IAGE Newsletter

Inaugural Issue

IAGE
INTERNATIONAL ASSOCIATION FOR GREEN ENERGY

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Winter 2023

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EDITOR'S LETTER

XIAOYU WU, PhD

Editor-in-chief IAGE Newsletter Winter 2023

Assistant professor, Department of Mechanical and Mechatronics Engineering, University of Waterloo

xiaoyu.wu@uwaterloo.ca

Dear readers,

I would like to welcome you to the inaugural issue of the IAGE Newsletter. As the Communication Committee Co-chair, I was thrilled to have the opportunity to edit this first issue. Our committee aims to have four issues of Newsletter per year, and the next issue will be released in Spring 2023.

This issue, coming with the new year of 2023, focuses on the two important issues of green energy: energy efficiency and energy storage. As the installed capacity of variable renewables increases and the challenge of energy security exacerbates, storing energy at times of abundance and then using it efficiently at energy-deficient times becomes of significant importance. In this issue, Dr. Samaneh Shahgaldi, Mr. Ross Barker and I contributed three feature articles on these topics. Dr. Shahgaldi provides an introduction to electrolyzers and fuel cells, which are important to store electricity in hydrogen energy. Mr. Barker introduces an invention of a flexible heat pump of high efficiency to help households to save their energy bills. In my article, I talk about the concept of power-to-ammonia to use excess electricity to produce ammonia as a commodity and energy storage medium to decarbonize the food, energy, and trade sectors.

I am also delighted to share some interesting news that I have read recently on the topics of energy efficiency and energy storage. These are not meant to be exhaustive listings of all the latest development in the field of green energy, but rather to be some of my favorite news articles. I hope you will also find them interesting and useful.

The 15th International Green Energy Conference (IGEC2023) will be held in-person and online on July 10–13, 2023 at the University of Glasgow. In this issue, I asked Dr. Zhibin Yu, the chair of the IGEC2023, to provide some information about the James Watt School of Engineering at the University of Glasgow. I hope this will help those attending the conference to get to know our host better.

We also have reports on the latest developments of the IAGE International Chapters as well as our journal, the International Journal of Green Energy. It is also my great pleasure to share the lists of award winners to you all!

I hope you enjoy the inaugural issue of the IAGE Newsletter. Happy 2023!

Sincerely,

XiaoYu Wu

A New Year Filled with Challenges, Hopes and Opportunities

XIANGUO LI, PH.D., P.ENG., FCAE, FEIC, FCSME
President, International Association for Green Energy (IAGE)

Professor, Mechanical and Mechatronics Engineering
Director, Laboratory for Fuel Cell and Green Energy,
University of Waterloo,
Waterloo, Ontario N2L 3G1
Canada

xianguo.li@uwaterloo.ca

Dear IAGE members,

I am delighted at the opportunity and privilege of writing this welcome message to the IAGE members and beyond through this IAGE Newsletter. I hope everyone has had a wonderful holiday season, with opportunities to relax and enjoy with your family and to re-energize for the challenges and opportunities in the new year.

Humanity is seeing its formidable challenges at the short and longer terms. The Covid-19 pandemic is lingering without a clear day of end in sight; while greenhouse gas emissions (GHG) are surging back to its pre-pandemic historical height, with global climate changes and high frequency occurrences of extreme weather conditions. Global climate changes are feared to bring a sweep of environmental changes along with more possibilities of releasing/activating never-seen-before viruses and bacteria that may pose serious safety concerns and health hazards to humanity. The vicious cycle of possible self-acceleration must be stopped, the very pressing one is to curb anthropogenic GHG emissions, majority of which is contributed by the energy sector. Therefore, it is essential to develop technologies on the forms and utilizations of energy that have no, minimal, or reduced impact on environment, economy and society, or what might be referred to as **Green Energy**.

This is the very first official issue of the Newsletters that IAGE is publishing in its decade-old history. As such, I am writing a separate page within this issue of the Newsletters, providing an overview of IAGE and related activities that led to the current issue of the Newsletters and the current state of the affairs for the IAGE. **The IAGE has nine standing committees, two technical divisions, and over 10 national and/or regional chapters.** Further details are available at the IAGE's official website https://www.iage-net.org/. You are warmly welcome if you are interested in getting involved in IAGE, please getting in touch with us at your earliest convenience.

The 15th International Green Energy Conference (IGEC-XV) will be held in hybrid mode at the University of Glasgow, UK, July 10-13, 2023, and is being organized by colleagues there, headed by Dr. Zhibin Yu, Professor of Thermal Energy. The University of Glasgow, founded in 1451, has a glorious history in energy science and engineering, with the forefathers of thermodynamics including such well-known researchers as **Lord Kelvin, William Rankine** and **James Watt**, and is the birthplace of many important concepts and ideas of modern energy systems, such as refrigeration, heat pump, Kelvin temperature scale, steam engine, and Ranking power cycle. It is a perfect place to meet and discuss energy and opportunities arising from the solutions to challenges the energy community faces. I will be happy to see many of our members and colleagues attending our flagship event in the beautiful historical city of Glasgow and use your knowledge and wisdom to shape the direction of our amazing technical organization.

Sincerely,

Xianguo Li

The 15th International Green Energy Conference (IGEC2023) at the University of Glasgow

Being the 4th oldest university in the English-speaking world, the University of Glasgow has a strong heritage of pioneering engineers and world changers. Engineering at Glasgow has a long and proud history going back several centuries. Notable landmarks include:

- Appointing the first Professor of Engineering in the UK in1840.
- Hosting the first Chair of Naval Architecture in 1880, John Elder – ship building being a major industry in Glasgow.
- The first Engineering degree program in the UK which started in 1872.
- The first Faculty of Engineering in the UK founded in 1923.

Below are some of the key figures that the University of Glasgow has hosted, who have made significant contributions to Engineering.

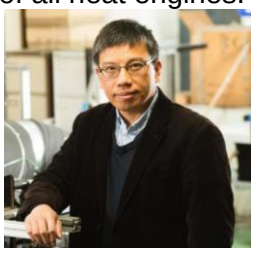
- **William Thomson, Lord Kelvin (26 June 1824 – 17 December 1907)**
  Lord Kelvin was a giant in the world of science, and his achievements make him one of Glasgow's most famous citizens. 'Lord Kelvin' was the title William Thomson took when he was made the first 'science lord'. He taught at the University of Glasgow for fifty-three years and became its Chancellor. He did important work in the mathematical analysis of electricity and formulation of the first and second laws of thermodynamics.
- **James Watt (9 January 1736 – 25 August 1819)**
  Born in Greenock, Scotland, in 1736, James Watt was employed by the University as an instrument maker at the age of 20, providing him with lodgings and a workshop. During his employment he manufactured a range of items for the Professor of Practice of Medicine, Joseph Black, that included an organ and a perspective machine. When presented with a model Newcomen steam engine in need of repair, Watt devised a separate condenser which would improve efficiency and permit enormous savings in fuel. Through developing this idea with industrialist Matthew Boulton, Watt is considered to be one of the key figures of the Industrial Revolution. The model Newcomen engine survives to this day and is on long-term display at The Hunterian.
- **William John Macquorn Rankine (5 July 1820 – 24 December 1872)**
  William John Macquorn Rankine was a Scottish mechanical engineer who also contributed to civil engineering, physics and mathematics. He was a founding contributor, with Rudolf Clausius and William Thomson (Lord Kelvin), to the science of thermodynamics, particularly focusing on the first of the three thermodynamic laws. He developed the Rankine scale, an equivalent to the Kelvin scale of temperature, but in degrees Fahrenheit rather than Celsius. Rankine developed a complete theory of the steam engine and indeed of all heat engines.

RESEARCH-LED TEACHING

Today, the James Watt School of Engineering offers an exciting range of research-led, professionally accredited undergraduate and postgraduate taught degree programs that include not only the core engineering disciplines (Aeronautics, Civil, Electronics & Electrical and Mechanical Engineering) but also unique specialist degree programs, such as Biomedical Engineering, Product Design Engineering, Electronics with Music, and Civil Engineering with Architecture.

RESEARCH

The school's research environment boasts world leading research groups and facilities within an integrated research structure of sufficient scale to enable major engineering challenges to be tackled effectively. This includes coverage of a broad range of Engineering subjects, as well as the interfaces with biology, chemistry, computer science, medicine and physics.



Professor Zhibin Yu
James Watt School of Engineering
University of Glasgow

Dr. Yu is the chair of the IGEC2023. His research is focused on thermal energy technologies and their fundamental thermodynamic, heat transfer, fluid-dynamic problems.

*Part of the texts in this article are from the School Office of the James Watt School of Engineering and Wikipedia.

Interested in hosting IGEC in 2025?

We are calling for bids!

More info on Page 18

The International Green Energy Conference (IGEC) is a multi-disciplinary international conference on the use of energy with no or reduced environmental impacts and will provide a forum for the exchange of the latest technical information, for the dissemination of high-quality research results, for the presentation of new developments in the areas of energy and environment, and for the debate and shaping of future directions and priorities in sustainable development and energy security. Green energy may be defined as the form and utilization of energy with no, minimal, or reduced negative environmental and societal impacts, or simply as environmentally friendly energy use. Therefore, papers on related topics are solicited from all relevant disciplinary areas, ranging from new concepts, modeling, experiments, to computational simulation.

The conference will be of value and interest to researchers, scientists, engineers and practitioners who are working in relevant fields of energy and environment, from policy making, technical development to management and marketing.

The conference will be composed of the following events and activities:
• General contributed abstracts/papers that will be presented orally in technical sessions.
• General contributed poster presentations.
• Keynote papers by invited speakers.
• Panel sessions on special topics of particular interest.
• Book/Journal/Industry exhibitions.
• Social events for the conference delegates.

All papers will be screened and reviewed by the conference Technical Committee under the direction of the International Advisory Committee. Eligible papers will be published in the Conference Proceedings, which will be available during the Conference and included in the registration package. High-quality original papers of archival value will be considered for publication in Special Issues of prestigious international journals:
• International Journal of Green Energy
• Energy
• Frontiers in Thermal Engineering

Website: https://www.iage-net.org/igec2023
Abstract/paper submission link: https://www.iage-net.org/igec2023-submission
Sponsorship is available at various levels, please contact conference chair Prof. Zhibin Yu (Zhibin.Yu@glasgow.ac.uk)
All other correspondence regarding the conference to the Conference Secretary, Sambhaji Kadam (Sambhaji.Kadam@glasgow.ac.uk)

A Short Introduction to Electrolyzers and Fuel Cells

Samaneh Shahgaldi, the Université du Québec à Trois-Rivières

The current energy reliance on fossil fuels is predominantly responsible for the release of greenhouse gases (GHGs) and their increasing concentration in the atmosphere, which has already a cataclysmic impact on the environment, human health, and the economy. The recent floods and fires in Western Canada are a mere hint of catastrophe that the climate change could do to the environment. Canada's GHG emissions increased by 21.4%, or 129 Metric tonnes $CO_{2\text{-eq}}$ between 1990 and 2019, largely driven by the increased emissions from oil and gas extraction as well as transport. The adversity of the anticipated environmental, human-health and economic impacts would notably extend to Canada's north, affecting many indigenous and remote communities. The manifestation of these impacts is expected to become more grievous, unless united efforts to reduce emissions are undertaken by adopting cleaner energy sources and energy conversion systems.

According to the Paris agreement, Canada pledges to reduce its GHG emissions to 30% below its 2005 emission levels by 2030, that is equivalent to achieving the global target of holding warming well-below 1.5ºC. 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. Therefore, it is imperative to transition to emission-free energy supply and develop carbon neutral, affordable, and sustainable alternative energy sources to mitigate climate change and to meet the recommended emission target. The hydrogen strategy sets an ambitious framework to cement hydrogen as a key part of Canada's path to net-zero carbon emissions by 2050 and make Canada a global leader in hydrogen technologies. Hydrogen is the most efficient renewable energy carrier fuel with the highest energy content per mass unit, being its higher heating value (HHV) 3.54 kWh/m^3 (39.42 kWh/kg), that is, 2.5 and around three times more energetic than methane and gasoline, respectively.

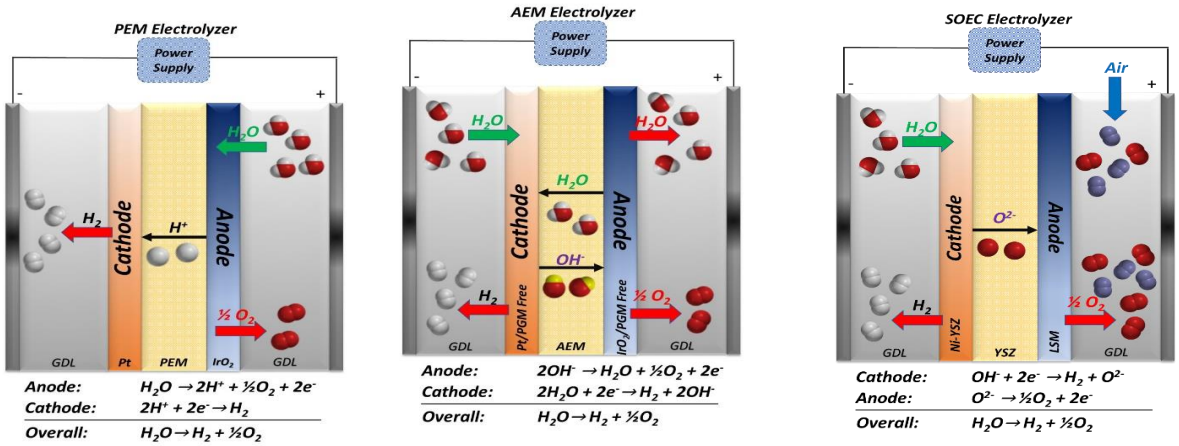


Figure 1. Schematics of three types of electrolyzers

Hydrogen can be produced from different renewable and non-renewable sources of raw materials using methods such as steam reforming of methane, oil/naphtha reforming, coal gasification, biomass, biological sources and water electrolysis. Among them, eco-friendly and high purity green hydrogen – also referred to as "clean hydrogen" – can only be produced by water electrolysis from renewable energy sources which emits only oxygen as by-product without any carbon emissions. However, as of now water electrolysis is only responsible for 4% of the global industrial hydrogen production, largely due to the economic issues.

There are two main groups of electrolyzers: Nonmembrane- and Membrane-based electrolyzers. Hydrogen production from electrolysis of alkaline water in a nonmembrane-based electrolysis technology is now a mature technology, but it has certain drawbacks that prevent it from becoming a pragmatic solution. The other types are proton exchange membrane (PEM), anion exchange membrane (AEM), and solid oxide electrolysis (SOE). These technologies have attracted a lot of scientific and industrial attention due to their numerous advantages. Figure 1 presents the schematic illustration of the three electrolysis cells. PEM electrolyzers come with an impressive range of advantageous characteristics including high efficiency, fast response, operation at lower temperatures (20–80°C), and low gas crossover rate at a wide range of power inputs. The main issues for mass production that need to be addressed are related to the durability of some key components. Large-scale commercialization will occur when an overall reduction of price and guaranteed long life of the systems are established. AEM water electrolysis combines

Professor Samaneh Shahgaldi
Canada Research Chair in PEM Fuel Cells and Electrolyzer, Université du Québec à Trois-Rivières
Samaneh.Shahgaldi@uqtr.ca

In the Canadian transportation sector, 95% of vehicles are powered with petroleum-based fuel, contributing to 14% of global greenhouse gas emissions. Canada seeks to achieve Zero Emission Vehicle (ZEV) mandates by the year 2050. Therefore, the need for greener fuels for meeting climate change targets is crucial. Developing innovative, new renewable energy solutions is a necessary step to limit the catastrophic impact of climate change. Proton exchange membrane (PEM) fuel cells generate electricity using hydrogen and oxygen through a catalyzed electrochemical reaction at low temperatures and are a compelling option for clean mobility and power generation. After nearly three decades of intensive research, PEM fuel cells have reached the early stage of commercial deployment, the remaining challenges include the need to lower the production cost and to increase durability and cell performance. Dr. Shahgaldi and her team are working on the development of components design to address all the challenges. These components include catalysts, gas diffusion layer, bipolar plate, etc.

the advantages of PEM and alkaline electrolysis. It relies on milder alkaline electrolytes or distilled water instead of a concentrated potassium hydroxide solution. It is then possible to use cheaper catalysts and stack components. However, low ionic conductivity, low power efficiency, medium range membrane needs to be addressed. SOE is considered a technology of the future, as it is viewed as a high-efficiency process and produces high-purity H_2. SOE works at a high temperature, i.e., 500–1000°C and it uses a solid ceramic membrane, which makes it compact and gives it a fast response time. The advantages of having an SOE include its superior ionic conductivity. SOE comes also with some disadvantages, *e.g.*, the relative immaturity of the technology, the energy-intensive nature of the process, low durability, and the need for ultrahigh operating temperatures.

Cost effective hydrogen production method will lead to accelerate the mass production of fuel cells. After nearly three decades of intensive research, PEM fuel cells have reached the early stage of commercial deployment, the remaining challenges include the need to lower the production cost and to increase durability and cell performance. Figure 2 presents a schematic image of a half-cell of membrane-electrode assembly (MEA) which is the core component of PEM fuel cells. The current state-of-the-art of MEA consists of a Pt-C based electrode in catalyst layers (CLs), perfluorosulfonic acid (PFSA) membranes, and gas diffusion layers (single layer gas diffusion layer (GDL) and microporous layer (MPL)).

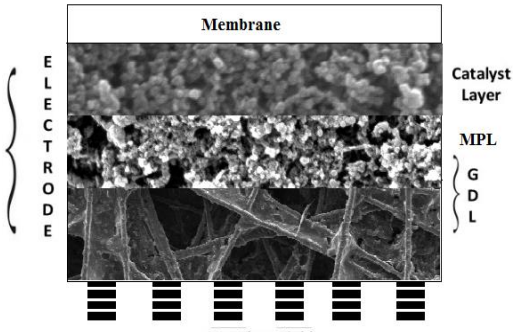


Figure 2. Schematic of a half-cell membrane electrode assembly (MEA)

Despite great strides made in the consumer space, there has been public scrutiny on the components and manufacturing processes of being unrepresentative of the virtues of this green technology. Therefore, we are going to develop on the components and design of fuel cells to decrease the cost and increase the performance and durability.

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Power-to-ammonia to decarbonize multiple sectors

XiaoYu Wu, University of Waterloo

Ammonia (NH_3) is a versatile chemical that is or will be used widely in different sectors, such as food, energy, and trade sectors, as shown in Fig. 1. However, the current industrial ammonia production process, named after its inventors as the Haber-Bosch process, accounts for 1% of the annual anthropogenic greenhouse gas (GHG) emissions due to the extensive use of fossil fuels in the process.[1] Decarbonizing NH_3 production is critical, and the integration of different sectors to boost the clean NH_3 demand was shown to provide higher economic incentives than focusing on the decarbonization in one sector only.[2]

Currently, around 80% of the annually produced NH_3 is used for fertilizer production. In addition, NH_3 is also used as a refrigerant for food preservation. This demonstrates the importance of NH_3 in the food sector. Meanwhile, in the energy sector, liquid NH_3 is an excellent hydrogen (H_2) carrier for lower-cost H_2 storage and distribution,[3] because it contains 2.1 times more H_2 per volume than compressed H_2 at 700 bar.[4] The use of NH_3 for H_2 and energy storage is expected to grow significantly, as evidenced by the H_2 strategies and white papers published in different countries and regions. Furthermore, NH_3 is important in the trade sector. On the one hand, NH_3 is widely traded as a commodity. For example, the European Union, the United States, and India, three out of the top five NH_3 producer, import significant amounts of NH_3. On the other hand, NH_3 is also proposed as a clean fuel for shipping and aviation,[5,6] which will be used for transportation of bulk cargo.

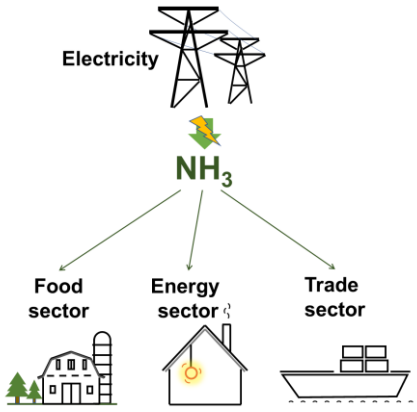

Fig. 1 The use of ammonia in different sectors. Adapted from reference 2 under the creative Commons CC-BY-NC-ND license

To reduce the GHG emissions associated with NH_3 production, there are two main methods: carbon capture, and electrified production. The latter is also called power-to-ammonia (P2A), and it is an option of decarbonization only when clean electricity, e.g., wind and solar, is used. The P2A technology with a high technology readiness level (TRL) is the integrated process of water electrolysis, air separation and electrified Haber-Bosch process to generate NH_3.[7] Other P2A technologies are still under development in the labs, including direct nitrogen reduction to NH_3, plasma-assisted NH_3 production, etc.

Apart from technological advancement (e.g., increasing energy efficiency and single pass conversation ratio), there are several other challenges to accelerate the development of P2A for multi-sectoral decarbonization. For example, a grid-connected P2A can increase its capacity factor, but the associated GHG emission from the grid cannot be neglected.[7] Additionally, incomplete NH_3 conversion during the energy production processes could cause NH_3 emissions that may disturb the Earth's nitrogen cycle with potential higher global warming impacts.[8]

Professor XiaoYu Wu
Department of Mechanical and Mechatronics Engineering
University of Waterloo

Dr. Wu's research group combines expertise in thermal science, material engineering and techno-economics to develop sustainable technologies for energy conversion and chemical production, such as hydrogen and ammonia conversion, energy storage, and membrane separation.

https://uwaterloo.ca/gpw/

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Flexible heat pump technology

Ross Barker, University of Glasgow

Researchers from the University of Glasgow have developed a new type of heat pump, a flexible heat pump technology, which could help households save on their energy bills and contribute towards net-zero emissions goals.

In a new paper published in the journal Communications Engineering, the researchers outline how their flexible heat pump technology provides an elegant and low-cost solution to the problems of current heat pumps by integrating heat storage - a small water tank and a coil of copper tube. The water tank recovers some excess thermal energy produced during the pump's operation and stores it as an additional heat source for the heat pump's operation later.

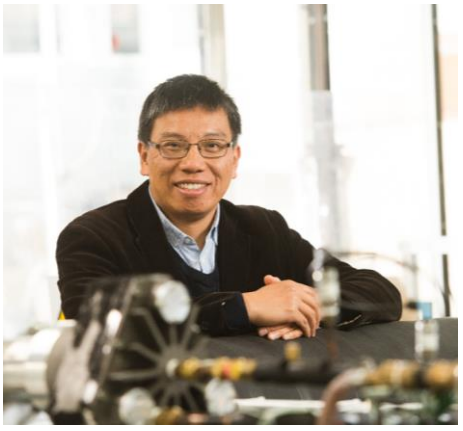
The recovered heat has a much higher temperature than the outdoor air that provides the heat source, and it can be reused as a temporary heat source, substantially reducing the pump's power consumption.

For air source heat pump applications, the recovered heat stored in the water also allows the flexible heat pump to run continuously during defrosting. That makes it more efficient and effective than the current generation of heat pumps, which interrupt the heat supply during defrosting while still consuming electricity.

The researchers have demonstrated the advantages of their new heat pump by building a working prototype using off-the-shelf components. Thorough testing against current-generation heat pump designs has shown their design to be around 3.7% more efficient than current design with a relatively low heat supply temperature of 35 °C.

When the supply temperature increases, so does the amount of energy recovered, improving the system's efficiency, and saving more power. The team's analysis predicts that, after optimization, it could be up to 10% more efficient than current products when the heat supply temperature increases to 65 °C.

The team have protected their invention with a PCT patent (Reference: WO2022069581A1) and are actively looking for ways to make the flexible heat pump technology commercially available in the near future.



Zhibin Yu, Professor of Thermal Energy at the University of Glasgow's James Watt School of Engineering, led the research and development of the flexible heat pump. He said: "The advantages of the flexible heat pump against current heat pump products are analogous to the advantages of condensing boiler against the non-condensing boiler – both recover excess heat to greatly improve efficiency.

Our flexible heat pump solves many of the problems with the current generation of heat pumps, making them capable of delivering improved performance while using less power. The cost of a small water tank heat storage is marginal, but the power saving is significant. It can be widely applied for all kinds of the heat pump applications. We believe that this could help drive improved takeup of heat pump technology in homes across the world."

The team's paper, titled 'A flexible heat pump for heat recovery', is published in Communications Engineering, a Nature portfolio journal. The research was supported by funding from the Engineering and Physical Sciences Research Council in the UK.

Every newsletter, the Editor will curate the news that they have read on the latest development in green energy. The focus of this Winter issue is on energy storage, hydrogen, and energy efficiency.

Energy Storage

- Novel Iron-Air Batteries to Be Manufactured. Form Energy, a start-up to develop iron-air batteries for long-duration energy storage, will build a 55-acre manufacturing facility in West Virginia, the US.
- Store Solar Energy in Batteries. Neoen, an energy producer of exclusively renewables, has begun the construction of a 200 MW/400 MWh battery energy storage system for a solar photovoltaic (PV) plant in Queensland, Australia.
- Thermal Energy Storage Using Sand. A Finnish company, Polar Night Energy, has started its operation of a sand-based thermal energy storage system to produce low-emission district heating in Finland.
- Redox Flow Battery Connected to Grid. The first phrase of a 200 MW/800 MWh redox flow battery plant was connected to the electrical grid in Dalian, China. The cost was estimated to be 4.75 yuan/Wh.
- Sustainability in Battery Industry to Be Enforced. The European Commission has reached provisional political agreement to enforce the sustainability requirements for batteries in the EU market, including their carbon footprints, recyclability, performance and durability.

Hydrogen

- $750 Million Funding to Accelerate Clean Hydrogen Technologies. On December 16, 2022, The Biden-Harris Administration announced its intent to issue $750 million in funding aiming to lower the cost of clean hydrogen technologies.
- Clean Canadian Hydrogen to be Exported. The Canada-Germany Hydrogen Alliance was established to harmonize polices, secure supply chains, establish a transatlantic corridor for hydrogen and hydrogen technologies between the two countries.
- Hydrogen-Powered Fuel Cell Engine revealed. Airbus revealed its development on a hydrogen-powered fuel cell engine, which will be potentially used in its zero-emission aircraft by 2035. Liquid hydrogen tanks and associated distribution systems will also be on board, based on their announcement.
- Ammonia-Fueled Ships in Order. NYK Line, Japan Engine Corporation, IHI Power Systems Co., Ltd. and Nihon Shipyard Co., Ltd. announced that the design of their ammonia-fueled vessel prototype is completed and received approval in principle.
- The first 100% hydrogen train route. Alstrom's Coradia iLint hydrogen train started its passenger operation in Bremervörde, Lower Saxony, Germany. These trains will be fueled daily and around the clock for a range of 1,000 kilometers.

Energy Efficiency

- Energy Efficiency 2020 report. The International Energy Agency (IEA) released its annual analysis on the energy efficiency markets and policy in December 2022. Improving energy efficiency was a prioritized action for many countries due to energy crisis last year.
- The Most Energy-Efficient State in the US. According to the American Council for an Energy-Efficient Economy, California secured the top spot in their Energy Efficiency Scorecard. The state leads in the building energy codes and vehicle emissions standards, promotes efficiency in utilities and equity in energy efficient programs.

Impact factor: 3.206

CiteScore: 4.7

In 2022, the International Journal of Green Energy (IJGE) has been evolving significantly to embrace the rapid changes in the publication of scientific research outcomes. To prepare for expected significant expansion of IJGE in 2023 and beyond, there are several developments:

- Our publisher, Taylor & Francis, has decided to remove the maximum cap on the page budget. Starting in 2023, all the high-quality articles accepted for publication in IJGE will have assigned issue number quickly.
- We have significantly expanded the Editorial Board and welcomed 10 associate/assistant editors (AEs) to IJGE.
- We also initiated the very first Early Career Editorial Board to encourage early career researchers to get involved in IJGE.

Warmest welcome to our latest associate editors for IJGE! They are

Professor SeongDae Kim
Engineering Management & Technology Department
University of Tennessee at Chattanooga
USA

Professor Seyed Soheil Mansouri
Department of Chemical and Biochemical Engineering
Process and Systems Engineering Centre (PROSYS)
Technical University of Denmark
Denmark

Professor Jing Shi
Department of Mechanical and Materials Engineering
University of Cincinnati
USA

Professor Yixiang Shi
Department of Energy and Power Engineering
Tsinghua University
China

Journal website: https://www.tandfonline.com/journals/ljge20

IAGE Opens Chapters in Countries!

Professor Hikmet Karakoc
Chair of IAGE International Committee

Faculty of Aeronautics and Astronautics, Eskisehir Technical University, Turkey

The IAGE Board has decided to open International Chapters to represent the IAGE worldwide.

This decision has been taken to promote activities in the regions where the chapter belongs. We believe the representative offices of different chapters will support the recognition of the association in various areas and increase the number of members of this valuable association.

In 2022, the establishment of IAGE chapter started in 10 countries and the IAGE chapter Presidents of these countries were determined. These countries are listed below: Canada, China, Denmark, Hong Kong, Korea, Malaysia, Serbia, Singapore, Turkey, UK.

More IAGE chapters will be opened in 2023! You can also suggest IAGE Chapter President for your country. Please contact Professor Hikmet Karakoc (hkarakoc@eskisehir.edu.tr) for more information.

A Chronicle of Green Drive

2000: Conceptualization for a new energy journal, **International Journal of Green Energy (IJGE)**

2001: Negotiation with publisher and Association of Energy Engineers (AEE)

IJGE cover

2002: Common understanding reached

2003: Written agreement signed and preparation for IJGE launch

2004: **First volume of IJGE published** (4 issues/volume, number of issues/volume increased over the subsequent years)

2005: The **International Green Energy Conference (IGEC)** series launched, and the first IGEC **(IGEC-I)** held at Waterloo, Canada, June 2005

Green Energy Conference for Youth launched in collaboration with ABC (Association for Bright Children) – this conference was run annually for three years (2005-2008)

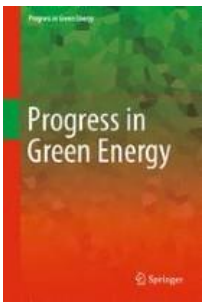
2006: IGEC-II held in Oshawa, Ontario, Canada, June 2006

2007: IGEC-III held at Mälardalen University, Västerås, Sweden, June 2007

International Association for Green Energy (IAGE) launched

Master of Engineering – Green Energy Certificate Program launched at the Department of Mechanical and Mechatronics Engineering, University of Waterloo, Ontario, Canada

Book Series cover



2008: IGEC-IV held in Beijing, China, October 2008

2010: IGEC-V held in Waterloo, Ontario, Canada, June 2010

2011: IGEC-VI held in Eskişehir, Turkey, June 2011

Progress in Green Energy Book Series launched

2012: IGEC-VII held in Dalian, China, May 2012

2013: IGEC-VIII held in Kiev, Ukraine, June 2013

2014: IGEC-IX held in Tianjin, China, May 2014

IGEC-IX in Tianjin

2015: IGEC-X held in Taichung, Taiwan, May 2015

IJGE increased to 12 issues/volume

2016: IGEC-XI held in Anchorage, Alaska, USA, May 2016

2017: IGEC-XII held in Xi'an, China, August 2017

IJGE increased to 15 issues/volume

One of IAGE logos

2021: IGEC-XIII held virtually, July 2021

2022: IGEC-IX held virtually, July 2022

IAGE new logos released

2023: IGEC-X to be held in Glasgow, UK, July 2023 (hybrid conference)

IJGE page budget removed, publishing all the papers accepted **with no page limit**

IAGE Newsletter launched

IAGE AWARDS

2021 Recipients

Distinguished Service Award

Professor Dr. **T. Nejat Veziroglu**, University of Miami

Citation: For outstanding exemplary services to the professional community and humanity through his lasting contribution, leadership and impact, and as the founding president for the International Association for Hydrogen Energy, founding editor in chief for the International Journal of Hydrogen Energy, and honorary editor for the International Journal of Green Energy.

IAGE Lifetime Achievement Award

Professor Dr. Adrian Bejan, Duke University

Citation: For revolutionary contributions to thermal sciences through entropy generation minimization and the original development of a new law in physics, the constructal law, for predicting natural design and its evolution as climate, social ecosystems, and sustainability.

2022 Recipients

IAGE Lifetime Achievement Award

Professor Chung K. Law, Princeton University

Citation: For foundational contributions to fuel chemistry, reacting flows, and green energy.

IAGE Outstanding Researcher Award

Dr. Piotr Zelenay, Los Alamos National Laboratory

Citation: For outstanding research and advancement of knowledge in fuel cells, electrochemical energy, and green energy systems.

IAGE Technology Innovation Award

Dr. Kui Jiao (other group members: Qing Du, Linhao Fan, Bowen Wang, Zhi Liu, Yang Wang, Zhiming Bao), Tianjin University

Citation: For innovative analysis and numerical simulation leading to novel solutions for the designs of fuel cell components, stacks and systems.

IGEC2022 AWARDS

2022 Best Student Paper Award (3 winners, $500 CAD/winner)

1. IGEC2022-046 How NO_x Adsorbs on Ba Sites in Proximity to Pt Over γ-Al_2O_3(100)
Shilong Li, Zhijun Li, Xuebao Wang, Zhiyang Su, Miansun Yang; State Key Laboratory of Engines, Tianjin University, China

2. IGEC2022-097 Hybrid Stochastic Reconstruction of Catalyst Layers in Polymer Electrolyte Membrane Fuel Cells
Pascal Ruzzante and Xianguo Li; Department of Mechanical and Mechatronics Engineering, University of Waterloo, Canada

3. IGEC2022-129 Analysis of Modified CO_2 Based Combined Power and Ejector-Expansion Refrigeration Cycle With Dual Evaporators Activated by Engine Exhaust Heat
Yan Zhu, Mingzhang Pan, Zongrun Wang, Youcai Liang; South China University of Technology and Guangxi University, China

2022 Best Student Paper Award Honorable Mentions

1. IGEC2022-144 Potential of Thermally Driven Refrigerator Using Single Rotor Expander-Compressor Device
Saif Alshammari, Sambhaji T. Kadam, Zhibin Yu; James Watt School of Engineering, University of Glasgow

2. IGEC2022-040 The Influence of Dispersion Solvent on Anode Catalyst Layer for Proton Exchange Membrane Water Electrolyzer
Shuoyao Yin et al. State Key Laboratory of Engines, School of Mechanical Engineering, Tianjin University, China

3. IGEC2022-078 Effects of Pt Electrode Charge on the Structures of Ionomer Films in Proton Exchange Membrane Fuel Cells
Yuewen Zhang, Linhao Fan, Kui Jiao; State Key Laboratory of Engines, School of Mechanical Engineering, Tianjin University, China

4. IGEC2022-064 Numerical Analysis of the Effect of Chamber Height and Wall Temperature on the Spray Wall Interaction for the GDI System
Santu Dolui, Akhil Ailaboina, Kaushik Saha, DESE, IIT Delhi, New Delhi, India

2022 Best Student Presentation Award (3 winners, $300 CAD/winner)

1. IGEC2022-060 Energy system optimization using ASPEN utility planner
Shu Qi Nyan, Heriot-Watt University

2. IGEC2022-084 Novel mini-channel cold plate with different shapes of pin fins for effective battery thermal management
Zengjia Guo, The Hong Kong Polytechnic University

3. IGEC2022-098 Hybrid databased modeling approach to predict thermal behavior of Li-Ion batteries
Adithya Legala, University of Waterloo

2022 Best Student Presentation Honorable Mentions

1. IGEC2022-106 Study on gravity effect on frost characteristics under natural convection
Shangwen Lei, Beijing Institute of Technology

2. IGEC2022-143 Experimental study on low platinum loading hydrophilic-hydrophobic dual catalyst layer at the cathode of PEMFC
Jiao Han, Tianjin University

3. IGEC2022-036 Immobilized ferrocyanide coordination additives as antioxidant for chemical stability enhancement of proton exchange membranes
Na Xie, Tianjin University

4. IGEC2022-070 Hybrid battery and hydrogen energy storage for a 100% wind power microgrid
Michael Giovanniello, University of Waterloo

5. IGEC2022-141 A techno-economic survey on waste heat recovery options for UK glass sector
Narges H. Mokarram, University of Glasgow

IJGE AWARDS (2021)

2021 IJGE Best Reviewer Award

- Bowen Wang: Tianjin University
- Hadi Rostamzadeh: University of Mohaghegh Ardabili Ardabil
- Ronghui Qi: South China University of Technology
- Zirong Yang: China Automotive Technology and Research Center
- Linhao Fan: Tianjin University
- Jian Zhao: University of Waterloo
- Agnimitra Biswas: National Institute of Technology Silchar (India)
- Nima Ahmadi: Urmia University of technology
- Mohamed Mohamed: Minia University
- Nadir Yilmaz: Howard University

2021 Most Downloaded Original Paper Award

Experimental investigation of an Organic Rankine cycle system using an oil-free scroll expander for low grade heat recovery

Youcai Liang and Zhibin Yu
South China University of Technology
University of Glasgow
Email: liangyoucai@scut.edu.cn
DOI Number: 10.1080/15435075.2021.1880915
International Journal of Green Energy, 18 (8) 812-821, 2021

2021 Most Downloaded Review Paper Award

Assessment of electric vehicle charging infrastructure and its impact on the electric grid: A review

Muhammad Ashfaq, Osama Butt, Jeyraj Selvaraj, and Nasrudin Rahim
Wisma R&D University of Malaya, Malaysia
Email: jeyraj@um.edu.my
DOI Number: 10.1080/15435075.2021.1875471
International Journal of Green Energy, 18 (7) 657-686, 2021

2021 Most Cited Original Research Paper Award

Experimental analysis of solar concrete collector for residential buildings

V. S. Chandrika, Alagar Karthick, Nallapaneni Manoj Kumar, P. Manoj Kumar, B. Stalin, and M. Ravichandran
KPR Institute of Engineering and Technology, India
Email: karthick.power@gmail.com
DOI Number: 10.1080/15435075.2021.1875468
International Journal of Green Energy, 18 (6) 615-623, 2021

2021 Most Cited Review Paper Award

Recent advances in bioethanol production from Lignocellulosic biomass

Ganesh Lamichhane, Ashis Acharya, Darbin Kumar Poudel, Babita Aryal, Narayan Gyawali, Purushottam Niraula, Sita Ram Phyual, Prakriti Budhathoki, Ganesh Bk, and Niranjan Parajuli
Tribhuvan University, Nepal
Email: nparajuli@cdctu.edu.np
DOI Number: 10.1080/15435075.2021.1880910
International Journal of Green Energy, 18 (7) 731-744, 2021

Call for Nominations

Call for nominations to the 2023 IAGE Awards

The International Association for Green Energy (IAGE) is pleased to announce the Call for Nominations for 2023 IAGE society level awards. For full consideration, nominations must be received by **April 30, 2023**. Award winners will be announced at the 15th International Green Energy Conference venue and will be listed after the conference on the IAGE website.

Nominations should be emailed to the Honours and Awards Committee Chair, Dr. Jing Shi at jing.shi@uc.edu. The entire nomination package (completed nomination form, and the required documents applicable to the award category) should be submitted in one single email.

The IAGE society level awards include the following categories:

- **Lifetime Achievement Award** recognizes an individual who has made extraordinary contribution to the advancement of green energy over his/her lifetime. The Lifetime Achievement Award is the highest honor bestowed upon an individual by IAGE.

- **Distinguished Service Award** is an honor bestowed to an individual who has provided exemplary service to the Association. It recognizes the individual's outstanding contribution to the IAGE, IGEC, IJGE, and the professional communities at large.

- **Outstanding Researcher Award** recognizes outstanding scientific work in green energy research by a world-leading scientist or engineer. The award recipient must have demonstrated exceptional contribution to the green energy research community.

- **Technology Innovation Award** recognizes and celebrates the researchers and/or inventors from the industry, academia, or individuals regarding their innovative ideas, products, or concepts. The Award is intended to encourage individuals or parties to think about "Technology Innovation" benefits.

- **Young Researcher Award** recognizes outstanding scientific work in green energy research by a young scientist or engineer. The award recipient must show exceptional promise as a developing leader and make outstanding and continuing contribution to green energy research.

For more information about the awards, refer to the IAGE award page:
https://www.iage-net.org/igec2023-awards

Call for Bids

Call for bids to host the 17th International Green Energy Conference in 2025

The International Green Energy Conference (IGEC) is a 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. IGEC is held annually typically in July and is organized by International Association for Green Energy (IAGE).

IAGE Conference Committee (CC) is calling for bids to host the **17th IGEC in 2025**. For full consideration, bids should be submitted by email with subject line "Bid to host the 17th IGEC" to the CC chair SeongDae Kim (seongdae-kim@utc.edu) by **March 31, 2023**.

To be eligible to host the 17th IGEC,

- The proposed conference city should not have hosted the IGEC within the past 5 years.
- The organizer should have experience in conference organizing.
- The proposed conference city should be able to attract new participants and have good accessibility.

Bids should be brief and include the following information:

1. **Organizers**. List the following organizer(s) with contact info and affiliation:
    a. Organizing committee chair(s)
    b. Organizing committee members
    c. Hosting institution
2. **Institutional support and commitments**.
    a. Relevance of the organization to green energy
    b. Letter(s) of support from upper administration with detailed commitments, such as release time, secretarial support, and financial commitment
    c. Professional conference services that will be available and considered to execute the conference – general description of what is available and whether or not they have been contacted prior to submitting proposal.
3. **Conference site**. Provide the following:
    a. Brief description of the conference city
    b. Brief description of possible conference venues
    c. Site access and travel options: air travel and/or ground transportations with associated cost estimates
    d. Conference facilities
    e. Weather/climate
    f. Local attractions
    g. Accommodation: lodging options and cost estimates
    h. Tentative conference schedule
    i. Technical tours
    j. Conference finance: estimated revenue and expenses, plan for securing sponsorships
    k. Plan for conference promotion

The winning bid is expected to be announced by **May 31, 2023**. Bidders may contact any IAGE Conference Committee members before submitting the bid to discuss any aspect of the bid.

IAGE Conference Committee

- Seong Dae Kim, Ph.D. (seongdae-kim@utc.edu)
- Zhibin Yu, Ph.D. (Zhibin.Yu@glasgow.ac.uk)
- Chong Wen Tong, Ph.D. (chong_wentong@um.edu.my)

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Membership Committee	Zhibin Yu	zhibin.yu@glasgow.ac.uk
Nominating Committee	Xianguo Li	xianguo.li@uwaterloo.ca
Scientific Committee	Zhongchao Tan	zhongchao.tan@uwaterloo.ca

TECHNICAL DIVISION CHAIRS

Energy storage division	Kui Jiao	kjiao@tju.edu.cn
Fuel cell and Electrolyzer	Samaneh Shahgaldi	samaneh.shahgaldi@uqtr.ca

Website: https://www.iage-net.org/
Twitter: @the_IAGE
LinkedIn: https://www.linkedin.com/company/the-iage/

INTERNATIONAL ASSOCIATION FOR GREEN ENERGY IAGE

The IAGE Newsletter would like to acknowledge the supports from all the contributors

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