wang is currently an Associate Professor in the Department of Chemical and Materials Engineering at the University of Alberta, and also holding Canada Research Chair position in Batteries for Sustainability. His research mainly focuses on the rational design, development and applications of novel nanostructured materials for energy-related technologies including lithium-ion (and other alkaline ions) batteries, lithium-sulfur batteries, aqueous rechargeable batteries, metal-air batteries, supercapacitors, and electrocatalytic systems (e.g., water splitting, fuel cells, electrocatalytic and photoelectrocatalytic CO2 reduction). Prof. Wang received his Ph.D. at the University of California, Los Angeles (UCLA) in 2013. So far, he has published over 100 papers with a h-index of 40. Prof. Wang was awarded the Discovery Accelerator Supplement with his first NSERC Discovery Grant application as an early career researcher. He is the recipient of Petro-Canada Young Investigator Award (2018) and Concordia University Research Chair-Young Scholar (2019). He is associate editors/young associate editors of several international journals including Frontiers in Chemistry, Energy & Environmental Materials, and Renewables, and editorial board members of Sustainability: Sustainable Chemistry, and Current Trends in Chemical Engineering and Processing Technology. He has been invited as lead guest editors and guest editors for many special journal issues. Prof. Wang has organized, chaired or co-chaired many national and international conferences.

Building a circular economy for net zero manufacturing of chemicals and materials

JIN XUAN, UNIVERSITY OF SURREY, UNITED KINGDOM

Abstract

According to a United Nations report, chemicals production and consumption are to be doubled in the next 10 years to fulfil our essential needs. It's simply not going to happen unless we adopt a circular economy approach. The UKRI Interdisciplinary Centre for Circular Chemical Economy was established in January 2021 to kick start the timely transition of the UK's £32bn chemical industry into a circular system. In this talk, I will outline the vision and remit of the Centre and discuss why we need a whole system approach and an interdisciplinary team to address the challenge. I will then give some examples of the on-going research in our lab to tackle the challenges in the development of the circular chemical economy. I will show how we combine classic electrochemical engineering with cutting-edge enabling tools such as deep learning and digital twin technologies to deliver novel sustainable chemicals and materials and recover chemical feedstocks from end-of-life materials and captured CO2 emissions.

Biographical Sketch

Professor Jin Xuan graduated with a PhD in energy engineering from The University of Hong Kong in 2012. His academic career in the UK started in 2014, when he took up a Lectureship in the School of Engineering and Physical Sciences at Heriot-Watt University. Professor Xuan joined Loughborough University in 2018 as a Senior Lecturer, was promoted to Professor and awarded a Personal Chair in Low Carbon Processes in 2019 and became Head of the Department of Chemical Engineering in 2020. In 2022, Prof Xuan joined the University of Surrey as the Associate Dean (Research and Innovation) for the Faculty of Engineering and Physical Sciences. He is the Editor of Energy and AI (Elsevier), and the founding Editor-in-Chief of the new journal Digital Chemical Engineering (IChemE). Professor Xuan is currently leading the £4.5 million UKRI Interdisciplinary Centre for Circular Chemical Economy. Professor Xuan is the recipient of the Philip Leverhulme Prize in 2022, the Beilby Medal and Prize in 2020, Highly Commended Prizes for the IChemE Global Awards (Research Project, 2019) and IET Innovation Award in Energy and Power (2018) and Scottish Energy News Researcher of the Year Award in Energy and Materials in 2015.

Decarbonization with Efficient Green Hydrogen Production from Water Electrolysis

FENG-YUAN ZHANG, UNIVERSITY OF TENNESSEE, KNOXVILLE (UTK), USA

Abstract

Green hydrogen production with renewable energy sources plays a crucial role on decarbonization and net-zero future. Proton exchange membrane electrolyzer cells (PEMECs) have received increasing attention due to high efficiency/energy density and rapid response even at low-temperature operations. A novel thin liquid/gas diffusion layer (LGDL) with well-tunable pore morphologies was developed, which remarkably reduces the interfacial, ohmic, kinetic, and transport losses in PEMECs. In addition, the LGDL thickness reduction from hundreds of μm for conventional LGDLs to tens of μm leads to a decrease in the weight and volume of the PEMEC stack. More importantly, by taking advantage of the novel LGDL coupled with the development of a transparent PEMEC and a high-speed micro visualization system, the rapid electrochemical reactions and multiphase transport inside PEMECs are revealed to occur only on the catalyst layer adjacent to good electrical conductors. Based on these findings, thinfilm catalyst-coated LGDLs (CCLGDLs) are fabricated and exhibit much higher mass activity and catalyst utilization than conventional catalyst-coated membranes. Furthermore, an innovative electrode design strategy is proposed to build electron/proton transport nanohighways to ensure that the whole electrode meets the triple-phase boundary, therefore significantly enhancing oxygen evolution reactions (OERs) and hydrogen evolution reactions (HERs). Engineered electrocatalysts with nanostructures, including nanowire and nonosheet, create abundant active edges and nanopores, and promote electron/proton transport nanohighways for scalable, low-cost, and robust water electrolysis.

Biographical Sketch

Dr Feng-Yuan Zhang is a Professor and founding director of NanoHELP in the Department of Mechanical, Aerospace and Biomedical Engineering at University of Tennessee, Knoxville (UTK), USA. Prior to that, he had experience at University of Delaware, Penn State University, the University of California, Los Angeles and Stanford University. He received his B. S. and M.S. from Nanjing University of Aeronautics and Astronautics and received his Ph. D. from Nagoya University. His research interests lie in thermofluid, micro/nanotechnology, energy, multifunctional materials, advanced manufacturing, propulsion, sensors, and state-of-the-art spectroscopies and diagnostics. He has been team leader or investigator for numerous projects on hydrogen production, oxygen generation, water electrolyzers, fuel cells, pulse detonation engines, arcjet thrusters, electrochemical reduction of CO2/N2 to high-value products, and advanced instrumentation. His group develops thin and well-tunable liquid/gas diffusion layers (LGDLs) and catalyst-coated LGDLs (CCLGDL) with desired transport, catalytical, electrical and thermal properties, and investigates in-situ microscale ultrafast electrochemical reactions, interfacial effects and microfluidics in electrolyzer cells. Multiple conventional parts are integrated into one multifunctional plate to reduce the weight, volume and component quantity. He has authored/co-authored 4 book chapters and over 100 other publications, and has given over 60 talks. More information can be found at http://fzhang.utsi.edu/default.htm.

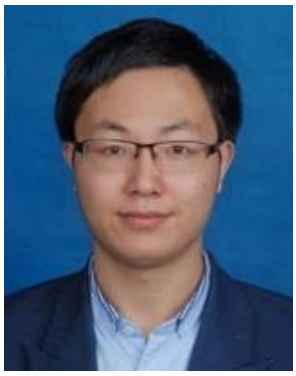
Special Sessions

Special Session 1: Advances in Thermoacoustic Technology

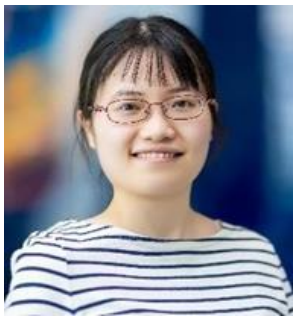
Session Description

Thermoacoustics is an interdisciplinary science that encompasses the fields of thermodynamics and acoustics. It is a fascinating subject that studies the thermoacoustic effect arising from the interaction between a compressible fluid and a porous material. In thermoacoustic engines, an appreciable temperature gradient is imposed along the porous material that induces spontaneous acoustic oscillations while in thermoacoustic refrigerators, the acoustic waves are utilized to produce a hydrodynamic heat pumping effect along the porous material. This Special Session is dedicated to the latest advances in thermoacoustic technology. It provides a unique platform to present state-of-the-art research findings in thermoacoustic devices (including thermoacoustic engines, thermoacoustic electric generators, thermoacoustic refrigerators/cryocoolers, etc.) and aims to promote innovative solutions associated with the practical applications of thermoacoustic technology. Contributions that investigate thermoacoustics-related issues in sound and vibration, thermal science, or materials/energy science, using theoretical, numerical, or experimental methodologies, from component to system levels, are welcomed.

Session Organizers



Dr Geng Chen *is currently a lecturer (assistant professor) and postgraduate supervisor in the School of Energy and Environment, Southeast University (SEU), China. He received his PhD degree from the University of Auckland, New Zealand in March 2021 and joined SEU in May 2021. He was a visiting scholar at James Watt School of Engineering, University of Glasgow, UK. His research mainly focuses on thermoacoustic engines, power generators, and refrigerators. He is the Double-Innovation Doctor of Jiangsu Province and was nominated for the Vice-Chancellor's Prize of best doctoral thesis by University of Auckland. So far, he has published more than 30 research articles in the international authoritative journals such as Renew. Sustain. Energy Rev., J. Sound Vib. and Int. J. Heat Mass Transf. He has been invited to the serve as the reviewer for more than 30 international journals and the academic/review/guest editor for a few international journals.*



Dr Jingyuan Xu *is currently a research scientist in Karlsruhe Institute of Technology (KIT), Germany. She received her Ph.D. degree from Technical Institute of Physics and Chemistry of the Chinese Academy of Sciences (CAS) in 2018 (CAS Outstanding Doctoral Dissertation Award, Beijing Outstanding Postgraduate Award, Wu Zhonghua Outstanding Postgraduate Award, etc). After her PhD, she worked as a Postdoctoral Research Fellow at University of Cambridge and then as a Research Associate at Imperial College London before joining KIT. Her research focuses on sustainable energy technologies based on thermoacoustics for cooling, heating and power generation. She has published over 40 peer-reviewed papers and granted 16 patents. She has been awarded Carl von Linde Award Young Researcher Award by International Institute of Refrigeration, Gustav and Ingrid Klipping Award by International Cryogenic Engineering Committee.*

Session Contents

Topic 1: Efficient energy harvesting with multi-stage thermoacoustic engines: A comparative analysis based on linear and CFD modelling

Short biography of the invited speaker

Mr. Armando Di Meglio is currently a Ph.D. candidate at Parthenope University of Naples. He completed his Bachelor's degree in Mechanical Engineering at Federico II University, followed by a Master's degree in Mechanical Engineering for Energy and Environment. His thesis focused on the numerical and experimental evaluation of aerodynamic noise in the automotive field. During his Ph.D., Armando has further developed his mathematical and physical background with a specific focus on numerical methods and CFD simulation for thermoacoustic energy systems. He also spent six months as a visiting Ph.D. student at Swansea University, enhancing his international experience and expertise in the field. Mr. Armando D Meglio has published nine indexed articles on Scopus, demonstrating his dedication to contributing to academic research in his specialized field.

Topic 2: Stability analysis of thermoacoustic engine with unconventional stacks

Short biography of the invited speaker

Elio Di Giulio completed his doctoral degree in Acoustics at University of Naples "Federico II", defending his thesis titled "Thermo-fluid Dynamic Properties of Porous Materials for Energy Conversion" in 2023. In 2022, he was a visiting scholar at the University Gustave Eiffel in Paris. He is actually a research fellow at the University of Naples "Federico II". Elio's primary focus lies in the numerical and experimental characterization of porous materials under oscillating flow for acoustic and energy applications. Since his master's thesis in 2019, Elio has been actively involved in the field of thermoacoustics, specifically studying heat transfer in oscillating flow. His work revolves around the characterization and analysis of porous materials for various energy conversion processes. With his expertise in numerical simulations and experimental investigations, Elio aims to contribute to the advancement of both acoustic and energy- related technologies.

Topic 3: Solid-state Thermoacoustics: A New Paradigm of Thermoacoustic Research

Short biography of the invited speaker

Dr Haitian Hao obtained his Ph.D. degree from Purdue University in 2021. He is now an Acoustic Test Engineer in industry. Dr. Hao's research is focused on thermoacoustic instability, acoustic metamaterials and thermoacoustic metamaterials. He has published 1 US patent and 15 journal and conference papers. He received the Leo Beranek Medal for Excellence in Noise Control Studies, and Adaptive Structures and Material Systems Best Paper Award in Structures and Structural Dynamics.

Topic 4: Improving Energy Efficiency and low heating temperature of a thermoacoustic cooler driven by a thermoacoustic engine with varying length of regenerators

Short biography of the invited speaker

Irna Farikhah is currently an Assistant Professor in Mechanical Engineering, Universitas PGRI Semarang, Indonesia. She hold a Ph.D degree from Tokyo University of Agriculture and Technology Japan majoring in System Engineering (Thermoacoustic). Moreover, she published some articles in some International Journals and Proceedings from International Conferences in Singapore, Tokyo and London. In 2019, she got scholarship from Turkish government as a research fellowship in Department of Mechanical Engineering, Celal Bayar University, Turkey. In 2020, she has appointed as a visiting research fellow at the Universitas Malaysia Perlis (UniMAP). She is also a member of World Society of Sustainable Energy Technologies (WSSET).

Topic 5: Recent advances and future directions of thermoacoustic energy conversion systems

Short biography of the invited speaker

Dr. Kai Wang is a Research Professor in the Institute of Refrigeration and Cryogenics at Zhejiang University. He received his B.Eng. degree in Energy and Environment Systems Engineering and Ph.D. degree in Power Engineering and Engineering Thermophysics from Zhejiang University in 2009 and 2014, respectively. Before joining Zhejiang University, he worked as a postdoctoral researcher in the Clean Energy Processes (CEP) Laboratory at Imperial College London during 2018-2019 and in the Energy Research Institute at Nanyang Technological University during 2014-2017. He is the Managing Editor for the journal Applied Thermal Engineering since 2019. His research interests focus primarily on high-performance energy technologies, components and systems for energy saving and carbon-emission reduction, including liquid-hydrogen production, storage and refuelling, organic Rankine cycles, thermoacoustic power generators/coolers, Stirling engines, co-/trigeneration systems and solar thermal technologies. He is the recipient of the Sadi Carnot Award from the International Institute of Refrigeration (IIR), one of the IIR Scientific Awards for young researchers working on thermodynamics. To date (January 2023), he has published 1 book, 2 book chapters, more than 60 peer-reviewed journal papers and owns more than 10 patents.

Topic 6: The principles and ways of achieving high performance on heat-driven thermoacoustic refrigerator/heat pump

Short biography of the invited speaker

Dr Kaiqi Luo obtained her Ph.D degree from Technical Institute of Physics and Chemistry, University of Chinese Academy of Sciences in 2021. Since graduation, she joined Building Energy Research Center of Tsinghua University as a postdoctoral researcher. Dr. Luo's research is focused on thermoacoustic energy conversion technology, especially including the investigations on the heat-driven or eletric-driven thermoacoustic Stirling refrigerators/heat pumps.

Topic 7: On the transition from R&D to a product

Short biography of the invited speaker

Kees (C.M.) de Blok (July 6th 1954, married, a son and two daughters) was educated as an engineer in electronics and was employed from august of 1971 until 2000 at the R&D institute of the Dutch telecom operator KPN. Since 1978 he was one of the pioneers developing measuring and installation techniques for the first experimental (1980) and operational (1982) optical fibre links in the Netherlands and gained a lot practical and theoretical experience in the field of lasers, optics and microwave technology. Currently he is active in further R&D in optimizing the modelling and performance of thermoacoustic systems in general, and is active and involved in introduction of this innovative conversion technology into new applications or into applications which are not feasible today by using conventional technologies for technical, economic or environmental reasons (e.g. f- gasses). since May 2022 he start working again but now at Bekaert Combustion Technology B.V. in the Netherlands on understanding and modelling thermoacoustic oscillations in hydrogen and other flames.

Topic 8: Thermoacoustic conversion with wall mass transfer

Short biography of the invited speaker

Dr Rui Yang is an associate professor at Technical Institute of Physics and Chemistry, Chinese Academy of Sciences. He received his Ph.D. degree in Refrigeration and Cryogenic Engineering from Zhejiang University in 2017. Before joining Technical Institute of Physics and Chemistry, he worked as a postdoctoral researcher in Technion-Israel Insitute of Technology in Israel during 2018-2021. He has published over 30 papers in leading journals. His research topics include thermoacoustic engine, thermoacoustic refrigerator and transport phemomena in oscillatory flow.

Topic 9: Investigation of thermoacoustic Stirling engine loaded with a liquid column

Short biography of the invited speaker

Dr HSU Shu Han received his Ph.D. in Engineering from Tohoku University in Sendai, Japan in 2017. He has been working as an assistant professor at National Taipei University of Technology in Taipei, Taiwan since 2018. His research interests focus on studying thermoacoustic engines/refrigerators using both theoretical and experimental approaches, as well as exploring applications of thermoacoustic devices.

Topic 10: Revisit Thermoacoustic Mixture Separation

Short biography of the invited speaker

Dr Yuki Ueda obtained his Ph.D. degree from Nagoya University in 2005. He was a postdoctoral fellow at The University of Tokyo from 2005 to 2006. He joined the Tokyo University of Agriculture and Technology as an associate professor in 2006, and then, he has been a professor since 2019. Dr. Ueda's research is focused on thermoacoustics, which can be related to sustainable energy technologies, renewable/waste energy utilization, and advanced heat pump. He has obtained some patents and published around 50 journal papers. Note that the picture was taken 17 years ago.

Topic 11: Synchronization of Taconis oscillations under external forcing: results of CFD and low-order modeling

Short biography of the invited speaker

Dr Peng Yang is an associate professor at Xi'an Jiaotong Univeristy. He received his Ph.D. degree for power engineering and engineering thermophysics from Xi'an Jiaotong Univeristy in 2018. He was a visiting scholar at University of Illinois at Urbana-Champaign in 2016-2017. He joined Xi'an Jiaotong Univeristy as an assistant professor in 2019. Dr. Yang's research is focused on enhancement for heat and mass transfer, analysis and optimization for thermodynamic cycles, including thermoacoustic/Stirling/refrigeration/heat pump technologies, advanced system thermal management. He has published over 30 SCI journal papers and owned some patents. He also serves as a reviewer for some famous international journals.

Special Session 2: Advances in green refrigeration and cold storage technologies

Session Description

Global climate change and emissions are tightly intertwined. Our last decade was the warmest on record, and we are all aware by now of our need to reduce human activity-related emissions to slow global warming. Unfortunately, warming has increased Europe's reliance on cooling. This has resulted in its emergence to the forefront of areas targeted for decarbonisation. This special session is organized by the CO-COOL consortium is a large international collaboration aiming to develop improved cooling technologies that leverage either renewable electricity/heat or waste heat to keep people and spaces cool without warming our planet. This special session is devoted to the latest development and R&D achievements in the topic of green refrigeration and cold storage, with particular interest in composite sorbents and composite phase materials for cooling energy conversion and cold storage.

Session Organizers

Yongliang Li (University of Birmingham, UK)

Vincenza Brancato (ITAE-CNR, Italy)

Session Contents

Topic 1: Development and characterizations of salt hydrates based composites for adsorption cooling

Short biography of the invited speaker

Dr Yannan Zhang graduated in Energy & environmental systems engineering at Zhejiang University, China, in 2014 and completed her Ph.D. in Power Engineering and Engineering Thermophysics at Shanghai Jiao Tong University in 2019. She currently works as a postdoc researcher in CNR-ITAE since 2020. Her research activity mainly focus on the development and characterizations of high-performance adsorption materials and the development and modification of adsorption-based thermal energy storage systems and desalination systems. She has published 12 papers on international Journals.

Topic 2: Formstable phase change materials based on hybrid salt hydrates for cold storage

Short biography of the invited speaker

Muhammad Maqbool is currently research fellow in the Birmingham Centre for Energy Storage at University of Birmingham. He obtained his PhD degree in Materials Science and Engineering from Peking University in 2022. After his graduation, he joined Inha University, South Korea for a short-term Project as research fellow. He has contributed over 11 articles in peer reviewed high impact (total impact factor >110) journals and have received over 260 citations. His contributions have been awarded with Governor's Bronze Medal and Peking University Academic award. His research interests mainly focus on development of polymer-based materials for thermal management including heat transfer and storage.

Topic 3: Innovative strategies for materials development for low-temperature thermochemical energy storage

Short biography of the invited speaker

Emanuela Mastronardo received her PhD in Materials Engineering and Chemistry in 2016 at the Engineering Department of the University of Messina, Italy. The researcher developed part of her doctoral work at the Laboratory for Advanced Nuclear Energy of the Tokyo Institute of Technology, Japan. In 2017 she received funding from the European Union's Marie Sklodowska-Curie Individual Global Fellowhip Horizon 2020 research and innovation program N ° 74616. EM was a Post-doctoral Researcher at the Materials Science and Engineering Department of Northwestern University, US, (2017-2019) and at the Institute of Catalysis and Petrochemistry of CSIC, Spain (2019-2020). Currently, she is "Senior" Researcher at the Engineering Department of the University of Messina and lecturer in the course of Materials Science and Technology. The researcher is the author of 33 publications (h-index 13), she participated to several international and national conferences, also as Keynote Speaker and member of the scientific committee. She received the "Seal of Excellence" award issued by the European Commission, and the "AICIng for young researchers" award. The researcher is also a member of AIMAT - the Italian Association of Materials Engineering, of the joint program International Energy Agency Solar Heating and Cooling (IEA / SHC) / Energy Conservation and Energy Storage (ECES), and of SolarPACES Task III.

Topic 4: Aging issues on novel composite materials for low temperature thermochemical energy storage applications

Short biography of the invited speaker

Prof. Luigi Calabrese (M) graduated from Material Engineering in 1998 and obtained his Ph.D. in Materials Chemistry and Engineering at University of Messina, in 2002. Currently, he is Associate Professor in the field of Material Science and Technology at the Department of Engineering of the University of Messina. His main research activities are focused on: - Synthesis and characterization of adsorbent materials for sustainable energy technologies; - Advanced composites and functional materials for industrial applications; Materials durability and degradation. Up to date, he has published over 180 articles in indexed international journals. 5 Chapters on scientific books. 1 Book on Springer Scientific series and 7 patents. His publications gained 3355 citations and are ranked with an h-index of 34.

Topic 5: Nanoconfined salt in anistropic graphene aerogel matrix for thermochemical energy storage

Short biography of the invited speaker

Dr Waseem Aftab is currently a research fellow in the Birmingham Centre for Energy Storage at University of Birmingham. He obtained his PhD degree in Materials Science and Engineering from Peking University in 2019. He was awarded International Exchange Talent Fellowship at the same institution from 2019 to 2021 and President Fellowship at Southern University of Science and Technology from 2021 to 2022. He has contributed over 35 articles in peer reviewed high impact journals and have received over 1900 citations, with h-index of 19. His contributions have been awarded with Governor Gold Medal, Outstanding PhD scholar award, and Peking University Academic award. His research interests mainly focus on development of novel materials for thermal energy harvesting, storage, and utilization.

Topic 6: Dynamics of water vapour adsorption for heat conversion systems: comparative study of loose adsorbent grains and consolidated layers

Short biography of the invited speaker

Larisa G. Gordeeva is a Leading Researcher at Boreskov Institute of Catalysis (BIC), Novosibirsk, Russia (the Department of Unconventional Catalytic Processes, the Group of Energy Accumulating Materials and Processes). She received her Ph.D. in Chemical Kinetics and Catalysis at BIC in 1998, and Dr. Sci. degree (Dr. Hab.) in Physical Chemistry at the same Institute in 2013. Her research interests are in the field of Material chemistry, Nanocomposites salt/matrix, Metal- Organic Frameworks, Adsorption, Adsorptive heat transformation and storage, Rational design of adsorbents for various applications. She has about 100 relevant publications in peer-reviewed scientific Journals and book chapters with more than 2300 citations (Scopus h-factor 29). She was a principal investigator of a number of Russian and International research projects.Larisa Gordeeva is deeply involved in joint international projects. She was a Visiting Researcher/Professor at Institute of Advanced Energy Technologies (Italy), Institute of Chemical Engineering (Poland), University of Warwick (UK). L. Gordeeva is a member of the Organizing/Advisory Committees of the International Conferences: Heat Powered Cycles (HPC), Enerstock, Actual Problems of Adsorption and Catalysis, etc.

Special Session 3: Fuel Cells and Electrolyzers

Session Description

In order to mitigate the rising levels of greenhouse gases (GHG) in the atmosphere, which is a leading contributor to climate change, the world's current energy paradigm is undergoing a radical transformation. Development of an at-scale, clean hydrogen economy is a strategic priority and required to diversify our future energy systems, generate economic gains, and achieve net zero emissions by 2050. This special session will cover the latest developments and advancements in fuel cells and electrolyzers from fundamentals, to advanced materials, design, engineering, products, and applications. It will be of particular value and interest to those in the relevant fields.

Session Organizer

Dr Samaneh Shahgaldi is an Associate Professor at the University of Quebec and an Adjunct Associate Professor at the University of Waterloo. She holds the Canada Research Chair (CRC) at proton exchange membrane fuel cells and electrolyzer. She is an award-wining researcher and a member of the editorial board of the International Journal of Green Energy. She was also a Senior Research Scientist at Cummins/ Hydrogenics dealing with different Fuel Cell and Water electrolyzer projects. She published more than 50 articles with over 1790 citations on hydrogen storage, production, fuel cells, nanomaterials, etc. Currently, her team are working on different fuel cells and electrolyser components such as membrane electrode assembly, catalyst, catalyst layer, and bipolar plates.

Session Contents

Topic 1: Recent Development in Oxygen Reduction Reaction Electrocatalyst

Short biography of the invited speaker

Dr. Mohammad Soleimani Lashkenari is currently a researcher (associate professor) in the Amol University of Special Modern Technologies (AUSMT), IRAN. He received his PhD degree from the Babol Noshirvani University of Technology, Iran in October 2014 and joined AUSMT in February 2015. His research interest is related to deploying functional nanocomposites (carbon based materials, MOFs, magnetic structures) as an active electrode for MOR, ORR/OER, CO2 reduction, and HER reactions and supercapacitors. He is looking for the use of scalable synthesis methods for different active electrode materials as well as improving their performance and stability in functional conditions based on the targets of the well-known roadmaps.

Topic 2: Energy management of fuel cell vehicles: from the stack behavior to the hybrid power source integration

Short biography of the invited speaker

Loïc Boulon received the master degree in electrical and automatic control engineering from the University of Lille (France), in 2006. Then, he obtained a PhD in electrical engineering from University of Franche-Comté (France). Since 2010, he is a professor at UQTR (Full Professor since 2016) and he works into the Hydrogen Research Institute (Deputy director since 2019). His work deals with modeling, control and energy management of multiphysics systems. His research interests include hybrid electric vehicles, energy and power sources (fuel cell systems, batteries and ultracapacitors). He has published more than 140 scientific papers in peer-reviewed international journals and international conferences and given over 40 invited conferences all over the world. In 2022, he is in the top 10 of the world most prolific authors of the topic "Proton Exchange Membrane Fuel Cell (PEMFC)" and in the top 20 of the topic "Plug-in Hybrid Vehicles", in Elsevier SciVal. In 2015, Loïc Boulon was general chair of the IEEE-Vehicular Power and Propulsion Conference in Montréal (QC, Canada). Prof. Loïc Boulon is now VP-Motor Vehicles of the IEEE Vehicular Technology Society and he found the "IEEE VTS Motor Vehicle Challenge". He has been the holder of the Canada Research Chair in Energy Sources for the Vehicles of the future and he is now the Director of the Réseau Québécois sur l'Energie Intelligente.

Topic 3: Ultra-Thin Metallic Bipolar Plates of PEMFCs: Manufacturing Methods and Common Defects

Short biography of the invited speaker

Dr Hossein Talebi-Ghadikolaee is an assistant professor of Mechanical Engineering at the University of Kashan, Kashan, Iran. He received his B.Sc. and M.Sc. degrees in Mechanical Engineering from Babol Noshirvani University of Technology in 2013 and 2015, respectively, and went on to complete his Ph.D. in Mechanical Engineering at Tarbiat Modares University, Tehran, Iran, in 2019. He has been a member of Iran's National Elites Foundation since 2015. His research interests' focus on a variety of topics related to metal forming processes, plasticity theory, dynamic and quasi-static material characterization, deformation mechanics and ductile fracture analysis, fuel cells, and the fabrication process of ultra-thin metallic bipolar plates. In particular, he has been involved in projects related to the manufacturing process of ultra-thin metallic bipolar plates, predicting forming defects, and characterizing mechanical behavior of materials. He has made significant contributions to the field, with over 50 peer-reviewed articles published in high-impact journals, conferences, and book chapters. His work has helped to advance the understanding of manufacturing processes of sheet metal, material characterization, and ductile fracture analysis of metallic component.

Topic 4: Investigate the role of cellulose acetate and oxidized carboxymethyl cellulose polymer electrolytes in LIBs

Short biography of the invited speaker

Dr Amir Rezvani-Moghaddam is an Assistant Professor at Faculty of Polymer Engineering at Sahand University of Technology, Tabriz, Iran. His main research interests are in novel coatings and hybrid polymer nanocomposites using novel nanomaterials. His research also includes nanomaterials' synthesis, lithium-ion batteries, fluorescent materials and carbon dots. He leads the Ink and Coating LAB (INKOAT LAB) at the Faculty of Polymer Engineering at the Sahand University Technology in Iran. INKOAT LAB performs fundamental and applied research in polymer science, coatings technology and Inkjet ink industry. INKOA LAB has made contributions in areas like novel hybrid polymer nanocomposites, novel coatings and inkjet inks. INKOAT LAB research group is highly engaged in generating new knowledge related to novel coatings, and the design of products for high-tech applications of industrial interest.

Topic 5: Anion Exchange Membrane Fuel Cells for Green Energy Conversion

Short biography of the invited speaker

Dr Ramesh Kumar Singh is currently working as an Assistant Professor in Vellore Institute of Technology, Vellore, India. Dr Singh received his integrated M.Sc.-Ph.D. degree from the Indian Institute of Technology Bombay, on the development of low-cost Pt core oxygen reduction reaction (ORR) catalyst and used electrochemical impedance spectroscopy (EIS) to understand the underline physical cell process of ORR. He then pursued his postdoctoral research at Ariel University, Israel, with Prof. Alex Schechter, where he focused on the development of new electrocatalysts for urea oxidation relevant to fuel cell technologies. He then joined the laboratory of Prof. Dario R. Dekel, at the Technion - Israel Institute of Technology, as a postdoctoral fellow, where he focused on the development of Pt-free hydrogen oxidation reaction catalysts, carbide-support, and low-cost metal-free ORR catalysts and their integration in anion exchange membrane fuel cells. Currently, his work focuses on developing efficient metal-oxide support for oxygen reduction catalysts, green hydrogen production, ion-exchange membrane development and metal-oxide support.

Special Session 4: Energy for Buildings

Session Description

To achieve the carbon reduction goal, great efforts have been made worldwide. In the world rapidly growing its wind and solar power generation. Especially in the UK, 80% carbon emission reduction from power generation has been achieved compared with 10 years ago. However, carbon emission from buildings is almost unchanged. Domestic space heating and hot water demand contributes to 40% of the total carbon emissions. The actions must be taken to decarbonize building. This special session is aimed at presenting the latest decarbonizing energy technologies and energies used in buildings, ranging from components to systems, and from modeling, simulations and analyses to experimental investigations.

Session Organizer

Shuli Liu is Professor in the School of Mechanical Engineering, Beijing Institute of Technology, China, with about 20 years research experience. She aims to integrate the key strands of: application of renewable energy and sustainable technology; PCM thermal energy storage and Thermal chemical energy storage; building energy performance (materials, construction and lifecycle, etc.) and low carbon behaviors of occupiers and operators, to achieve a smart, Eco home for the future. She has been involved in 13 research projects funded by NSFC, EPSRC, KTP, and industry partners such as Tata Steel, Triton Shower and Orbit House Group Ltd, etc. over £1.7 million. Shuli has over 100 journal and conference publications. She is CIBSE member and fellow of higher education academy, UK. Shuli is also member of World Society of Sustainable Energy Technologies, UK and IBPSA, England.

Session Contents

Topic 1: A study of an indirect expansion solar-assisted air source heat pump with hybrid thermal energy storage for space heating in North China: efficient-economic-environmental analysis

Short biography of the invited speaker

Shuli Liu is Professor in the School of Mechanical Engineering, Beijing Institute of Technology, China, with about 20 years research experience. She aims to integrate the key strands of: application of renewable energy and sustainable technology; PCM thermal energy storage and Thermal chemical energy storage; building energy performance (materials, construction and lifecycle, etc.) and low carbon behaviors of occupiers and operators, to achieve a smart, Eco home for the future. She has been involved in 13 research projects funded by NSFC, EPSRC, KTP, and industry partners such as Tata Steel, Triton Shower and Orbit House Group Ltd, etc. over £1.7 million. Shuli has over 100 journal and conference publications. She is CIBSE member and fellow of higher education academy, UK. Shuli is also member of World Society of Sustainable Energy Technologies, UK and IBPSA, England.

Topic 2: Multi-level scale-up research on distributed clean building heating using heat thermal storage of PCM and solar energy

Short biography of the invited speaker

Prof. Xiangfei Kong acquired his doctoral degree from Tianjin University in 2013. He commenced his career in the same year at Hebei University of Technology. He's Assistant Dean of Energy and Environment Engineering College, Head of the Department of Heating, Ventilation and Air-conditioning and the principal of national first-class major. His study mainly covers efficient building thermal energy storage and research on corresponding primary application. In order to fulfill building energy conservation, technologies like phase change material, low-grade thermal energy reservation and foundation of building thermal environment etc. have been thoroughly investigated. As an essential technique route, building energy conservation works for national strategic aim on carbon peaking and carbon neutrality. Being selected as one of the world wide Top 2 % scientists, Prof. Kong has published over 120 sophisticated academic papers. Among which, he's first/corresponding author to 72 of them (61 articles rated Q1), ESI Hot Paper (0.1 %) 1, ESI Most Cited papers (1 %) 2. There are more than 1900 citations (most cited paper: 177 citations) of his papers. With the H-index of 23, he coedited Phase Change Materials. He has obtained/filed 40 national patents, 5 software copyrights and 2 transformation and application of patented achievements. Dr. Kong has edited/coedited 5 technical standards. He has won three provincial and ministerial second prizes, including the second Prize of Tianjin Technology Invention (Sequence 2) and the second Prize of Huaxia Construction Science and Technology (Sequence 2). In addition, he has won the China Xiangjiang Scholars Award Program. He is the executive director and member of Expert Committee of Tianjin Building Energy Supply Technology Engineering Center, Secretary of International Society for Built Environment (ISBE), member of China Green Building and Energy Conservation Committee, member of Science and Technology Service Expert Committee of China Higher Education Association.

Topic 3: Energy and Environmental Assessment of a Shared Workspace in UK Educational Buildings During the Winter Season

Short biographies of the invited speakers

Thara Al-Mindeel is a doctoral researcher at the School of Architecture, Building, and Civil Engineering of Loughborough University. She received her Master's in Sustainable Architecture with first class honors from Imam Abdulrahman bin Faisal University (IAU), KSA in 2017. She started her career in academia at Jubail Industrial College, KSA where she contributed to teaching activities and delivery of modules for bachelor programs. She is mainly interested in topics related to sustainable, healthy, and low energy buildings. Her current research focuses on optimizing energy consumption, thermal comfort and indoor air quality inside the built environment.

Mahroo Eftekhari CEng DPhil FCIBSE MASHRAE MInstR SFHEA- Professor and course director for MSc in Low Energy Building Services Engineering at Loughborough University. She has a long-term interest in developing control systems, fuzzy logic, Model Predictive Controller MPC, developing software for airport and strategies for buildings in order to reduce energy consumption while providing thermal comfort and improving occupant's well-being. She has a sustained record of application for research funding from a wide range of funding bodies and industrial partners, mainly Tata Steel, Vexo and Mitsubishi R&D. The EPG and direct funding from Tata Steel have resulted in setting up Building & Industrial services Pipework Academy (BISPA www.bispa.org). This is a unique national centre of excellence for delivering CPD courses in Building Information Modelling (BIM) and pipework systems. Interactive rigs have been designed and built in the Civil laboratories and were launched by Loughborough University's Vice Chancellor and the CIBSE president in July 2016.

Eftychia Spentzou DipArchEng MSc PhD PGCAP FHEA ARB Architect. Lecturer in Architecture and Design Management. Her research combines her architectural background with modelling expertise (computational fluid dynamics (CFD) and dynamic thermal modelling (DTM)) and has demonstrated approaches to increase resilience of the existing building stock, deliver sustainable development, and provide solutions to fuel poverty. Eftychia's research spans the relationship between visionary architecture, sustainability and vernacular practices and the interactions between humans and the built environment.

Topic 4: A solar powered PCM heat exchanger to stabilize indoor temperature for winters in Pakistan

Short biography of the invited speaker

Dr Abdur Rehman Mazhar, is an Assistant Professor and the head of the PhD program in Mechanical Engineering at the National University of Sciences & Technology Pakistan. He completed his PhD from Coventry University, UK in 2019 with expertise in energy, renewables and thermofluids. Prior to this he completed his MSc in Power Engineering from TU Munich in Germany with a research thesis at Fraunhofer ISE. Dr. Abdur Rehman Mazhar is a young researcher involved in many promising research ventures. Over the span of just four years, he has published more than 20 articles in high-impact factor journals. At the same time, he has about 6 years of teaching experience in Pakistan and the UK at both undergraduate and postgraduate levels. He is also supervising several post and undergraduate students in their final year thesis.

Topic 5: Experimental investigation of natural ventilation characteristics of a solar chimney coupled with earth-air heat exchanger (SCEAHE) system in summer and winter

Short biography of the invited speaker

Dr Li is now an Associate Professor at the School of Civil Engineering of Chongqing University, China. In 2014, he graduated with the doctoral degree of architectural and civil engineering at Coventry University, UK. His research interests include building ventilation, low carbon technology, and building energy conservation. Dr. Li has been involved in over 20 research projects and has published over 60 journal and conference papers. Dr. Li is also the peer reviewer for more than 15 high quality journals.

Topic 6: Experimental investigation of Earth-air ventilation system ventilation systems in low-energy buildings

Short biography of the invited speaker

Dr Abdullahi Ahmed is a Chartered Building Services Engineer (CIBSE) with over 15 years academic and professional practice in Building Services Engineering and Sustainability Design. Dr Ahmed is the Director for Engineering and Built Environment at Canterbury Christ Church University. Hold a PhD in low-energy systems modelling. He is active member of CIBSE as a member of the course accreditation panel, CIBSE membership reviewer and planning/scientific committee of CIBSE Technical Symposium. He is principal investigator and project manager for several multi-disciplinary and multi-partner research projects. He received and managed research funding from local and international funding agencies relating to projects in circular economy, micro-grid, district scale low-energy renovation and building performance evaluation. He was Keynote and invited speaker for several national and international events and workshops across Europe, Middle East, and Africa. Dr Ahmed Supervised and examined innovative PhD research projects in areas of Energy, climate change and built environment sustainability and resilience.

Topic 7: Heat Storage and the Discharge Performance of a Phase Change Material (PCM) Storage Tank

Short biography of the invited speaker

Dr Zhao is now an Associate Professor at the School of Urban Planning and Municipal Engineering in Xi'an Polytechnic University. She acquired her doctoral degree from Chongqing University and worked as a post-doctoral research fellow at Southwest Jiaotong University. She focuses her research on the renewable energy applications and PCMs. Dr. Zhao has been led or participated 10 research projects including National Natural Science Foundation of China and has published over 20 scientific papers.

Special Session 5: Advances on Chemical Energy Storage: Hydrogen and Carbon Reduction

Session Description

Chemical energy storage is the process of converting and storing energy in the form of chemical bonds, which can later be released and utilized as needed. Hydrogen energy and carbon reduction are emerging as promising solutions within chemical energy storage for global energy challenges. This session will provide a comprehensive overview of recent advancements in these areas, bringing together esteemed researchers, engineers, and experts. It will cover the entire hydrogen value chain, from production to storage and utilization, including novel hydrogen production methods, storage technologies, and diverse applications in fuel cells for transportation, power generation, and industrial processes. The session will also highlight carbon reduction technologies, covering novel approaches for capturing, storing, and repurposing carbon dioxide, such as industrial processes, direct air capture, carbon utilization in value-added products, and geological and oceanic carbon storage techniques.

Session Organizers

Prof. Kui Jiao received a PhD in mechanical engineering from the University of Waterloo, Canada in 2011. He is currently a professor in the State Key Laboratory of Engines at Tianjin University, China. His research interests include fuel cells, batteries, thermoelectric generators, and turbocharger compressors. He has published three books and over 100 papers in highly reputable international journals, including Nature. He has led more than 30 national and industrial projects in China and provided modeling and design services in the development of fuel cell engines for several major automotive fuel cell manufacturers. He serves as the founding editor of Energy and AI and associate editor of International Journal of Green Energy. He is also a Fellow of the Royal Society of Chemistry (FRSC) and a Fellow of the Institution of Engineering and Technology (FIET).

Dr Bowen Wang received his PhD degree from Tianjin University in 2021. Now, he is an assistant professor in State Key Laboratory of Engines at Tianjin University, and the "Hong Kong Scholar" in the Hong Kong Polytechnic University. His research interest focuses on fuel cells, water electrolysis, hydrogen energy and machine learning modeling of energy conversion systems. He published more than 30 high-quality journal papers, including Nature, and three books, and had 10 Chinese invention patents and 3 software copyrights. He joined several national and industrial projects for automotive fuel cell modeling. He won the Best Reviewer Award of International Journal of Green Energy.

Session Contents

Topic 1: Microenvironment design strategies for enhanced CO2 electroreduction with a 60% full-cell energy efficiency

Short biography of the invited speaker

Prof. Fu obtained his Ph. D degree from the Department of Systems Innovation, The University of Tokyo, Japan in 2013, and then worked as a Research Fellow at the Institute of Industrial Science, The University of Tokyo, Japan. He joined School of Energy and Power Engineering, Chongqing University as a scholar of "Hundred Talents Program" of Chongqing in 2015. He won the young scholar of "Chang Jiang Scholars Program" of Ministry of Education, China in 2019. Prof. Fu's research interests include fuel cells and electrochemical CO2 reduction. He has authored and co-authored more than 100 journal papers. He also acted as the guest editor of special issue of Electronics, academic editor of DeCarbon, and editorial board member of Energy and AI.

Topic 2: Data-driven assisted functionally graded design of proton exchange membrane fuel cells

Short biography of the invited speaker

Dr Lei Xing received his PhD degree from Newcastle University (UK) in 2014, then worked as postdoctoral research associate in different word-leading universities, including Loughborough, Oxford, Purdue, and Birmingham, etc. He joined the School of Chemistry and Chemical Engineering at University of Surrey as a Lecturer in 2022. Dr Xing's research interest lies in the sustainable growth of chemical and energy industries via industrial decarbonation and AI-based digitalisation within the context of circular economy, with focuses on the next-generation processes, devices and systems of carbon capture and utilisation, fuel cells and electrolysis. His current research focuses on the whole system thinking and optimisation of the industrial clusters consisting of advanced carbon capture and utilisation and intermittent renewable energy, in which AI-based adaptive optimisation, techno- economic analysis and life cycle assessment are performed to underpin the Net Zero target. He is a Chartered Member of IChemE, Editorial Board Member of Energies, Frontiers in Energy Research et al, and Guest Editor, Topic Editor and Review Editor of several journals. He has published 85+ (with 4 highly cited) journal papers with h-index of 27 and 2500+ citation to date.

Topic 3: Structure design to boost the power density of proton exchange membrane fuel cells

Short biography of the invited speaker

Dr Guobin Zhang received his Ph.D. in 2021 under the supervision of Prof. Kui Jiao at Tianjin University, China, and he studied in the University of California, Irvine as a visiting scholar during 2018-2019. He joined the Xi'an Jiaotong University in 2021 and now is an assistant professor. Dr Zhang's main research interests are water and thermal management of fuel cells and electrolyzers, multiphase flow, heat and mass transfer in porous media, etc. As the first or corresponding author, he has published 19 international peer-review SCI journal papers in Chemical Reviews, Small Methods, Applied Energy, International Journal of Heat and Mass Transfer, etc.

Topic 4: Experimental and numerical investigation of spatially resolved catalyst support degradation during start-up and shut-down of PEM fuel cells of PEM fuel cells

Short biography of the invited speaker

Dr Yuze Hou received his Ph.D. degree from Tianjin University in 2022, specializing in the field of PEM fuel cells. He then joined Fraunhofer ISE as a scientist, where he currently focuses on catalyst degradation, multi-scale modeling, MEA optimization, and the application of AI in MEA production.

Topic 5: Time series health diagnosis system for polymer electrolyte membrane fuel cell based on convolutional neural networks

Short biography of the invited speaker

Dr Bowen Wang received his PhD degree from Tianjin University in 2021. Now, he is an assistant professor in State Key Laboratory of Engines at Tianjin University, and the "Hong Kong Scholar" in the Hong Kong Polytechnic University. His research interest focuses on fuel cells, water electrolysis, hydrogen energy and machine learning modeling of energy conversion systems. He published more than 30 high-quality journal papers, including Nature, and three books, and had 10 Chinese invention patents and 3 software copyrights. He joined several national and industrial projects for automotive fuel cell modeling. He won the Best Reviewer Award of International Journal of Green Energy.

Social Events

Civic Reception (Monday, July 10, 2023)

Civic welcome hosted by the Lord Provost of Glasgow

Time 18:00 – 20:00
Venue City Chambers, George Square, Glasgow, Strathclyde, G2 1DU

Please register by 25th of June 2023 via the Conference Webpage!

The Civic Reception, hosted by the Lord Provost of Glasgow, serves as a warm welcome to the delegates of the 15th International Green Energy Conference in the vibrant city of Glasgow. This exclusive event is organised by the esteemed Glasgow City Council and takes place in the prestigious City Chambers, which were inaugurated in 1888.
Glasgow City Council cordially invites you to a Civic Welcome, which will feature a delightful drinks reception and light refreshments. The Lord Provost of the City (City Mayor) or an appointed Deputy Bailie will be in attendance to extend greetings to the delegates through a brief speech.

Agenda

18:00	Guests arrive at the City Chambers, reception starts
18:15	Lord Provost/Bailie arrives
18:20	Civic Welcome by Lord Provost/Bailie
18:25	Reply to Civic Welcome
18:30	Formalities conclude, drinks and refreshments, networking
20:00	Event finishes

Acknowledgement
The Local Organizing Committee of the 15th International Green Energy Conference would like to express heartfelt appreciation to the Lord Provost and Glasgow City Council for graciously hosting the Civic Reception. We extend our gratitude for providing the splendid venue, arranging the drinks reception, and delivering the welcome speech.

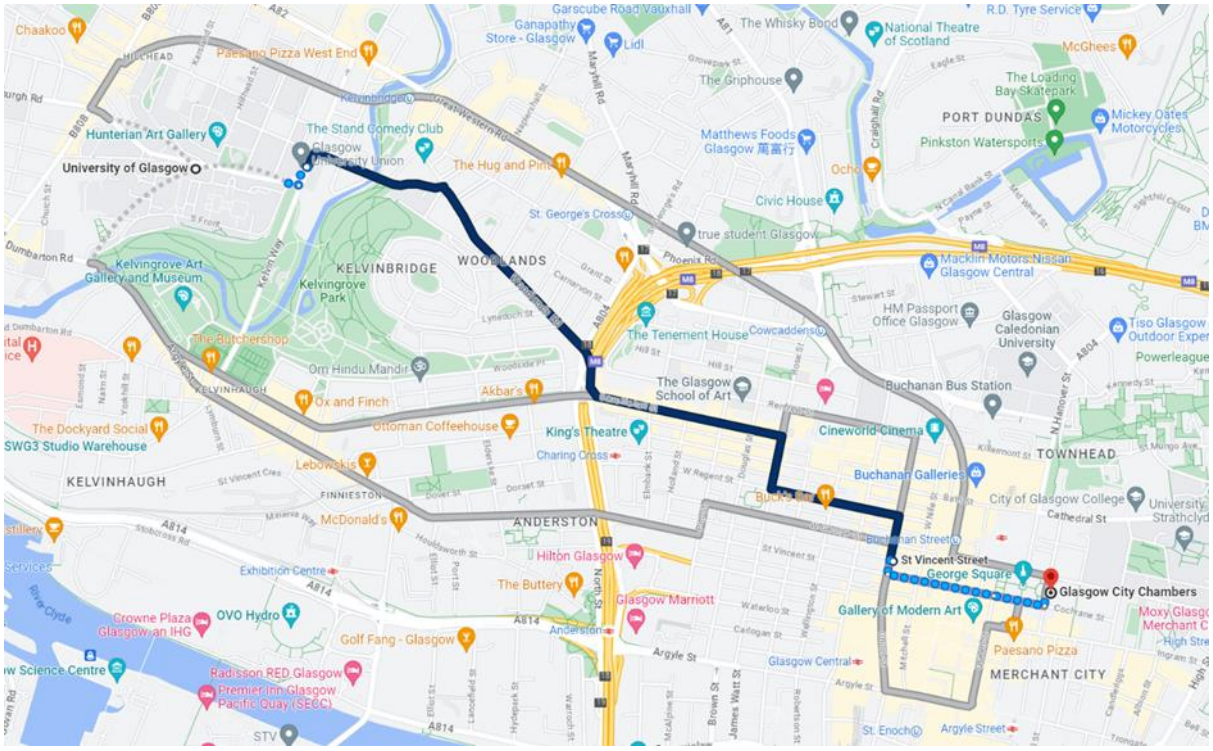
How to reach the City Chambers

Address for the Civic Reception

City Chambers, George Square, Glasgow, Strathclyde, G2 1DU

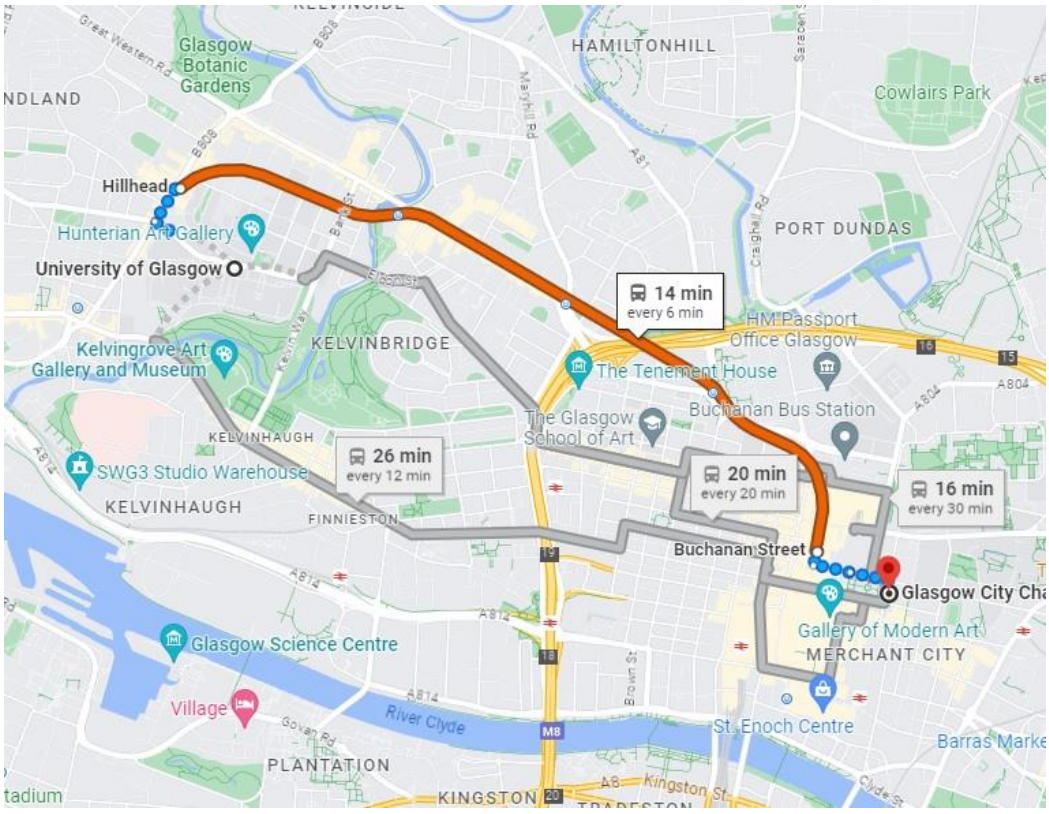
Bus lines from West End to City Centre

First Bus Number 4, 4A, 6A, 2, 3, 77

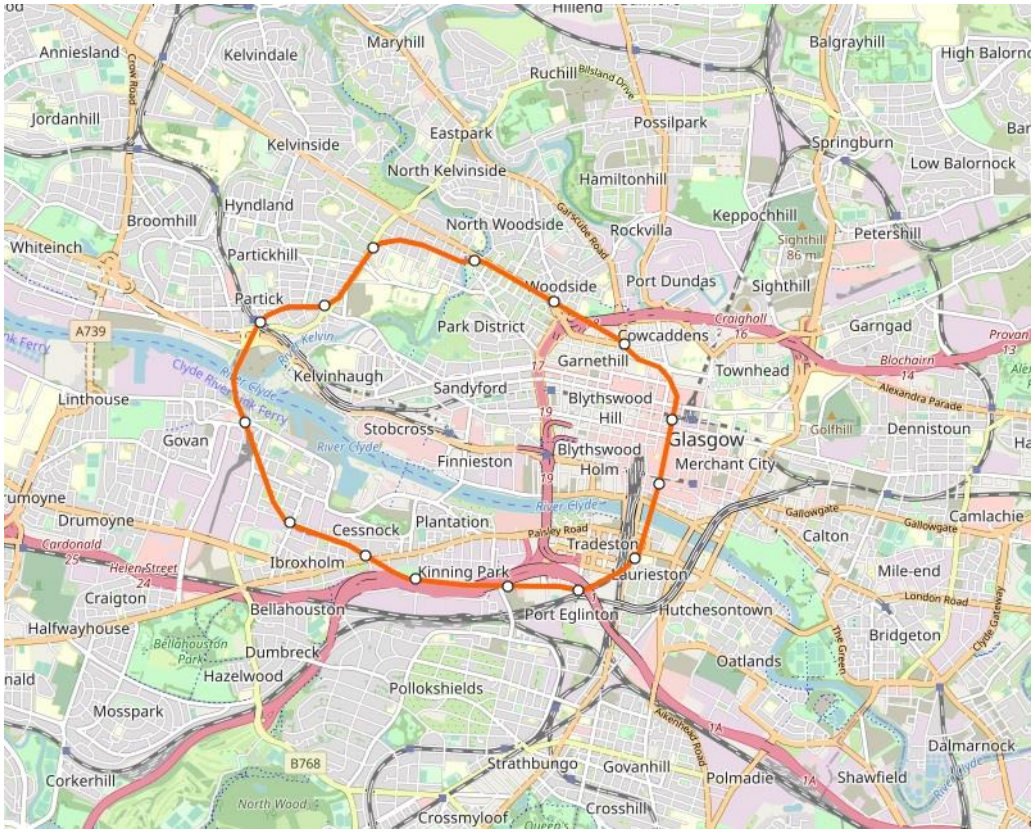


Subway from West End to City Centre

Use Hillhead Station (on Byres Road) and exit at station Buchanan Street



Subway Maps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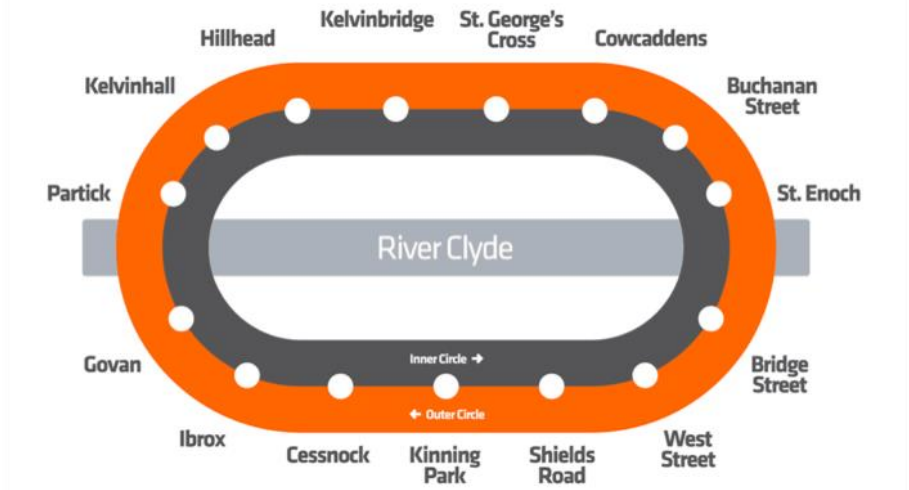
Maryhill
Ruchill
Balgrayhill
High Balornock
Jordanhill
Kelvinside
Eastpark
Possilpark
Springburn
Low Balornock
North Kelvinside
Hamiltonhill
Hyndland
Broomhill
North Woodside
Rockvilla
Keppochhill
Petershill
Whiteinch
Partickhill
Woodside
Port Dundas
Sighthill
Partick
Park District
Cowcaddens
Garngad
A739
Garnethill
Townhead
Kelvinhaugh
Sandyford
Blythswood Hill
Linthouse
Govan
Stobcross
Glasgow
Dennistoun
Finnieston
Blythswood Holm
Merchant City
Drumoyne
Cessnock
Plantation
Tradeston
Calton
Camlachie
Ibroxholm
Kinning Park
Laurieston
Mile-end
Craigton
Bellahouston
Port Eglinton
Hutchesontown
Halfwayhouse
Bridgeton
Dumbreck
Oatlands
Hazelwood
Pollokshields
Mosspark
Dalmarnock
Corkerhill
Strathbungo
Govanhill
Polmadie
Shawfield
Crossmyloof
Crosshill


Hillhead
Kelvinbridge
St. George's Cross
Cowcaddens
Kelvinhall
Buchanan Street
Partick
St. Enoch
River Clyde
Govan
Inner Circle
Bridge Street
Outer Circle
Ibrox
Cessnock
Kinning Park
Shields Road
West Street

Gala Dinner (Wednesday, July 12, 2023)

Time 18:30 – 22:00
Venue Cloisters and Bute Hall, Main Building, University of Glasgow

Agenda

18:30 – 19:30 Happy-hour networking and live bagpipe music performance with drinks in Cloisters
19:30 – 22:00 Gala Dinner in Bute Hall

Bute Hall

The Bute Hall, built from 1878 to 1884, is a unique setting for events of up to 1100 delegates in theatre style or 220 for formal dining. Situated in the main building of the University, this large traditional Hall has a stunning cathedral like ceiling, ornate stained-glass windows, and painted pillars. The Hall, along with the adjacent Randolph Hall, was designed by Sir George Gilbert Scott and named for John Patrick Crichton-Stuart, 3rd Marquess of Bute, who gifted the funds for its construction.

Technical and Cultural Tours (Friday, July 14, 2023)

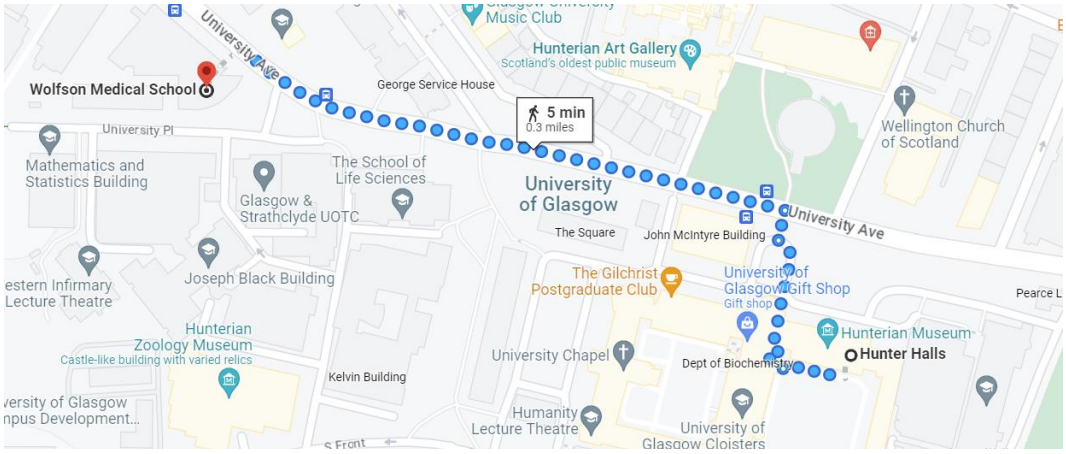
After three days filled with innovation, knowledge sharing, and ground-breaking discoveries, it's time to unwind, connect with fellow attendees, and have some fun!

We invite you to be a part in the cultural or technical tour, designed to provide you with a memorable experience and a chance to build lasting connections. We have organised visits to Stirling Castle and Whitelee Wind Farm on Friday, July 14, 2023.

Instructions

1. Please sign up to secure your place at https://forms.office.com/e/NqeteUEFzD
2. Free transportation will be provided for delegates.
3. Each delegate is allowed to participate in the Stirling Castle tour or the Whitelee Windfarm.
4. A maximum of three accompanying persons can be registered per delegate.
5. Admission to Whitelee Wind Farm is free. However, delegates are responsible for booking their own tickets for the Stirling Castle.
6. Pick up times
    a. Stirling Castle: 10:00 at University of Glasgow (Wolfson Medical School) and 15:00 at Stirling Castle
    b. Whitelee Wind Farm: 10:00 at University of Glasgow (Wolfson Medical School) and 14:00 at Whitelee Wind Farm

Bus pick-up point at the University of Glasgow



Stirling Castle

Situated on a commanding volcanic rock above the river Forth, Stirling Castle played a pivotal role as Scotland's key stronghold. Evolving from its ancient origins, it became a majestic royal residence and an impregnable fortress over the centuries. The castle bore witness to the Wars of Independence, tumultuous conflicts between Scots and the struggle against England, exchanging hands an astounding eight times in just 50 years. Notably, its strategic location afforded a front-row view of legendary battles like Stirling Bridge and Bannockburn. During peaceful periods, Stirling Castle welcomed Scottish royalty seeking solace, comfort, and the thrill of superb hunting. It also served as the centre of government, witnessing the construction of magnificent architectural endeavours like the Great Hall, the Chapel Royal, and the Palace of James V. These additions solidified its status as one of Scotland's most significant sites. The castle was not devoid of infamy, as infamous acts such as the murder of the Earl of Douglas by James II occurred within its walls. Furthermore, it nurtured the formative years of influential figures in Scottish and British history, including Mary Queen of Scots, James VI, and James I. In later years, Stirling Castle assumed a vital military role, becoming the home of the renowned Argyll and Sutherland Highlanders. After the departure of soldiers, extensive restoration projects were undertaken to revive the castle's main structures to their former magnificence. Today, Stirling Castle enjoys international acclaim as a must-visit attraction, captivating visitors with its rich history and captivating architecture.

Visit for more detail https://www.stirlingcastle.scot/

Visit for ticket booking https://www.stirlingcastle.scot/visit/tickets/

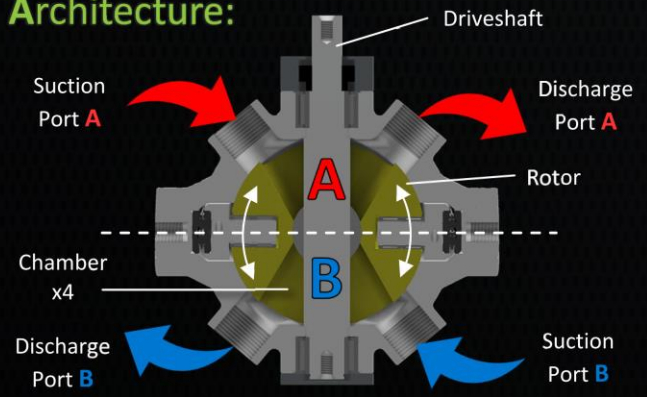
Whitelee Wind Farm

Whitelee, situated on Eaglesham Moor just a short 20-minute drive from central Glasgow, stands as the largest onshore windfarm in the United Kingdom. Its impressive array of 215 turbines harnesses the power of the wind, generating a remarkable 539 megawatts of electricity. This substantial output is capable of supplying energy to over 350,000 households. Aside from its remarkable energy production, Whitelee offers visitors an extensive network of trails stretching over 130 kilometres. These trails can be explored on foot, by bicycle, or even on horseback, providing ample opportunities for outdoor enthusiasts to immerse themselves in the breath-taking surroundings. What's more, visitors can enjoy the convenience of free parking and admission to our onsite Visitor Centre.

Visit for more detail https://www.whiteleewindfarm.co.uk/ (entry is free)

fetu ROTICULATE — A Unique Energy Machine

Architecture:



Compander

Chamber stages A & B can differ in volume. One performing as Compressor, one as Expander; Discharge & Suction may be linked to form a closed fluid cycle. Stage A & B may also be run in parallel or series as a dedicated & highly effective Expander or Compressor.

Roticulate™

The patented **FeTu** device uses shaft rotation in conjunction with a fixed periphery orbit to control a single spherical rotor which rotates and articulates (Roticulate™) in 3D space, enabling precise & simultaneous management of four volumetric chambers which share a single set of mechanical constraints.

Translating energy seamlessly & continuously between rotational and volumetric sources; applicable wherever work and fluid co-exist, also performing well as a pump.

Dynamic in-chamber ratio

The IP portfolio includes an ingeniously simple method of varying the in-chamber expansion or compression ratio to accommodate the management of, or production of, varying temperatures. Effectively a non-physical manner of facilitating variable valve timing.

Heat Engine

2023 takes the technology into new territory, preforming as a heat engine within a closed thermodynamic cycle. Detailed (independently verified) analysis predicts a capability to establish new performance norms in Electrical generation from low-grade waste and geothermal sources as low as 60°C, predicting conversion ratios in excess of 60% Carnot whilst utilising ethical organic fluids <150 GWP. The company have also registered IP for a revolutionary new 'Fenton Cycle', an oil-free single-phase gas cycle capable of establishing new performance norms above 250°C.

Why is FeTu so Efficient?

Isentropic Efficiency: >95%

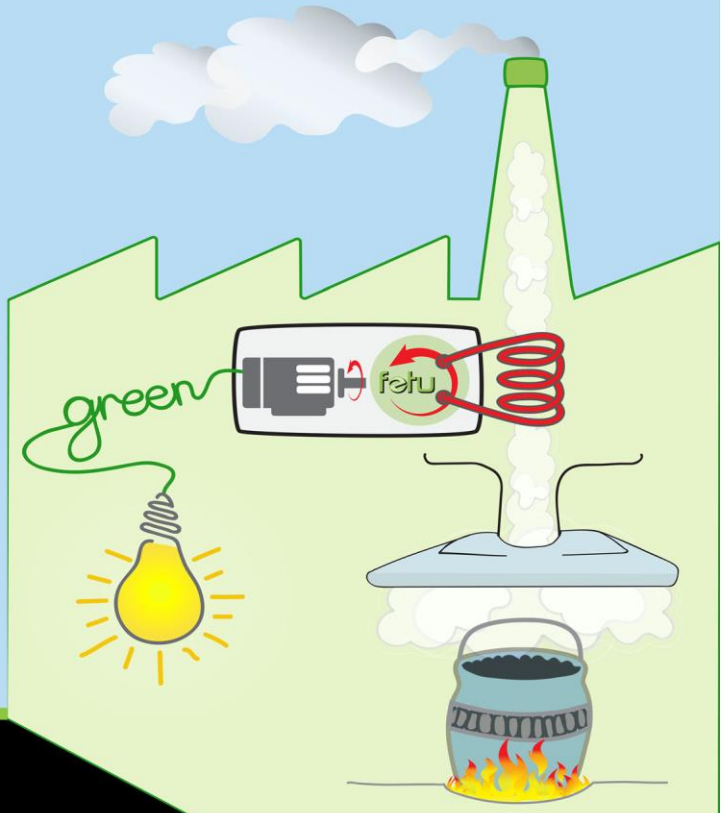
The machine natively resides halfway between the suction and discharge temperature, resulting in an inability to add or subtract heat in-process, yielding an inordinately high Isentropic Efficiency.

Volumetric Efficiency: >95%

Protracted leak path regions and tight manufacturing tolerances offer excellent contact-free sealing, whilst adding a barrier fluid takes the completely collapsing chambers close to absolute Volumetric Efficiency.

Other USP of this Unique machine

- Mechanically simple, lightweight, and compact.
- High, single-stage, Pressure Ratio.
- Variable capacity, variable ratio.



Opportunities?

We are a small innovation business trying to make the world a better place and can only thrive in good company.

We seek Funding Collaborators & End Users with unresolvable low-temp H2P challenges.

Our door is always open to interest from Commercial Sponsors & Ethical Investors.

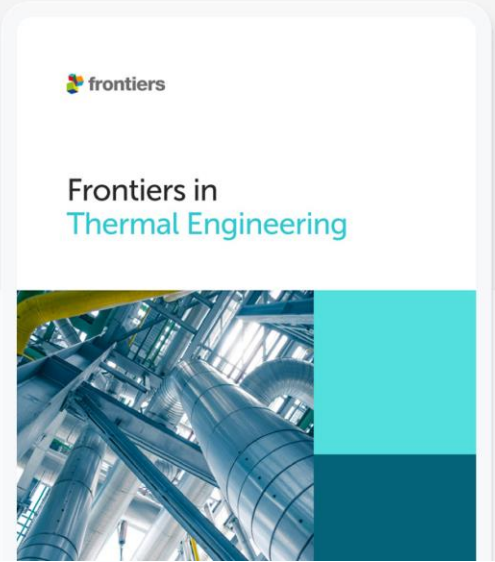
info@fetu.co.uk ***www.fetu.co.uk***

frontiers

Frontiers in Thermal Engineering

This journal explores technological advances in thermal engineering which can support access to affordable, sustainable and modern energy for all.

Frontiers in Thermal Engineering publishes high-quality research across the field of thermal energy science and engineering, including fundamental and basic research to applied and industry focused engineering and technology development. A strong emphasis is given to applied aspects related to the design, development, demonstration and implementation of components, devices, equipment, technologies and systems involving thermal processes for the production, transmission, storage, utilization, conservation and management of energy with improved energy efficiency and minimized energy foot print. The journal is particularly focused on addressing technological advances which support United Nations' Sustainable Development Goal (SDG) #7: access to affordable, reliable, sustainable and modern energy for all; and SDG#13: urgent action to combat climate change and its impacts. This open-access journal is at the forefront of disseminating and communicating scientific knowledge, impactful discoveries and technological innovation.



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frontiersin.org/thermal-engineering

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PEOPLE MAKE GLASGOW

University of Glasgow Public Wi-Fi

eduroam Wi-Fi

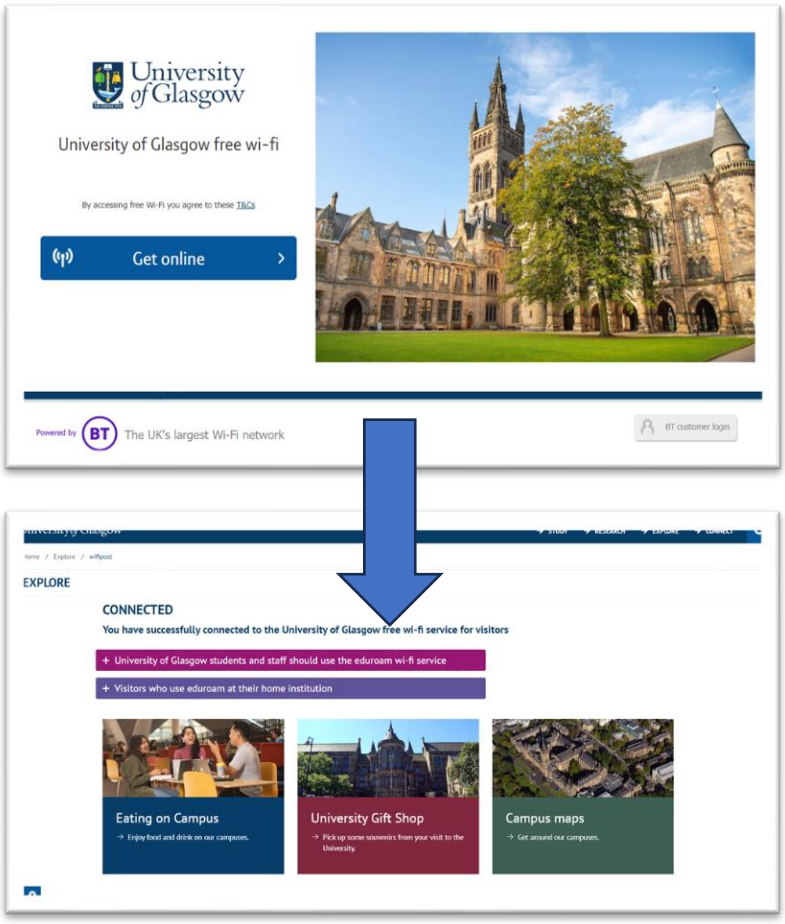
If you are visiting from another institution that uses eduroam, you can connect here too.

UofG Visitor Wi-Fi

For everyone else. No registration is required. Just connect to the UofG visitor wireless network using your device.

Connection

Select **UofGvisitor** in your Wi-Fi network options (where you usually connect to a Wi-Fi service). On selecting it you will be presented with the public Wi-Fi landing page and all you need to do to get online is to click the 'Get Online' button and you will be redirected to the **UofGvisitor Connected** page. From there, you can access your online world.

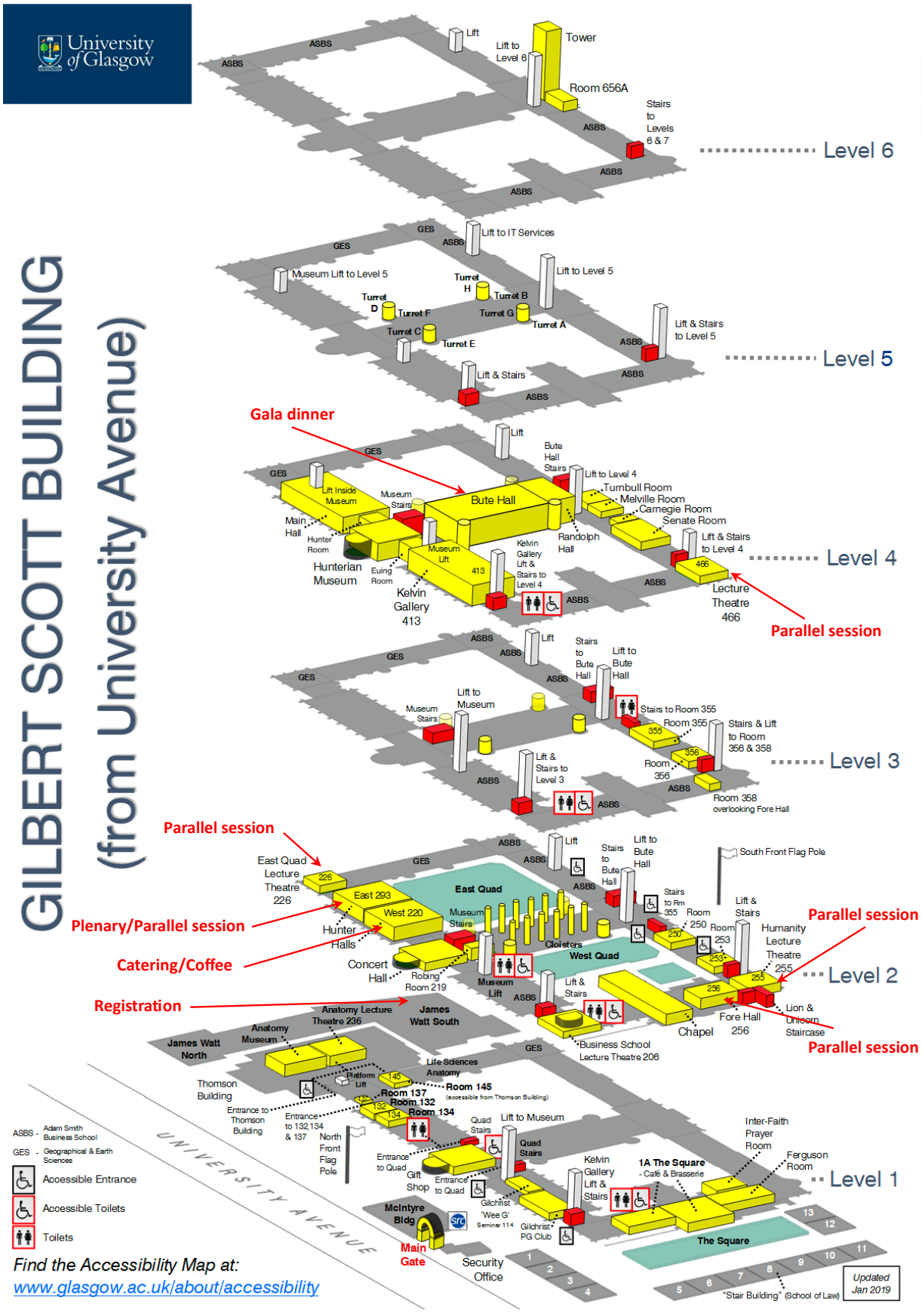


Instructions

- **Registration:** You are not required to register for the service and can use it straight away with a simple click-to connect by pressing the 'Get Online' button on the landing page.
- **Connection period**
  - You will have access for up to 2 hours at a time. At the end of the 2 hours the service will time you out, even if you are in the middle of using the service.
  - If you are inactive for 15 minutes within those 2 hours, the service will also time you out.
- **Reconnection:** If you are disconnected through a timeout then the next time you try to use the service nothing will work until you do something that triggers the landing page and use that to 'Get Online' again.
- **Disconnection:**
  - Either disconnect from 'UofGvisitor' in your Wi-Fi network options
  - Or leave inactive for 15 minutes or wait for your 2 hours to be reach, whichever is first.

Map of Conference Venue

[University of Glasgow - Explore - Accessibility]



Changes in the registration venue

New Address: The foyer of James Watt South Building, University of Glasgow, G12 8QQ