MEI Symposium 26

Full Program

Wednesday 28 October 2026

Melbourne
Energy
Institute

THE UNIVERSITY OF
MELBOURNE

Contents

Welcome *6*
Professor Richard Sandberg 6

Plenary *7*

The Demand Dividend: How Data Centres Can Help Build Australia's Future Grid **7**
Plenary speaker: Mr. Herb Moore 7

Research Program: Power Generation and Transport *8*
CHAIR: **Associate Professor Shiaohuey Chow** 8

KEYNOTE: ACES (Advanced Clean Energy Storage) Project, how seasonal energy storage support sustainability, affordability and security **9**
Keynote speaker: Mr. Ryo Nishida 9

Achieving affordable, clean shipping by integrating ship designs, operations and clean fuels **9**
Speaker: Mr. Nguyen Cao 9

Holistic Design of Suction Bucket Foundations for Emerging Offshore Wind in Australian Waters **10**
Speaker: Dr. Jude Perera 10

Geothermal Pavements: Transforming Transport Infrastructure into Clean Energy Systems **10**
Speaker: Dr. Xiaoying (Annie) Gu 10

Research Program: Energy Materials *11*
CHAIR: **Associate Professor Wallace Wong** 11

KEYNOTE: Critical Minerals for a Critical Industry **12**
Keynote speaker: Mr. Anthony Vippond 12

Resolving Ultrafast Light–Matter Interaction Dynamics in Next-Generation Organic Photovoltaics with Laser Spectroscopy **12**
Speaker: Ms. Stella (Xinyue) Xu 12

Recovery of Critical Metals from E-waste using Advanced Microwave Technology **13**
Speaker: Dr. Alex Duan 13

Turbostratic Carbon Films: Advancing Fast-Charging Battery Materials for the Energy Transition **13**
Speaker: Dr. Mehrdad Parsa 13

Research Program: Heavy Industry and Resources *14*
CHAIR: Dr. Tim Werner 14

KEYNOTE: Connecting copper to the renewable energy transition **15**
Keynote speaker: Professor Damien Giurco 15

Responsible Mining for the Energy Transition: How Chinese Mining Companies Navigate ESG and Governance in Australia **15**
Speaker: Ms. Zhanran (Jessie) Xu 15

Catalytic Membranes for CO2 capture **16**
Speaker: Mr. Pravin Bolne 16

Global transition, location transformations: Governance challenges for the energy transition at the sites of extraction **16**
Speaker: Dr. Ana Carballo 16

Research Program: Energy Systems *17*
CHAIR: **Professor Pierluigi Mancarella** 17

KEYNOTE: From automatic to agentic control for power? **18**
Keynote speaker: Professor David Hill 18

Using Electric Vehicles as Home Batteries: Smart Energy Management for Solar Homes Under Uncertainty **18**
Speaker: Associate Professor Joyce Zhang 18

How Much Solar PV Can Our Neighbourhoods Handle? Teaching AI the Physics of the Grid **19**
Speaker: Mr. Orlando Pereira Guzmán 19

Balancing lifetime and economic performance in switchable PEM electrolyser stacks **19**
Speaker: Ms. Pauline Thuene 19

Program

08:00-8:25	**REGISTRATION AND COFFEE**	
08:30-8:40	**Welcome and opening of MEI Symposium 26**	**Prof. Richard Sandberg** *Director*, Melbourne Energy Institute, University of Melbourne
08:40-9:30	**OPENING PLENARY** **The Demand Dividend: How Data Centres Can Help Build Australia's Future Grid**	**Mr. Herb Moore** *Senior Manager Energy & Utilities* AirTrunk
	Power Generation and Transport	CHAIR: **A/Prof. Shiaohuey Chow**
09:30-10:00	**KEYNOTE** **ACES (Advanced Clean Energy Storage) Project, how seasonal energy storage support sustainability, affordability and security**	**Mr. Ryo Nishida** *Senior Regional GM, Business Development Group* Mitsubishi Heavy Industries Asia Pacific
10:00-10:30	**MORNING TEA**	
10:30-10:45	**Achieving Affordable, Clean Shipping by Integrating Ship Designs, Operations and Clean Fuels**	**Mr. Nguyen Cao** *PhD Student* Department of Mechanical Engineering, Faculty of Engineering and IT
10:45-11:00	**Holistic Design of Suction Bucket Foundations for Emerging Offshore Wind in Australian Waters**	**Dr. Jude Perera** *Research Fellow* Department of Infrastructure Engineering, Faculty of Engineering and IT
11:00-11:15	**Geothermal Pavements: Transforming Transport Infrastructure into Clean Energy Systems**	**Dr. Annie Gu** *Research Fellow in Geotechnical Engineering* Department of Infrastructure Engineering, Faculty of Engineering and IT
	Energy Materials	CHAIR: A/Prof. Wallace Wong
11:15-11:45	**KEYNOTE** **Critical Minerals for a Critical Industry**	**Mr. Anthony Vippond** *CEO and Director* Lotus Recycling
11:45-12:00	**Resolving Ultrafast Light–Matter Interaction Dynamics in Next-Generation Organic Photovoltaics with Laser Spectroscopy**	**Ms. Stella (Xinyue) Xu** *PhD Student* School of Chemistry, Faculty of Science
12:00-12:15	**Recovery of Critical Metals from E-waste using Advanced Microwave Technology**	**Dr. Alex Duan** *Trace Chemical Analysis Specialist and Manager of TrACEES* School of Chemistry, Faculty of Science
12:15-12:30	**Turbostratic Carbon Films: Advancing Fast-Charging Battery Materials for the Energy Transition**	**Dr. Mehrdad Parsa** *Research Associate in Graphite Processing* Department of Chemical Engineering, Faculty of Engineering and IT
12:30-13:30	**LUNCH AND POSTER COMPETITION –** B115 foyer (Basement), Melbourne School of Design	

	Heavy Industry and Resources	CHAIR: **Dr. Tim Werner**
13:30-14:00	**KEYNOTE** **Connecting copper to the Renewable Energy Transition**	**Prof. Damien Giurco** *Circular Economy Chair* Faculty of Engineering and IT The University of Melbourne
14:00-14:15	**Responsible Mining for the Energy Transition: How Chinese Mining Companies Navigate ESG and Governance in Australia**	**Ms. Jessie (Zhanran) Xu** *PhD Student* School of Geography, Earth and Atmospheric Sciences, Faculty of Science
14:15-14:30	**Catalytic Membranes for CO2 Capture**	**Mr. Pravin Bolne** *PhD Student* Department of Chemical Engineering, Faculty of Engineering and IT
14:30-14:45	**Global Transition, Location Transformations: Governance Challenges for the Energy Transition at the Sites of Extraction**	**Dr. Ana Carballo** *Honorary Research Fellow* *School of Geography, Earth and Atmospheric Sciences,* Faculty of Science; *Head of International Programmes,* Transparency International Australia
14:45-15:15	**AFTERNOON TEA**	
	Energy Systems	CHAIR: **Prof. Pierluigi Mancarella**
15:15-15:45	**KEYNOTE** **From Automatic to Agentic Control for Power?**	**Prof. David J Hill** *Professor of Electrical Power and Energy Systems* Monash University
15:45-16:00	**Using Electric Vehicles as Home Batteries: Smart Energy Management for Solar Homes Under Uncertainty**	**A/Prof. Joyce Zhang** *Associate Professor, Operations Research* School of Mathematics and Statistics, Faculty of Science
16:00-16:15	**How Much Solar PV Can Our Neighbourhoods Handle? Teaching AI the Physics of the Grid**	**Mr. Orlando Pereira Guzmán** *PhD Student,* Department of Electrical and Electronic Engineering, Faculty of Engineering and IT
16:15-16:30	**Balancing Lifetime and Economic Performance in Switchable PEM Electrolyser Stacks**	**Ms. Pauline Thuene** *PhD Student* Department of Electrical and Electronic Engineering Faculty of Engineering and IT

MEI Symposium 26

WEDNESDAY 28 OCTOBER

Melbourne Energy Institute

THE UNIVERSITY OF MELBOURNE

Welcome

Professor Richard Sandberg

Director, Melbourne Energy Institute
Chair of Computational Mechanics, Mechanical Engineering, *University of Melbourne*

Prof. Richard Sandberg is the Melbourne Energy Institute's Director and Chair Professor of Computational Mechanics in the Department of Mechanical Engineering at the University of Melbourne.

His main interest is in high-fidelity simulation of turbulent flows in turbomachinery and aerospace applications in order to gain physical understanding of flow and noise mechanisms. He also uses the data to help assess and improve low-order models that can be employed in an industrial context, in particular by pursuing novel machine-learning approaches.

He received his PhD in 2004 in Aerospace Engineering at the University of Arizona and prior to joining the University of Melbourne, he was a Professor of Fluid Dynamics and Aeroacoustics in the Aerodynamics and Flight Mechanics research group at the University of Southampton and headed the UK Turbulence Consortium (www.turbulence.ac.uk). He was awarded a Veski Innovation Fellowship entitled: "*Impacting Industry by enabling a step-change in simulation fidelity for flow and noise problems*", was granted an Australian Research Council Future Fellowship for 2020-2024 and was elected Fellow of the Australasian Fluid Mechanics Society in 2024.

Read more about the Melbourne Energy Institute.

Plenary

The Demand Dividend: How Data Centres Can Help Build Australia's Future Grid

Abstract: Australia's digital and energy transitions can strengthen each other - but only if they are planned together. Large-scale data centres bring something the energy system urgently needs: substantial, predictable and long-term demand capable of underwriting new renewable generation, storage and network infrastructure. This keynote will explore how clear policy, credible demand forecasts and reciprocal commitments can turn that opportunity into real projects. With data centres paying their way and supporting additional energy supply - and governments, networks and developers providing timely connections, transparent costs and achievable delivery pathways - digital growth can help finance Australia's future energy system and leave the grid stronger than it found it.

Plenary speaker: Mr. Herb Moore

Senior Manager Energy & Utilities, *AirTrunk*

Mr. Herb Moore is a leader in energy solutions at **AirTrunk** throughout Australia. AirTrunk is a leading hyperscale data centre provider enabling the growth of cloud and artificial intelligence across the Asia-Pacific & Middle East.

With extensive Australian experience spanning electrical power systems, electricity networks, grid connections and renewable energy, Herb has delivered complex grid connections and energy infrastructure projects across Australia and New Zealand. He is responsible for securing reliable, cost-effective power and connection solutions to support large-scale digital infrastructure, while enabling the integration of renewable generation and energy storage.

With a Bachelor of Arts (Art History) and Master of Engineering (Electrical) from the University of Melbourne, and an MBA from Melbourne Business School, Herb brings a unique blend of commercial acumen, engineering expertise and power-system experience to the energy industry. He partners with utilities, developers and industry stakeholders to deliver practical solutions to complex energy challenges.

Herb has a keen interest in enabling the growth of the digital economy and in the evolution of the electrical power system required to support it. He has published work in the fields of commissioning quality, engineering performance and value within the Australian electrical power industry.

Melbourne Energy Institute

THE UNIVERSITY OF MELBOURNE

Research Program: Power Generation and Transport

CHAIR: **Associate Professor Shiaohuey Chow**

Deputy Program Leader - Power Generation and Transport, Melbourne Energy Institute
Associate Professor, Geotechnical Engineering, Department of Infrastructure Engineering,
University of Melbourne

A/Prof. Shiaohuey Chow is an Associate Professor and the Discipline Leader for Geotechnical Engineering at the University of Melbourne. Her expertise includes offshore geotechnical site investigation, anchoring solution in sand, strain rate effects in soil and sample disturbance effects on soft soils. Her works have received several international best paper awards, including the Telford Premium Prize in 2016 and Manby Prize in 2014 from the Institution of Civil Engineers (ICE), UK.

She is also the Director of the Australian Centre for Offshore Wind Energy, and a member of the Executive Committee for the Melbourne Energy Institute. She collaborates widely with both academic and industry partners nationally and internationally.

Shiaohuey also enjoys engaging with the community to share her passion in geotechnical engineering and to promote more girls in STEM. She is an Associate Editor for the Gotechnique Letters, a member of the Technical Committee 214 on Foundation Engineering for Difficult Soft Soil Conditions of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), and Deputy Chair of the Australian Geomechanics Society (Victorian Chapter).

Shiaohuey obtained her PhD at the University of Sydney in 2013, and her MEng degree in geotechnical engineering from the Nanyang Technological University, Singapore in 2003. Prior to her appointment at Melbourne, she was a Research Fellow at the Centre for Offshore Foundation Systems (COFS), the University of Western Australia.

Read more about MEI's Power Generation and Transport research program.

KEYNOTE: ACES (Advanced Clean Energy Storage) Project, how seasonal energy storage support sustainability, affordability, and security

Abstract: MHI has declared Mission Net Zero to achieve carbon neutrality by 2040. To realize this, MHI has established 3 pillars of focus to achieve carbon neutrality and these pillars includes decarbonizing existing infrastructure, realisation of a hydrogen solutions ecosystem and building a carbon solutions ecosystem.

Examining the role of hydrogen in the energy transition, the key focus of this presentation will be on the pivotal role of hydrogen in the energy transition. Using the **Advanced Clean Energy Storage (ACES Delta)** project as a case study, learn more about the project's goals, its role in reducing carbon intensity, and the importance of hydrogen in achieving climate targets while at the same time addressing the challenges in production and storage of hydrogen, the need for involvement of major industry players, and the collaborative efforts required to bring such a complex project to fruition.

Keynote speaker: Mr. Ryo Nishida

Senior Regional GM, Business Development Group, *Mitsubishi Heavy Industries Asia Pacific*

Mr. Ryo Nishida leads the energy-related business development across the region. He works with governments, utilities, and industry partners to develop opportunities in power generation, energy production and storage including hydrogen.

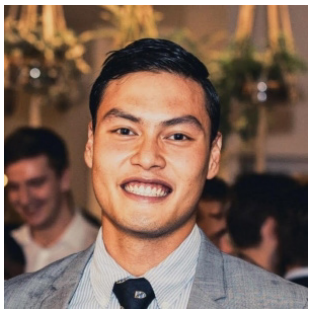
At this symposium, he will introduce the Advanced Clean Energy Storage (ACES) project, a commercial-scale renewable hydrogen project in Utah, United States, and discuss how seasonal energy storage support energy transition, social infrastructure cost, and diversifying energy.

Achieving affordable, clean shipping by integrating ship designs, operations and clean fuels

Abstract: The International Maritime Organisation (IMO) greenhouse gas (GHG) emissions strategy aims to achieve near-net-zero GHG emissions from international shipping by around 2050. This research presents an analysis of the trade-offs linked to typical merchant vessels that navigate international trade routes. The study encompasses the computation of levelised shipping costs and the expenses linked to GHG emissions abatement using a physics-based ship performance model. An optimisation model then identifies the lowest-cost fleet decarbonisation pathway considering emissions and regulatory constraints. Achieving affordable, clean shipping depends not only on the fuels and propulsion systems used, but also on vessel design and operational parameters.

Speaker: Mr. Nguyen Cao

PhD Student, Dept of Mechanical Engineering, Faculty of Engineering and IT, *University of Melbourne*



Nguyen Cao is a PhD candidate at the University of Melbourne, researching the technical, economic and environmental performance of maritime fuels and propulsion systems. He recently completed a studentship at Cambridge CARES, studying onboard pre- and post-combustion carbon capture and storage systems. He holds a Master of Energy Systems from the same university, where he participated in the Zero Emission Energy Laboratory Program through the collaboration between the Melbourne Energy Institute and Ekistica. Prior to postgraduate studies, he worked as a solar photovoltaic engineer and completed his Bachelor of Engineering in Mechanical Engineering at the University of Sydney.

Holistic Design of Suction Bucket Foundations for Emerging Offshore Wind in Australian Waters

Abstract: Australia is beginning offshore wind development, requiring foundation solutions tailored to local conditions from the outset. This presentation reports a holistic study of suction bucket foundations (large steel caissons installed by controlled suction) adapted for Australian waters. We address specific challenges: greater water depths and severe wave climates in Bass Strait, carbonate seabed sediments, limited domestic steel supply, and evolving port and fabrication capability. The work integrates geotechnical behaviour, structural design, transport and towing logistics, and port-based assembly. The outcome is a practical framework to reduce cost, installation time and environmental impact whilst building Australian offshore wind capability.

Speaker: Dr. Jude Perera

Research Fellow, Dept of Infrastructure Engineering, Faculty of Engineering and IT , *University of Melbourne*

Dr Jude Perera is a Research Fellow at the University of Melbourne specialising in resilient structures, extreme loading, and sustainable infrastructure. His broader work spans rockfall protection, smart construction technologies, and upcycling of decommissioned offshore assets. On this project he contributes to structural design and dynamic loading analysis, and leads the transportation workstream covering towing, float-out, and port-based logistics for suction bucket foundations.

Geothermal Pavements: Transforming Transport Infrastructure into Clean Energy Systems

Abstract: Shallow geothermal systems use the relatively stable temperature of the ground to provide efficient heating and cooling. They typically exchange heat with the ground through fluid-circulating pipes installed in boreholes, trenches or foundation elements. This presentation explores how these pipes can instead be integrated beneath roads, car parks and pedestrian areas, transforming transport infrastructure into geothermal heat exchangers while retaining its conventional structural and mobility functions. Drawing on numerical modelling, laboratory testing and practical applications, the presentation examines the potential of geothermal pavements to reduce building energy consumption and introduces emerging opportunities involving phase-change materials and bio-mediated ground improvement.

Speaker: Dr. Xiaoying (Annie) Gu

Research Fellow in Geotechnical Engineering, Dept of Infrastructure Engineering, Faculty of Engineering and IT, *University of Melbourne*

Dr Annie Gu's research focuses on shallow geothermal energy, energy geostructures and coupled heat and water transport in the built environment. She specialises in geothermal pavements and has investigated their thermal performance under different climatic, geological and hydrological conditions. Her current work explores multifunctional geothermal infrastructure, including permeable pavements, bio-mediated ground improvement and geothermal applications for climate-resilient buildings and coastal environments.

Melbourne Energy Institute

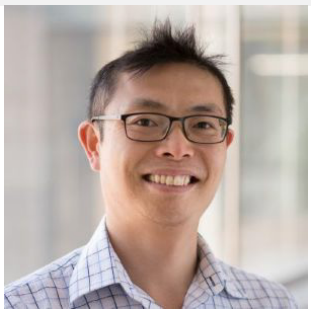
THE UNIVERSITY OF MELBOURNE

Research Program: Energy Materials

CHAIR: **Associate Professor Wallace Wong**

Program Leader – Energy Materials, Melbourne Energy Institute

Associate Professor, School of Chemistry, *University of Melbourne*



A/Prof Wallace Wong is an Associate Professor at the School of Chemistry , and a Chief Investigator and Deputy Director of the ARC Centre of Excellence in Exciton Science.

Wallace has been an ARC Future Fellow (2014-2018) and an ARENA Research Fellow (2011-2014). The core expertise of his research group is the design and synthesis of organic materials with applications in energy conversion, electronics, and chemical sensing.

Read more about MEI's Energy Materials research program.

KEYNOTE: Critical Minerals for a Critical Industry

Abstract: As the global transition to renewable energy accelerates, the management of end-of-life photovoltaic (PV) infrastructure presents both a critical environmental challenge and a strategic resource opportunity. This presentation explores the shift from linear waste management to a robust circular economy model, specifically focusing on the recovery and repurposing of critical minerals from decommissioned solar assets. Specialising in recycling solar pv and the solar cells for the recovery of aluminium, copper, silver and nano silicon to be utilised in battery products.

Keynote speaker: Mr. Anthony Vippond

CEO & Director, *Lotus Recycling*

Mr Anthony Vippond is the CEO and inventor of Lotus Energy Recycling's world renowned solar pv recycling technology. Combining qualifications in Engineering, Electrical and Renewable Energy Management, Anthony possesses deep expertise in aligning technical innovation with market deployment and investment strategy.

Resolving Ultrafast Light–Matter Interaction Dynamics in Next-Generation Organic Photovoltaics with Laser Spectroscopy

Abstract: Lightweight, flexible solar cells made from organic molecules offer a promising low-cost, eco-friendly alternative to conventional silicon solar cells. In recent years, the efficiency of organic solar cells has begun to plateau at around 20%, highlighting the need for a deeper understanding of the entire light-to-electricity conversion process. This presentation demonstrates how ultrafast laser spectroscopy uses extremely short light pulses to capture what happens to the molecules immediately after they absorb light. We also present creative approaches in device-engineering that can control these light–matter interactions, thereby reducing energy losses and improving the efficiency of next-generation organic solar cells.

Speaker: Ms. Stella (Xinyue) Xu

PhD Student, School of Chemistry, Faculty of Science, *University of Melbourne*

Ms. Stella Xu completed a Bachelor of Science (Chemical Physics) and a Master of Science (Chemistry) at the University of Melbourne. She received the Dean of Science Excellence Award in 2021 and was awarded the Science Graduate Medal and the Wyselaskie Scholarship in Natural Science upon completing her master's degree in 2023. She is currently conducting research on advanced ultrafast laser spectroscopic techniques to study photovoltaic and singlet fission materials under the supervision of Prof. Trevor Smith and Dr. Chris Hall at the Ultrafast Microspectroscopy Laboratory in the School of Chemistry.

Recovery of Critical Metals from E-waste using Advanced Microwave Technology

Abstract: Rare earth elements (REEs) are essential for electric vehicles, wind turbines and advanced electronics, but recycling them from discarded magnets remains energy-intensive and chemical-heavy. This project is developing MicroLeach, an microwave-assisted recycling technology that recovers valuable REE from waste permanent magnets using less energy, fewer chemicals and shorter processing times than conventional heating methods. Early results achieved up to 97% recovery of key REEs while minimising unwanted iron extraction. By creating a cleaner, potentially scalable recycling process. MicroLeach will reduce waste, strengthen supplies of critical materials, and support Australia's transition to a circular, low-carbon economy.

Speaker: Dr. Alex Duan

Trace Chemical Analysis Specialist & Manager of TrACEES, School of Chemistry, Faculty of Science, *University of Melbourne*

Dr Alex Duan is a Senior Academic Specialist in the School of Chemistry at the University of Melbourne and Manager of the Melbourne TrACEES Platform. His research focuses on green analytical chemistry, microwave-assisted hydrometallurgy, and sustainable recovery of critical metals from e-waste. He also leads analytical method development and multidisciplinary research using advanced mass spectrometry to solve complex environmental and industrial challenges.

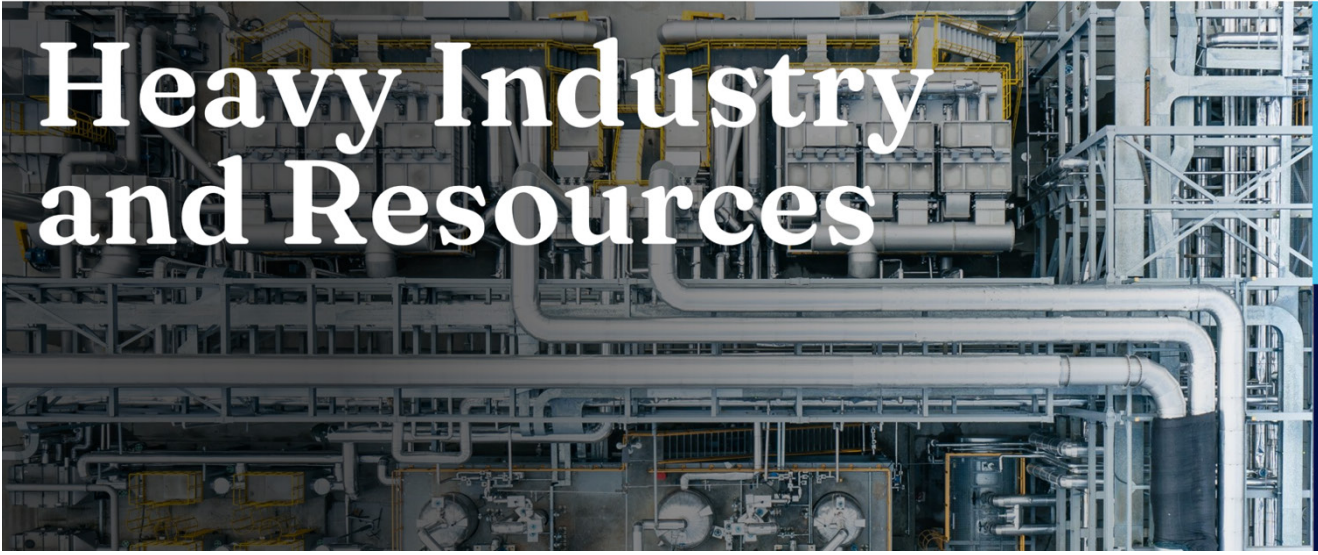
Turbostratic Carbon Films: Advancing Fast-Charging Battery Materials for the Energy Transition

Abstract: Fast-charging lithium-ion batteries (LIBs) require anode materials that maintain high performance under practical operating conditions. In this work, Turbostratic Carbon Films (TCFs) were evaluated as anodes for LIBs. The TCF demonstrated excellent electrochemical performance, including strong rate capability and stable long-term cycling behaviour at practical electrode loadings. The favourable performance was achieved using conventional electrolytes, highlighting the potential of TCFs to support efficient lithium-ion transport and stable charge-transfer behaviour. Further, TCFs offer a unique combination of electrical conductivity, mechanical robustness, and structural characteristics that make it attractive for advanced energy storage applications. The combination of high-rate performance, cycling stability, and scalable low cost manufacturing suggests that TCFs are a promising anode platform for next-generation fast-charging LIBs. The findings demonstrate the potential of TCF as an advanced carbon material for high-performance energy storage systems.

Speaker: Dr. Mehrdad Parsa

Research Associate in Graphite Processing, Dept of Chemical Engineering, Faculty of Engineering and IT, *University of Melbourne*

Dr Mehrdad Parsa is a materials scientist and entrepreneur with more than 12 years of experience in battery materials, electrochemistry, process development and technology commercialisation. As a Senior Research Fellow at the University of Melbourne, he leads projects focused on developing and translating advanced materials technologies for battery and energy storage applications. He is also the CEO and founder of CarboPhite, where he applies this expertise to the development of lower-cost, lower-emission technologies. His experience spans research, pilot-scale development, industry collaboration and commercialisation.



Melbourne Energy Institute

THE UNIVERSITY OF MELBOURNE

Research Program: Heavy Industry and Resources

CHAIR: Dr. Tim Werner

Deputy Program Leader - Heavy Industry and Resources, Melbourne Energy Institute

Senior Lecturer in Energy Transition, School of Geography, Earth and Atmospheric Sciences, Faculty of Science, *University of Melbourne*

Dr. Tim Werner s a Senior Lecturer in the School of Geography, Earth and Atmospheric Sciences. He completed his PhD at Monash University in 2017 and subsequently served as a postdoctoral research fellow at RMIT University, Melbourne. He has held Visiting Scholar positions at Yale University and the Vienna University of Economics and Business. In 2018, Dr. Werner joined the University of Melbourne as a Research Fellow in GIS and Extractive Industries, contributing to an ARC Laureate Project. In 2021, he secured funding for an ARC DECRA Fellowship, focussing on investigating critical metal resources, their mining footprints, and potential future supply chain impacts. He now coordinates the **Responsible Mining and Energy Transition Group**.

Dr. Werner's research expertise encompasses environmental engineering, geographical science, economic geology, physical geography and conservation biology. His interests span many topics, including mineral supply chain resilience and dynamics, land use changes, resource economics and governance, material recycling and waste management, and energy transition pathways. His current focus revolves around examining land use impacts of mining critical minerals.

Read more about MEI's Heavy Industry and Resources research program.

KEYNOTE: Connecting copper to the renewable energy transition

Abstract: As electrification in the economy grows, alongside the renewable energy transition – the centrality of maintaining access to copper becomes paramount. This paper looks ahead to 2050 to explore trends in copper demand and the changing mix of supply from mined and secondary sources, including changing geographies of supply and contrasts in economic, social and environmental impacts.
In addition, global flows of copper aligned with limiting planetary temperature rises to 1.5 deg C are presented, together with the role of circular economy frameworks; improved publicly available data regarding traceability, supply and provenance; and initiatives such as Copper Mark in supporting sustainability.

Finally, evolving models of access and governance for primary and secondary supply, including a global minerals trust, are presented.

Keynote speaker: Professor Damien Giurco

Professor and Chair of Circular Economy; Faculty of Engineering and IT, *University of Melbourne*
Program Lead Circular Economy, SPW CRC;
Deputy Director Sustainability, circAlloy;

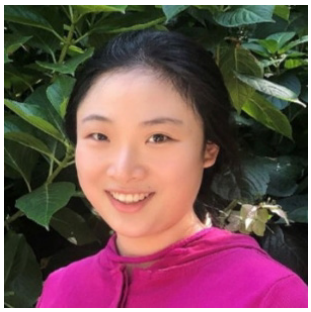
Professor Damien Giurco is the inaugural Chair of Circular Economy at The University of Melbourne. His research with government and industry partners spans responsible minerals and metals; material requirements for the clean energy transition and advancing a circular economy to support sustainable consumption and production. He was a theme lead in the Future Battery Industries CRC and NSW Decarbonisation Innovation Hub.
Damien is Deputy Director - Sustainability in the Australian Research Council's Training Centre for Resource Efficient Alloys in a Circular Economy and the Program Leader for Circular Economy within the Solving Plastic Waste Cooperative Research Centre.

Responsible Mining for the Energy Transition: How Chinese Mining Companies Navigate ESG and Governance in Australia

Abstract: The global energy transition depends on a secure and responsible supply of critical minerals such as lithium, nickel, copper, and rare earths. As Chinese mining companies play an increasingly important role in developing these resources worldwide, they face growing expectations to meet environmental, social, and governance (ESG) standards across different countries. This presentation examines how Chinese mining companies operating in Australia respond to evolving governance requirements, including environmental regulation, community engagement, and responsible business practices. The research highlights the opportunities and challenges of balancing resource security, sustainability, and international collaboration in support of a just and resilient energy transition.

Speaker: Ms. Zhanran (Jessie) Xu

PhD Student, School of Geography, Earth and Atmospheric Sciences, Faculty of Science, *University of Melbourne*



Ms Zhanran (Jessie) Xu is a PhD researcher exploring the governance of critical mineral supply chains, focusing on how Chinese mining companies respond to ESG requirements and regulatory expectations in host countries. She is also a Project Officer with Transparency International Australia's Accountable Mining Programme, where she contributes to research on mining governance, transparency, and responsible critical mineral development. Her work bridges academia and practice to advance understanding of sustainable resource governance for the global energy transition.

Catalytic Membranes for CO2 capture

Abstract: Solvent-based carbon capture technology faces challenges in large-scale implementation due to energy-intensive solvent regeneration. Recent advancements explore catalysts to improve energy efficiency; however, catalyst attrition, pump breakdown from recirculation, effects on absorption kinetics, and large equipment requirements remain barriers. Herein, we propose catalytic polymer membranes incorporating acid nanocatalysts onto hydrophobic nanofibers to improve solvent regeneration efficiency. Catalytic functionalities in high-surface-area polymer membranes with tunable porosity enhance reaction kinetics, enabling rapid CO_2 desorption at low temperatures. Catalyst nanoparticles were deposited onto PTFE and polypropylene and tested in a flat-sheet membrane contactor, revealing catalyst-polymer interactions and operating conditions for scaled-up applications.

Speaker: Mr. Pravin Bolne

PhD student, Chemical Engineering, Faculty of Engineering and IT, *University of Melbourne*

Mr. Pravin Bolne is a third-year PhD student in the Chemical Engineering department at the University of Melbourne. He is working with Prof. Sandra Kentish and Prof. Kathryn Mumford on the development of energy-efficient carbon capture technologies, specializing in membranes and catalysis. Passionate about green and sustainable technologies, he is committed to tackling real-world challenges.

Global transition, location transformations: Governance challenges for the energy transition at the sites of extraction

Abstract: The energy transition is creating economic opportunities globally, underscored by an increased uptake of critical minerals. Governments, communities and industry are pressured to make the most of this favourable context, yet, these opportunities are accompanied by increasing governance risks affecting local communities and the environment at the site of extraction. This presentation will discuss a report examining six country case studies across the Americas, Africa and the Asia-Pacific, showing how rising demand for critical minerals is affecting local people and places. This includes a focus on how corruption compounds the risks, highlighting the need for stronger governance to ensure a just energy transition takes place.

Speaker: Dr. Ana Carballo

Head of International Programmes, *Transparency International Australia*

Honorary Research Fellow, School of Geography, Earth and Atmospheric Sciences, Faculty of Science, *University of Melbourne*

Dr. Ana Carballo leads the Accountable Mining Programme at Transparency International Australia, which focuses on policy and advocacy research to promote good governance of the resources sector in over twenty countries. Her research sits at the intersection of environmental politics, social geography and development ethics with a particular focus on natural resources governance in Latin America and beyond.

Ana's current research investigates imaginaries of energy transition, bridging resource extraction in the Global South with net-zero pursuits in the Global North. Ana translates this research into actionable policy, leading anti-corruption initiatives at the nexus of extractive industries and the global energy transition. She brings over 15 years of experience working with civil society organisations across Latin America, Europe, and the Asia-Pacific region.

Melbourne Energy Institute

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Research Program: Energy Systems

CHAIR: **Professor Pierluigi Mancarella**

Energy Systems Program Leader, Melbourne Energy Institute
Chair Professor of Electrical Power Systems, Department of Electrical and Electronic Engineering, Faculty of Engineering and IT, *University of Melbourne*

Professor Pierluigi Mancarella is the Chair Professor of Electrical Power Systems at the University of Melbourne, Australia, and Professor of Smart Energy Systems at the University of Manchester, UK. His key research interests include techno-economic modelling and analysis of multi-energy systems, grid integration of renewables and distributed energy resources, energy infrastructure planning under uncertainty, and security, reliability, and resilience of low-carbon networks.

Pierluigi is the Energy Systems Program Leader at the Melbourne Energy Institute, a Fellow of the IEEE (Institute of Electrical and Electronics Engineers), an IEEE Power and Energy Society Distinguished Lecturer, the Convenor of the CIGRE (International Council of Large Electric Systems) C6/C2.34 Working Group on "Flexibility Provision from Distributed Energy Resources", holds the 2017 Veski Innovation Fellowship for his work on urban-scale virtual power plants, and is a recipient of the international Newton Prize 2018 for his work on power system resilience in Chile. He is author of several books and over 300 research papers and reports and is a Senior Editor of the IEEE Transactions on Power Systems, and the Oxford Open Energy journal.

Pierluigi is the Australian principal investigator of the US-UK-Australia Global Center in Climate Change and Clean Energy "EPICS" ("Electric Power Innovation for a Carbon-free Society"). In the past few years, he has supported the Finkel Review panel, the Australian Energy Market Operator, the Australian Energy Market Commission, and the Australian Energy Regulator on relevant research and consultancy projects on power system security, reliability, and resilience, and has led and been involved in several projects via the Australian Renewable Energy Agency, Cooperative Research Centres, and the Commonwealth Scientific and Industrial Research Organisation.

Read more about MEI's Energy Systems research program.

KEYNOTE: From automatic to agentic control for power?

Abstract: The field of automatic control has played a central role in establishing the electrical power grid over about 100 years. After changes in the 1990's, many of the schemes developed have been taken over by numerous market mechanisms, Adding to this complexity is the energy transition whereby the whole system is being reinvented over just decades based on the high use of variable renewable energy (VRE) sources. Given the coincident timing of the challenges arising and the emergence of agentic AI it is not surprising that the potential of these recent advances in power system operation is becoming a hot topic. But how far do we really trust AI agents? The talk will firstly review the eras of control in power systems and then discuss the opportunities for research on the new problems arising in the energy transitions.

Keynote speaker: Professor David Hill

Professor of Electrical Power and Energy Systems, *Monash University*

Prof. David J. Hill holds the position of Professor of Electrical Power and Energy Systems at Monash University, Melbourne, Australia. He is also Professor Emeritus at The University of Sydney where he was Foundation Director of the Centre for Future Energy Networks. He consults internationally most recently in Australia for the NSW Government on decarbonization and energy preparedness. Professor Hill has been elected a Fellow of four learned academies in Australia, Sweden and Hong Kong. He has received numerous international awards for his research in control and power and energy systems.

Using Electric Vehicles as Home Batteries: Smart Energy Management for Solar Homes Under Uncertainty

Abstract: As more Australian households install rooftop solar and adopt electric vehicles (EVs), there is an opportunity to use EV batteries to store solar energy and reduce electricity costs. However, effective charging and discharging decisions are complicated by uncertainties in solar generation, household electricity demand and daily travel needs. This presentation introduces a decision-support approach that continuously updates (dis)charging plans as new information becomes available. Results based on real household energy and travel data from Victoria show that smart energy management can substantially reduce electricity costs and grid dependence while increasing the use of solar energy.

Speaker: Associate Professor Joyce Zhang

Associate Professor, Operations Research, School of Mathematics and Statistics, Faculty of Science, *University of Melbourne*

Dr Lele (Joyce) Zhang is an Associate Professor in School of Mathematics and Statistics at the University of Melbourne (UoM). She has a Bachelor's degree in Engineering (Southeast University, China), and a PhD in Operations Research (UoM). Her areas of expertise are broadly modelling and optimisation for complex systems, traffic flow theory, Monte Carlo simulation, City Logistics, and automated optimisation using large language models and machine learning. She is a Chief Investigator of ARC Training Centre in Optimisation Technologies, Integrated Methodologies, and Applications (OPTIMA), and a co-founder of Physical Internet Lab at UoM.

How Much Solar PV Can Our Neighbourhoods Handle? Teaching AI the Physics of the Grid

Abstract: Australia leads the world in rooftop solar PV, but every neighbourhood's electricity network has a limit. Beyond that limit, voltages rise too high and solar systems must switch off. Knowing each network's limit requires detailed electrical models that most distribution companies do not have. This talk presents an alternative: physics-informed artificial intelligence trained only on smart meter data. By teaching neural networks how power flows through the grid, they calculate voltages accurately under conditions never seen in the data, such as new solar connections. Tested on realistic Australian networks, this approach offers a practical path to connecting more solar PV.

Speaker: Mr. Orlando Pereira Guzmán

PhD researcher, Dept of Electrical and Electronic Engineering Department, Faculty of Engineering and IT, *University of Melbourne*

Mr. Orlando Pereira Guzmán received his B.Sc. and Lic. degrees in Electrical Engineering from the University of Costa Rica in 2017 and 2020, and his M.Sc. degree from the National University of San Juan, Argentina, in 2023. Previously, he worked as an engineering consultant on distribution network planning and electromobility projects across Latin America. His research develops machine-learning models that rely on smart meter data, enabling distribution companies to make informed and practical planning decisions on the integration of distributed energy resources.

Balancing lifetime and economic performance in switchable PEM electrolyser stacks

Abstract: Green hydrogen is expected to play an important role in decarbonising energy and industrial systems, but the cost and lifetime of Proton Exchange Membrane (PEM) electrolysers remain key challenges. This research investigates a switchable PEM electrolyser stack in which individual cells can be controlled according to their state of health (SOH). By balancing operation between healthier and more degraded cells, the approach aims to reduce SOH imbalance and extend useful stack lifetime. A model predictive controller is proposed to balance these long-term degradation effects against short-term benefits such as hydrogen production and renewable energy utilisation, supporting more cost-effective electrolyser operation.

Speaker: Ms. Pauline Thuene

PhD student, Dept of Electrical and Electronic Engineering, Faculty of Engineering and IT, *University of Melbourne*

Ms. Pauline Thuene received her Bachelor’s degree in Electrical Engineering from Frankfurt University of Applied Sciences and her master’s degree in Sustainable Energy, specialising in Electric Energy Systems, from the Technical University of Denmark. She has industry experience in both solar and wind energy and is currently pursuing a PhD at the University of Melbourne. Her research interests include the power-system integration and control of PEM electrolysers, the provision of grid services by distributed energy resources and renewable energy integration.

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