



THE UNIVERSITY OF  
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Melbourne  
Energy Institute

# Melbourne Energy Institute

Annual Report 2022



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# Message from the Director



## It was the year that things went back to normal-ish.

With the easing of COVID-19 restrictions in 2022, the Melbourne Energy Institute was able to resume what we now call normal.

Our MEInetwork22 program rumbled back to life with hybrid in-person and online seminars on the natural gas supply chain; how it works and how green and blue hydrogen might displace it. We had people in the room and an enthusiastic audience interstate and even overseas.

Our Energy Systems Short Course also returned to the campus and beyond, giving students the chance to engage with our expert conveners more actively. And our MEI Symposium 22 was an in-person only affair, with our students, staff and community getting together and exploring the best in energy research taking place across the University.

The year was also a busy one for research. MEI was most grateful to receive support from the Victorian State Government's Higher Education State Investment Fund for our Zero Emission Energy Laboratory ('ZEE Lab'). With this funding matched by our industry partners, we were able to place many student interns, hire many new PhD students and post-docs, support several start-ups and commercialise some clean energy and transport technologies. Quite an achievement.

And together with our collaborators at the University of Queensland, Princeton University and Nous Group, we launched the interim results of the Net Zero Australia project, providing a continental and a finely resolved assessment of potential Australian net-zero futures. This work continues into 2023 and is engaging with many in the community, industry and government.

But in the broader world of energy, things were far from normal.

Oil, coal and gas prices spiked globally at unprecedented levels. Australia's National Electricity Market was suspended for the first time since it was established, and regulation of domestic coal and gas prices was introduced. Pressure mounted around the world for urgent action on net-zero agendas. We at MEI followed all these developments closely, and facilitated what we hope is high quality research, informed debate and action in response.

As I reflect on 2022, I also sincerely thank the dedicated and generous team at MEI and our valued partners for their continued support. Let's make that the new normal in 2023 and beyond!

All the best,

**Michael**

Prof. Michael Brear, FTSE, FCI, FIEAust  
Director, Melbourne Energy Institute  
March 24th, 2022

# The Melbourne Energy Institute

The Melbourne Energy Institute (MEI) delivers influential, interdisciplinary research on the transition to a clean energy system. We work with the community, industry and government on some of the world's most pressing energy challenges.

MEI has over 300 specialists across Architecture, Economics, Engineering, Health, Law, Planning, Science and Social Science. They include a former Chief Scientist of Australia, several recipients of Australia Day Honours, several Fellows of Learned Academies and numerous Fellows of Professional Societies.

MEI researchers work together in four programs:

- [Energy Systems](#)
- [Hydrogen and Clean Fuels](#)
- [Power Generation and Transport](#)
- [Energy Materials](#)

We work with many leading organisations in Australia and overseas, and welcome all enquiries at [mei-info@unimelb.edu.au](mailto:mei-info@unimelb.edu.au).



# Introducing the MEI team

MEI is run by a team of dedicated staff who look after the Institute's external and internal research programs and stakeholder engagement.



**Professor Michael Brear**  
FTSE, FCI, FIEAust  
Director



**Ms Anita La Rosa**  
*Institute Manager*



**Professor Pierluigi Mancarella**  
*Program Leader Energy Systems, and Chair Professor of Electrical Power Systems*



**Associate Professor Kathryn Mumford**  
*Program Leader Hydrogen and Clean Fuels, and Associate Professor in the Department of Chemical Engineering*



**Dr Adrian Panow**  
*Director Major Projects*



**Ms Monica Pater**  
*Executive Assistant*



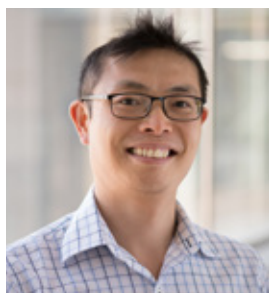
**Ms Catriona Richards**  
*Communications Coordinator*



**Professor Richard Sandberg**  
*Program Leader Power Generation and Transport, and Chair of Computational Mechanics*



**Ms Franca Tomaras**  
*Events Coordinator and Administrator*



**Associate Professor Wallace Wong**  
*Program Leader Energy Materials, and Senior Lecturer, Chemistry*

# MEI's Partners

MEI is proud to work alongside our industry and government partners. Collaborative research and knowledge transfer are central to MEI's work, and we welcome new partners.



# Highlights of 2022

## Net Zero Australia: First findings from a groundbreaking study

The University of Melbourne co-hosted the launch of interim results on pathways to net zero.

How might Australia achieve net zero emissions by 2050? What pathways are possible, and what would these look like on the ground?

These were some of the big questions tackled at the recent launch of interim results of the Net Zero Australia study, co-hosted by MEI at the University of Melbourne.

At the launch, five scenarios for achieving net zero emissions – and their consequences – were presented and discussed with a public audience of more than 200 in-person and close to 1,000 online by members of the study's Steering Committee, including MEI Director Professor Michael Brear, and chaired by former Chief Scientist of Australia, Professor Robin Batterham.

“Our findings show there's no two ways about it – to meet net zero by 2050, Australia must transform,” Professor Batterham said. “Major and long-term investment is required in new renewable generation, electricity transmission, hydrogen supply chains, and more. New skills and training are needed to capitalise on Australia's clean energy potential. This will create new costs, benefits and opportunities.”

Key insights from the interim modelling suggest that intensive capital investment is needed for Australia to achieve a net zero transition, but that this investment will bring significant benefits. Renewables can produce most or all domestic energy by 2050, will replace our fossil fuel exports, can provide clean energy to our region. A decarbonised energy market will mean a large workforce with new skills must grow across the nation, particularly in northern

Australia. More productive use of energy can keep domestic demand about the same, despite population growth, and carbon capture, utilisation and storage (CCUS) can play an important role, complementing renewables.

Emissions from farms, forestry and waste should fall, but are unlikely to reach net zero, and changes in land and sea use will occur, requiring careful planning and community engagement. Downscaling maps released at the launch showed possibilities for “Tasmania-sized” solar and hydrogen hubs to be developed across Australia's north.

The project's Steering Committee has emphasised that the results are not forecasts, but illustrations of possible pathways for Australia. The engagement and support of landowners and communities – particularly First Nations peoples – will be critical.

“The aim of this study is not to prescribe solutions for Australia, but to provide an evidence base on which to make decisions on how we achieve a net zero emission future,” said MEI Director, Professor Michael Brear. “Careful and considered engagement with different communities will be essential, and the future is what we choose it to be.”

Started in 2021, Net Zero Australia is a research partnership between the University of Melbourne, the University of Queensland, Princeton University and management consultancy Nous Group. Final results are scheduled for release in early 2023.

Visit [www.netzeroaustralia.net.au](http://www.netzeroaustralia.net.au) for a comprehensive summary of this initiative. This website includes all interim results, modelling inputs and methodologies, and we warmly encourage you to contact us at [info@netzeroaustralia.net.au](mailto:info@netzeroaustralia.net.au) if you wish to provide feedback.



## ZEE Lab launch: Students at the forefront of the energy transition

Talented graduate students joined leaders from industry, government, and academia for the formal commencement of MEI's new Zero Emission Energy Laboratory.

MEI has launched a new program for research with industry to reduce emissions and support the clean energy transition.

The Zero Emission Energy Laboratory program, or ZEE Lab for short, was launched at a gathering of graduate students, and academic and industry leaders at Melbourne Connect on 28 February.

Coordinated by MEI, the ZEE Lab creates an ecosystem for innovation, provides opportunities for students to apply their knowledge, and supports research into world-leading, commercially prospective, clean energy technologies.

Some technologies now under exploration include wind and solar forecasting tools, utility-scale energy storage, software for renewable-rich grids, and technologies for hydrogen and electric powered transportation.

The initiative is supported by \$4.7 million in State Government funding via the Victorian Higher Education State Investment Fund, matched by cash and in-kind funding from the University of Melbourne and industry.

Prior to the launch, the program has begun making connections through the ZEE Lab Internship Program, with an initial intake of 17 students undertaking a 12-week paid placement with industry partners.

The ZEE Lab Internship Program places outstanding graduate students from science, engineering, business and other relevant backgrounds with industry.

"These companies range from some of the world's largest energy and transport companies to start-ups and everything in between," MEI Director Professor Michael Brear said at the launch.

Sheida Shadpour, a recent master's graduate from the Department of Mechanical Engineering, took an internship with Ekistica, an engineering firm based in Alice Springs.

Drawing on her own research, Sheida worked with the firm to develop a new methodology to measure and analyse the performance of solar farms on Australia's National Electricity Market. "The aim is to give us a better idea of how well Australia's solar farms are performing, and identify areas for improvement," she said.

Sheida presented an overview of her experience and findings at the ZEE Lab launch.

Shawn Ingle, a final-year Mechanical Engineering master's student, took an internship with Electric Vehicles Pty Ltd.

With his hosts, Shawn analysed the business models of micromobility fleets of light electric vehicles – such as e-bikes and scooters – around the world and applied his findings to identify best-suited locations for hubs in the City of Melbourne and City of Yarra.

"I was excited about the prospect of learning more about micromobility through a project designed to make a positive dent on CO2 emissions while improving how a city's transport network operates," he said.

At the launch, Shawn shared a blueprint for the establishment of 'micromobility hubs' across Melbourne.

Dr Adrian Panow, MEI's Director of Major Projects and coordinator of the ZEE Lab program, says the response from industry partners has been very positive, with several offering ongoing employment to interns and multiple industrial research projects being launched.

"Our students will play an important role in the energy transition and ZEE Lab projects are helping them on their journey. For our industry partners, the ZEE Lab is an opportunity to investigate new business opportunities and access new talent," he said.





## A cleaner, greener way to remove CO<sub>2</sub> from air

MEI researchers have found a new approach to direct air capture that can run on zero emission renewable energy.

Meeting the targets of the Paris Agreement is now out of reach without technologies to actively remove carbon dioxide from the atmosphere, according to the latest report from the Intergovernmental Panel on Climate Change.

The catch is, most existing negative emission technologies, such as direct air capture, require a high energy input from non-renewable sources – potentially releasing even more greenhouse gas emissions into the atmosphere in the process.

Researchers at MEI have found a prospective way to address this, through a new approach to direct air capture that can run on zero emission renewable energy.

The new approach makes use of engineered ‘nanocatalysts’ to capture carbon dioxide and regenerate at a lower temperature, paving the way for the use of renewable energy sources, such as solar hot water.

“This technology puts direct air capture into a different perspective. Without radical changes, it simplifies the process and makes a huge difference by using renewables,” says Associate Professor Kathryn Mumford, MEI’s Program Leader for Hydrogen and Clean Fuels.

Mumford and Research Fellow Masood S. Alivand have been working on the technology since 2019. A provisional patent was filed in 2021, and the pair’s research findings were published this year in *Nature Communications*.

In typical direct air capture processes, carbon dioxide is extracted from air using either a solid adsorbent or liquid solvent. For solvent-based processes, after carbon dioxide is separated the liquid must be brought to a very high temperature to remove the captured carbon dioxide so that the solvent can be recycled and reused.

This boiling step in the process requires high energy input, making it impractical in most cases to use renewable energy sources such as solar.

Through the new approach, advanced “water-dispersible nanocatalysts” are added to the chemical solvent that can regenerate at a much lower temperature – at around 88 degrees Celsius compared to the usual 120-140 degrees.

“This lower operating temperature paves the way for hot water streams from green and renewable energy sources, such as solar hot water, or those already available in the processes, such as hot process water streams, thereby significantly reducing operating costs,” explains Alivand.

Additionally, only a small amount of the nanocatalyst is needed for the process to be effective – less catalyst, and less energy input means a huge reduction in cost.

The new technology is likely to be an attractive option for cement and fertiliser production companies, natural gas refineries, and high-emission industries in the power generation sector. It could also be a game-changer for remote areas like deserts, where renewable energy may be the only accessible source, Mumford says.

The research further contributes to Australia’s zero emission portfolio and its objectives to make direct air capture technologies economically feasible, and accelerate their massive-scale deployment to a capacity of 1-4 gigatonnes per year by 2050.

Prototyping is now underway with partners to trial direct air capture systems that use the nanocatalyst and are equipped with solar panels, enabling continuous operation powered by renewable energy.



## ADELE: German-Australian lab to advance green hydrogen

MEI has teamed up with German research and funding partners to establish a new laboratory for the advancement of green hydrogen.

ADELE – the German-Australian Joint Laboratory for ADvanced ELectrochemical Processes – has been established as a joint research presence between the Chair of Chemical Process Engineering at RWTH Aachen University in Germany and MEI at the University of Melbourne.

Research in the laboratory will focus on questions concerning electrochemical processes for the production and use of green hydrogen.

“The science is moving fast on green hydrogen, and through ADELE we’ll be able to bring together world-class experts to advance an important technology for the energy transition,” says Associate Professor Kathryn Mumford, Hydrogen and Clean Fuels Program Leader at MEI.

Hydrogen is expected to play a key role in the transition to a clean energy system. The element is commonly extracted from water using heat and chemical reactions, but these processes can be energy-intensive and highly polluting.

Green hydrogen refers to hydrogen produced using renewable energy. With the right technology, it could offer a major sustainable source of energy with zero emissions. Advanced electrochemical processes for hydrogen production, such as those being developed in the new laboratory, pose the opportunity to produce green hydrogen on a large scale, helping to greatly reduce greenhouse gas emissions and slow down climate change.

“We are excited to be working with the Melbourne Energy Institute and the University of Melbourne at the forefront of this technology that holds real potential for a clean energy future,” says Professor Matthias Wessling, Chair of Chemical Process Engineering at RWTH Aachen University.

The German Federal Ministry of Education and Research (*Bundesministerium für Bildung und Forschung*, BMBF) has offered to fund the program until 2024. Partners anticipate that the combination of active research, growing networks and sustainable implementation will ensure a continued research presence for ADELE over the long term.

*For more information, or to exchange ideas and knowledge on the topic of advanced electrochemical processes, please contact Associate Professor Kathryn Mumford ([mumfordk@unimelb.edu.au](mailto:mumfordk@unimelb.edu.au)).*



## An enormous geothermal pool under the Latrobe Valley could give us cheap, clean energy

Geothermal energy – generated by the natural heat of the Earth’s interior – is an immense source of cheap, clean and renewable energy, and one that is largely untapped in Australia. In Victoria’s Latrobe Valley, a hot aquifer of around 6,000 square kilometres underlies coal-mining country.

Researchers in the Faculty of Science and the School of Engineering are working on projects that aim to tap this significant resource. Dr Graeme Beardsmore from the School of Geography, Earth and Atmospheric Sciences recently published an article in *The Conversation* to highlight how this work might help unlock the potential of geothermal energy in Gippsland and the Latrobe Valley.

The full article can be read here: <https://go.unimelb.edu.au/p8xs>

## Energy poverty in the climate crisis: What Australia and the European Union can learn from each other

As the transition to clean energy unfolds, some fear the decarbonisation of the electricity sector will mean higher prices. And high prices can lead to energy poverty: when a household cannot afford the essential electricity services needed for a decent standard of living, such as heating.

New research led by Dr Sangeetha Chandrashekeran from the Life Course Centre compares approaches to energy affordability in the EU and Australia.

The research finds that Australia can learn a lot from the EU about putting policies in place to alleviate energy poverty. It also shows that under the right regulatory and market settings, electricity prices can be kept in check as the electricity sector decarbonises.

The full article in *The Conversation* can be read here: <https://go.unimelb.edu.au/h8xs>

# MEI Research Programs

## Energy Systems

The Energy Systems Program considers how different energy technologies interact with one another, society and the environment. The program includes the technical, economic and environmental analysis of energy networks, wholesale and retail energy markets, and energy system planning.

### CAPABILITIES

- Energy network, system and market integration of renewable energy sources
- Distributed energy resources and smart grids
- Integrated energy networks and multi-energy systems
- Security, reliability and resilience assessment of future energy systems
- Retail energy markets and consumer behaviours control trials, big data and machine learning

### IMPACT

- Modelling work on future system security and energy markets commissioned by the Finkel Review
- AEMO demand and reserves forecasting using AMI data and machine learning approaches
- Collaborations with AEMC and AER on power system resilience and reliability
- Integrated electricity-gas-hydrogen modelling for the Future Fuels CRC

### RESEARCH CENTRES

- [Centre for Market Design](#)
- [Centre for Resources, Energy and Environmental Law](#)
- [Power and Energy Systems](#)
- [Thermodynamics Laboratory](#)

## KEY RESEARCHERS

**Program Leader: Professor Pierluigi Mancarella**

Professor Lu Aye

Professor James Bailey

Professor Robin Batterham

Professor Howard Bondell

Professor Michael Brear

Professor David Byrne

Dr Sangeetha Chandrashekeran

Professor Robert Crawford

Professor Rob Evans

Professor John Freebairn

Professor Ross Garnaut

Dr Christopher Hall

Professor Fiona Haines

Professor Glenn Hoetker

Professor William Ho

Professor Chris Leckie

Professor Chris Manzie

Associate Professor Leslie Martin

Professor Brendon McNiven

Dr Reihana Mohideen

Professor Nando Ochoa Pizzali

Dr Behzad Rismanchi

Professor Mike Sandiford

Professor Prakash Singh

Professor Kate Smith-Miles

Professor Doreen Thomas

Dr Maria Vrakopoulou

## Power Generation and Transport

The Power Generation and Transport Program brings together researchers who investigate several forms of renewable and low emission power plants for stationary and mobile applications. This includes advanced wind, solar, gas turbine, reciprocating engine and energy storage technologies.

### CAPABILITIES

- Carbon capture and storage
- Conventional and alternative fuels and emissions chemistry
- Gas turbine, reciprocating engine, hybrid and electric powertrain dynamics and optimisation
- Wind turbines/farms, solar PV and energy storage dynamics and optimisation
- Low drag vehicles for land, sea and air
- Advanced computational methods and machine learning in energy applications
- Atmospheric chemistry
- Public health impacts of air pollution

### IMPACT

- Propulsion, engines and fuels for Ford, DST Group and MHI
- Improved aircraft engine aerodynamics for General Electric
- Modelling of real-world, solar PV performance across Australia with AEMO
- Operational forecasting of wind and solar farm power generation with Meridian Energy Australia and others

### RESEARCH CENTRES

- [ARC Centre for Exciton Science](#)
- [Fluid Mechanics Group](#)
- [Peter Cook Centre for CSS Research](#)
- [Thermodynamics Laboratory](#)

### KEY RESEARCHERS

**Program Leader: Professor Richard Sandberg**

Professor Robin Batterham

Dr Graeme Beardsmore

Professor Michael Brear

Professor Mark Cassidy

Dr Shiao Huey Chow

Professor Peter Cook

Professor Shyamali Dharmage

Dr Robert Gordon

Dr Eirini Goudeli

Professor Ralf Haese

Professor Lloyd Hollenberg

Professor Sandra Kentish

Dr Patricia Lavieri

Professor Chris Manzie

Associate Professor Leslie Martin

Professor Stephan Matthai

Professor Jason Monty

Professor Paul Mulvaney

Professor Guillermo Narsilio

Professor Peter Rayner

Dr Behzad Rismanchi

Professor Mike Sandiford

Associate Professor Robyn Schofield

Professor Mark Stevenson

Associate Professor Mohsen Talei

Associate Professor Yinghui Tian

Dr Claire Vincent

Professor Rachel Webster

Associate Professor Wallace Wong

Associate Professor Yi Yang

## Hydrogen and Clean Fuels

The Hydrogen and Clean Fuels Program integrates research into production, distribution and use of hydrogen in the energy system. The program studies electrolysis and clean fuel production, as well as hydrogen and clean fuel distribution and use in industrial and transport applications.

### CAPABILITIES

- Process engineering and techno-economics of hydrogen production from renewables and fossil fuels with carbon capture and storage (CCS)
- Advanced gas turbine and reciprocating engine systems running on hydrogen and hydrogen-derived fuels
- Assessment of hydrogen integration into the natural gas network, including Power to Gas (P2G) concepts
- Catalysis and process engineering of converting hydrogen to clean liquid fuels
- Sub-surface storage of hydrogen
- Resource economics
- Resource Law

### IMPACT

- Reciprocating engine research with hydrogen for Caterpillar, Ford and other partners
- Support to the Council of Australian Government's (COAG) National Hydrogen Strategy
- Provision of expert advice to the Hydrogen Energy Supply Chain (HESC) Project
- Optimisation of integrated energy systems featuring hydrogen for the Future Fuels CRC and other partners

### RESEARCH CENTRES

- [Centre for Resources, Energy and Environmental Law](#)
- [Peter Cook Centre for CSS Research](#)
- [Thermodynamics Laboratory](#)

### KEY RESEARCHERS

**Program Leader:** Associate Professor Kathryn Mumford

Professor Robin Batterham

Dr Joe Berry

Professor Michael Brear

Professor Peter Cook

Dr Eirini Goudeli

Professor Ralf Haese

Professor David Jamieson

Professor Sandra Kentish

Associate Professor Gang Li

Professor Pierluigi Mancarella

Professor Paul Mulvaney

Professor Richard Sandberg

Associate Professor Colin Scholes

Professor Geoff Stevens

Associate Professor Mohsen Talei

Associate Professor Yi Yang

## Energy Materials

The Energy Materials Program assembles researchers working in materials science and engineering, and focuses on the discovery and optimisation of materials for energy applications. This includes materials for energy generation, storage, transport, and consumption such as hydrogen electrolysis, batteries, solar energy conversion and lighting.

### CAPABILITIES

- Energy materials design aided by theory and computation
- Developing next-generation catalysts for carbon dioxide reduction
- Novel materials and processes for gas separation and capture
- Graphene materials in low-energy electronics and energy storage
- Materials and device optimisation in thin film solar technologies

### IMPACT

- Reduce energy consumption of separation processes for BHP, Masan and Ekos
- Developing organic and earth-abundant inorganic thin film solar photovoltaic technologies for ACAP
- Improve performance and reduce cost of anode materials in batteries for the Future Battery Industries CRC in conjunction with industry partners including Syrah Resources and AnteoTech
- Computational materials design for lightweight structural components in electric vehicles for Ford Motor Company

### RESEARCH CENTRES

- [ARC Centre of Excellence in Exciton Science](#)
- [ARC Training Centre in Future Energy Storage Technologies](#)
- [Experimental Condensed Matter Physics Group](#)
- [Integrated Computational Materials Engineering Group](#)

### KEY RESEARCHERS

**Program Leader:** Associate Professor Wallace Wong

Dr Christian Brandl

Dr James Bullock

Professor Amanda Ellis

Professor George Franks

Professor Ken Ghiggino

Professor David Jamieson

Associate Professor David Jones

Professor Sandra Kentish

Professor Dan Li

Associate Professor Gang Li

Dr Wen Li

Dr Tesfaye Molla

Professor Paul Mulvaney

Associate Professor Kathryn Mumford

Professor Greg Qiao

Professor Graham Schaffer

Associate Professor Colin Scholes

Dr Peter Sherrell

Professor Trevor Smith

Ms Jo Staines

# Students of MEI

Supporting early career researchers is central to MEI's growth. By fostering the ambitious talent of early career researchers, we can help them become future thought leaders in the energy sector.

## Spotlight on a student

Numerous graduate students are working on important energy projects within MEI. Below, meet some of our talented students whose work is contributing to a sustainable energy transition.



**Sheida Shadpour** was one of the first students to join MEI's ZEE Lab Internship Program. As a ZEE Lab intern, Sheida was paired with Ekistica, an engineering consultancy based in Alice Springs, to work on a solar farm analysis project. Her task was to come up with a way to measure and analyse the performance of solar farms on Australia's National Electricity Market (NEM). Sheida worked on a methodology to calculate performance ratio and curtailment losses – how well the farms are operating, and where they are making losses from limits to output – using publicly available datasets in combination with on-the-ground data.



**Shawn Ingle** is a master's student with a passion for sustainable transport. While completing studies in Mechanical Engineering and Business – and tinkering in the workshop on his own designs for a student racing car and electric bicycle – Shawn joined the first round of students in MEI's ZEE Lab Internship Program. Shawn was paired with Electric Vehicles Pty Ltd to work on a blueprint for 'micromobility hubs' that could better connect commuters to public transport networks across Melbourne.



**Xiaoying Gu**, a PhD student in Infrastructure Engineering, is building renewable energy solutions from the ground up. Through her research, Xiaoying is crunching the numbers on how we can better use urban roads and footpaths to reduce our energy footprint. Her work contributes to the developing technology of geothermal pavement systems – which use the ground as a heat source in winter and a heat sink in summer, and use thermal energy to heat and cool buildings.



**Vincenzo Bassi Zillmann** knows that the transition to renewables is not as simple as hooking up some rooftop solar. Need is growing for quick and accurate calculations that can assess the effect of clean energy technologies on network voltages, avoiding issues for the electricity grid. Through his PhD research in Electrical and Electronic Engineering, Vincenzo is finding new ways to calculate voltages without the heavy lifting of electrical models and power flow analyses.



**Chelsea Christy** had never considered how her love of maths could help a major company make the transition to renewables. Through MEI's ZEE Lab Internship Program, Chelsea – a final-year Electrical Engineering master's student with a background in Applied Mathematics – was placed with Energy Power Systems Australia (EPSA) to work on their new hybrid microgrid systems. She helped develop an algorithm that could simulate microgrid operation, optimising the use of solar over diesel power – and has since been kept on part-time by EPSA while she finishes her studies.



**Angela Keyte**, a Chemistry PhD student, has already begun to explore career options beyond the lab. A placement with consulting firm Arup, as part of the ZEE Lab Internship Program, opened her eyes to the practical applications of chemistry research for the transition to clean and renewable energy. Angela contributed research on how to use less water and more renewable energy in the generation of hydrogen, as a potential future green energy resource for Australia. The experience not only enriched her own learning, but opened career prospects beyond graduation, with Arup expressing interest in employing Angela after completion of her PhD.



**Arthur Gonçalves Givisiez** is keen to do his part as an electrical engineer to make the most of rooftop solar as a renewable source in our energy mix, in Australia and around the world. Through his PhD research, Arthur is looking into ways to improve network coordination and management that will optimise the contribution of solar photovoltaics, without hitting the current roadblocks of excessive voltage rises, asset congestion and unnecessary curtailment.



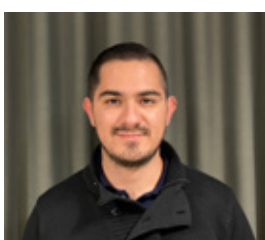
**Nour Wahba** through her PhD research is working on energy-efficiency for buildings. Heating and cooling systems in buildings are supposed to regulate temperature based on reading the room, but flaws in design mean they often miss the mark, wasting huge amounts of energy. Nour is working on a new control model that she hopes will stop systems from blasting rooms too hot or too cold – providing a more comfortable environment for occupants, and smarter energy-efficiency.



**Kevin Yang** is a budding data scientist with a passion for renewable energy. He was able to bring the two interests together via MEI's ZEE Lab Internship Program. On a placement at Meridian Energy's Mount Mercer wind farm, Kevin delved into on-site data and developed algorithms to improve power generation forecasting, helping the clean energy generator make the most of its potential in the energy mix.



**Carmen Bas**, a PhD researcher in Electric Power Systems, understands that achieving a low-carbon future will involve more than just updating our technology. As low-carbon technologies make an entrance in the hands of customers, our entire power system is changing, requiring a rethink of the way we generate, distribute, store, and use energy. Carmen is working on ways to model these system-wide changes, in order to inform better decision-making and bring benefits to all stakeholders – achieving a stable and reliable power system, and a clean energy future.



**Omar Castrejon Campos** is a recent PhD graduate with a wealth of real-world experience. While he enjoys the rigor of academic work, he sometimes misses the hands-on approach of his previous roles in management, policy, and international collaborations. As a ZEE Lab intern, Omar was placed with data science group Urban Analytica to work on a project considering the role of micromobility in the transition to a clean energy and transport system. The placement enabled him to explore his latest research in a real-world context, and opened doors to employment after graduation.



# Engagement

MEI runs a vibrant events and communications program that educates, informs and connects key stakeholders at the forefront of the clean energy transition. Our flagship **MEInetwork** program offers targeted educational and engagement opportunities for participants from academia and industry, while our **seminars, lectures and workshops** inform and stimulate broader collaboration and debate.

## MEInetwork22

The *MEInetwork* program provides opportunities for education, professional development and engagement among key research and industry stakeholders. Offered annually since 2018, it has become the centrepiece of MEI's events and engagement program.

The main components of the program are the **Energy Systems Short Course**, held mid-year as an intensive course for energy sector professionals and graduate students from the University of Melbourne; the **Energy Systems Seminar Series**, which offers a deep dive into the supply and value chain of a primary energy vector; and the **MEI Symposium**, which has become a platform for national and international researchers to share their latest findings on technologies, systems and opportunities for a clean energy transition.

The success of the *MEInetwork* program is made possible by the generous support of our industry and government partners. We work closely with our partners to develop a program that reflects current trends and challenges in the energy sector.

The following activities took place in 2022 as part of the **MEInetwork22** program.

### Energy Systems Short Course

The **MEInetwork22 Energy Systems Short Course** was held over three intensive weeks in July 2022. Under the instruction of leading energy industry experts and practitioners, attendees were equipped with the skills to analyse the financial, technical and environmental performance of various energy projects.

The 2022 Short Course was taught by **Dr John Burgess**, a University of Melbourne Honorary Professorial Fellow, with the assistance of **Jonathan Anderson**, a Senior Engineer working in the energy sector. Among the attendees were graduate students from the University of Melbourne and professionals from MEI's industry partners.

MEI received overwhelmingly positive feedback from course attendees, who said they gained valuable insights into the processes used to determine the viability of different energy investments, and the key components that underpin those decisions. MEI is grateful to Dr Burgess and Mr Anderson for sharing their time and knowledge, and for their dedication to creating a positive and engaging learning environment.



## **Energy Systems Seminar Series**

The **MEInetwork22 Seminar Series** was held as six hybrid lectures from May to October 2022, delivered by specialists from industry and the University. The series aimed to provide attendees with a deeper understanding of the gas supply chain. Topics and presenters included:

- Seminar #1 - Conventional and unconventional natural gas - **Steve Henzell**, Senior Technical Advisor at Advisian
- Seminar #2 - Gas markets and gas retailing - **Matthew Clemow**, Group Manager for Gas Operations at the Australian Energy Market Operator
- Seminar #3 - Liquefied natural gas and export - **Carolyn Au**, Operations Manager at Shell
- Seminar #4 - Natural gas and hydrogen transmission and distribution - **David Norman**, Future Fuels CRC; **Steve Davies**, Australian Pipelines and Gas Association, and **Robert Davis**, Senior Engineer - Low Carbon Future, Australian Gas Infrastructure Group
- Seminar #5 - Green hydrogen as an alternative to natural gas - **Michael Bielinski**, Chief Executive Officer of Siemens Energy
- Seminar #6 - Blue hydrogen as an alternative to natural gas - **Associate Professor Simon Smart**, University of Queensland and a Project Director for the Net Zero Australia study

The webinar recordings are available on the [MEI website](#).

## **MEI Symposium 22**

On 9 December 2022, the Melbourne Energy Institute hosted its end-of-year event, **MEI Symposium 22**. The annual **MEI Symposium** showcases the multi-disciplinary energy research taking place across the University of Melbourne and beyond. It provides a space for collaboration, as well as an opportunity to celebrate the past year's accomplishments.

The opening plenary keynote was presented by **Daniel Westerman**, Chief Executive Officer of the Australian Energy Market Operator (AEMO). In a presentation on **Paving the way to Australia's net-zero future**, Mr Westerman explored the changes needed for a smooth transition to a net-zero energy system in Australia, drawing unique insights from AEMO's **Quarterly Energy Dynamics** reports. Renewables, firming technology, and the implications for transmission and grids were all considered.



MEI Symposium 22 featured prominent international and local keynote speakers, talented graduate students, and academic staff presenting their research within MEI's four program areas.

As part of the Symposium program, MEI offered \$8,000 in prizes to graduate and postgraduate students, with awards of \$1,000 each for Best Poster and Best Presentation in four categories, following the themes of MEI's Research Programs. The presentations and posters were judged by MEI Program Leaders and representatives, and overseen by MEI Director **Professor Michael Brear**. MEI congratulates the following winners in each of the four categories:

### **Energy Systems**

#### **Best Poster**

Ana Luiza Santos de Sa, *Consumer preferences for electric vehicle charging management and response to time-of-use tariff discounts*

#### **Best Presentation**

Carmen Bas, *Feasibility of energy community projects in Victoria: towards capturing their whole system value*

### **Energy Materials**

#### **Best Poster**

Yixiong Ji, *The first ITO-free CZTSSe solar cell over 10% PCE achieved by a ZnO/AgNWs/ZnO(ZAZ) matrix*

#### **Best Presentation**

Peiyao Wang, *Cross-scale modelling of ion transport in nanoporous electrodes towards digital design of high-efficiency ionic devices*

### **Power Generation and Transport**

#### **Best Poster**

Massimiliano Nardini, *Pushing the boundaries of high-fidelity computational fluid dynamics: surface roughness in turbomachinery*

#### **Best Presentation**

Clare Walter, *Air pollution from fossil fuels: A public health policy gap*

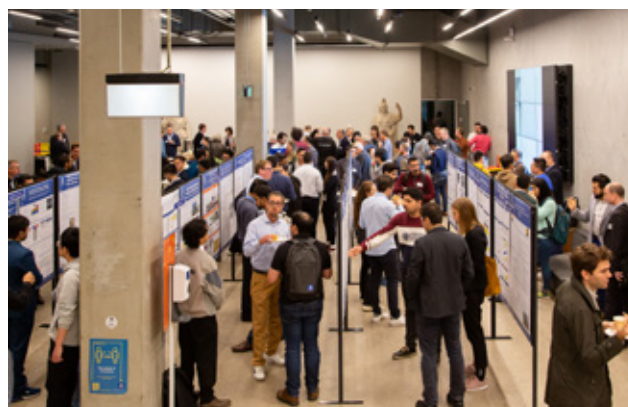
### **Hydrogen and Clean Fuels**

#### **Best Poster**

Jia Ming Goh, *Hydrogen storage within cellular pressure vessel*

#### **Best Presentation**

Joshua Butson, *Ultra-high-performance solar water splitting with earth-abundant cocatalyst foils*



## Seminars, lectures and workshops

MEI hosted several other seminars, lectures and workshops throughout 2022 as part of its education and engagement program.

### AEMO Quarterly Dynamics webinars

The Australian Energy Market Operator (AEMO) publishes a Quarterly Energy Dynamics report that provides market participants, businesses, consumers, governments and the wider energy community with updated information on dynamics, trends and outcomes in Australia's electricity and gas markets. MEI has become a key dissemination point for the findings of the quarterly report via the AEMO Quarterly Dynamics hybrid seminars, presented by **Kevin Ly**, Group Manager for Reform Development and Insights at AEMO.



### Suiso Economy: Hydrogen Supply Chains Between Japan and Australia

18 March 2022

Together with Asialink Business, MEI in partnership with the Consulate-General of Japan in Melbourne hosted the hybrid seminar Suiso Economy: Hydrogen Supply Chains Between Japan and Australia. Keynote speakers **Dr Akira Yoshino**, Nobel Prize Winner in Chemistry; and Director of Global Zero Emission Research Center (GZR) and National Institute of Advanced Industrial Science and Technology (AIST), and **Dr Alan Finkel AC**, Special Adviser to the Australian Government on Low Emissions Technology, discussed how Japan and Australia can create a highly feasible hydrogen supply chain, focusing on key areas of development including hydrogen strategy, technology, production, transportation, policies for cost reduction, international supply chains and partnerships.



### Unified Grid-Forming/Following Converter Control

26 May 2022

In this presentation hosted by MEI, **Professor Ian Hiskens** discussed the dynamic performance of grid-connected converter-based resources. A converter control scheme that has both grid-forming and grid-following characteristics was introduced. Using this control scheme, dynamic behaviour was explored under a variety of system conditions, with the aim of establishing some general properties.

An example illustrated the capability of the control scheme to support autonomous switching between grid-connected and islanded operation, and vice versa. Small disturbance (linear) analysis was used to provide insights into the nature of modal oscillations and the factors affecting oscillation frequency and damping. The public lecture was hosted as a hybrid event, simultaneously delivered in person and online.

### PhD-Level Short Course: Advanced Modelling of DER-Rich Active Distribution Networks

23-27 May 2022

The short course on Advanced Modelling of DER-Rich Active Distribution Networks covered fundamental and advanced modelling of active distribution networks with deep penetration of distributed energy resources (DER).

It was delivered as a five-day PhD-level course by the University's Power and Energy Systems Group and MEI. Topics discussed included power flow and optimal power flow algorithms suitable for diverse applications of active distribution networks with DER, consideration for uncertainty arising from renewables, provision of flexibility and grid services from DER, distributed multi-energy systems and community energy systems, and fundamentals of distributed energy markets.

### Project EDGE update: reactive power and voltage regulation devices to enhance operating envelopes

16 June 2022

In this online seminar hosted by MEI, **Professor Luis (Nando) Ochoa** and **Dr Michael Liu** from the University of Melbourne, together with **John Theunissen** from AusNet Services and **Nick Regan** from AEMO, presented the latest updates on the \$28-million ARENA-funded Project EDGE.

Project EDGE (Energy Demand and Generation Exchange) is a multi-year project that aims to demonstrate a proof-of-concept Distributed Energy Resource Marketplace that could efficiently provide both wholesale and local network services within the constraints of the power distribution grid.

The concept of 'operating envelopes' is being explored as a possible way to orchestrate the bidirectional flows from Distributed Energy Resources (DERs) – which include everything from solar PV to batteries, electric vehicles and future vehicle-to-grid – while ensuring the integrity of existing poles and wires.



Two clear opportunities exist to enhance operating envelopes and make the most of DERs: the use of reactive power from active customers (so they can help counteract the effects of exports or imports), and the use of voltage regulation devices, such as on-load tap changers at zone substations (so voltage headroom or legroom can be improved). However, both options present multiple challenges.

In this seminar, discussion focused on how operating envelopes can be enhanced using reactive power and voltage regulation devices. Presenters also discussed how the calculation of operating envelopes, now being trialled by AusNet Services using algorithms developed by the University of Melbourne, need to be further adapted.

### **What's happening in Australia's energy markets, and when will it end?**

14 July 2022

In mid-2022, unprecedented domestic natural gas prices followed dramatic price rises in internationally traded oil and coal. At the same time, some of our generation assets were flooded or offline, and some accused of improper behaviour. The entire National Electricity Market (NEM) was suspended for the first time since it was established.

But which of these factors – or others – really drove the suspension of the NEM? What are the implications for energy consumers? And what changes to our energy markets are needed to relieve these pressures and allow us to continue to decarbonise?

MEI hosted a public discussion centred on current events, and possible future directions for Australian energy markets. Discussion was moderated by Senior Research Fellow **Dr Sangeetha Chandrashekeran**, and featured MEI Director **Professor Michael Brear** alongside experts **Matthew Warren**, Principal of Boardroom Energy, and **Lynne Gallagher**, CEO of Energy Consumers Australia.

### **Will Australia have the workforce for a clean economy?**

18 August 2022

During this webinar with the Ai Group, **Professor Michael Brear** presented an update on the Net Zero Australia project, with a particular focus on a clean economy workforce.

### **Net Zero Australia: Interim findings from a groundbreaking study**

25 August 2022

What might net zero look like for Australia? What changes might we have to make to our economy, infrastructure, and outlook to achieve net zero emissions by mid-century?

With partners, including the University of Queensland, Princeton University and the Nous group, the University of Melbourne hosted the public release of interim results from Net Zero Australia, a ground-breaking multi-year study into how Australia might achieve a net zero economy.



Launched in 2021, the Net Zero Australia study aims to provide rigorous and independent analysis of the pathways by which Australia can achieve net zero in both domestic and export emissions. At the public release on 25 August, interim findings from the study were made public for the first time, detailing six scenarios for reducing emissions, and their consequences. Early downscaling results were also presented, exploring mapped land and sea use changes that may arise from a net zero transition.

The Net Zero Australia project will be completed in 2023, and continues its close engagement with state and commonwealth governments, industry and NGOs.

### **Professor Ross Garnaut presents: 'The Superpower Transformation: Making Australia's Zero-Carbon Future'**

5 October 2022

MEI, together with **Melbourne Climate Futures**, hosted the launch of *The Superpower Transformation: Making Australia's Zero-Carbon Future*, a new publication edited by **Professor Ross Garnaut**. At the launch, Professor Garnaut outlined the book's practical plans to turn Australia into an economic superpower of a post-carbon world. A follow-up from the bestselling *Superpower: Australia's Low Carbon Opportunity* (2019), the new book includes insights from experts **Professor Mike Sandford**, **Professor Ligang Song**, **Professor Frank Jotzo**, **Isabelle Grant**, **Susannah Powell**, **Dr Dylan McConnell**, and **Associate Professor Malte Meinshausen**.

The event began with an introduction by **Danielle Wood**, CEO of the Grattan Institute and opening remarks by **Associate Professor Ben Neville**, Deputy Director - Strategic Partnerships and Community Impact at Melbourne Climate Futures. Presentations were followed by Q&A with the audience and contributing authors, and a networking session.



### **Ducks on water: Lessons learned from New England's system operational analysis and renewable energy integration studies**

3 November 2022

MEI hosted a public lecture by **Professor Amro Farid**, titled *Ducks on Water: Lessons Learned from New England's System Operational Analysis and Renewable Energy Integration Studies*. Discussion was moderated by **Dr Sebastian Püschel**, an Academic Specialist in Future Grids and Markets at the University of Melbourne.

In this presentation, **Professor Amro Farid** sought to share lessons learned from two system operational analysis and renewable energy integration studies conducted in cooperation with ISO New England. In the first, variable energy resources (VERs) are increased in the coming decade to reveal a future of grid saturation and VER curtailment.

The follow-on New England Energy-Water Nexus Study showed that coordinated energy-water resources can create a triple bottom-line synergy worth \$70 million a year. The presentation made the case that a decarbonisation agenda must evolve from power grid studies with electricity as a single energy carrier to multi-energy engineering systems studies that specifically coordinate multiple energy carriers through many layers of coordinated planning and operations management decisions.

### **Graduate-level short course: Dynamics of low-carbon power systems**

14-18 November 2022

MEI hosted a five-day **Graduate-level short course: Dynamics of low-carbon power systems**, delivered as part of the strategic collaboration between the University of Manchester in the United Kingdom and the University of Melbourne.

The online short course covered fundamental and advanced modelling of the dynamics of power systems with increasingly deeper penetration of renewable energy sources (RES) and distributed energy resources (DER), most of which are inverter-based resources (IBR) that are asynchronously connected to the grid via power electronic interfaces.

The course was led by **Professor Jovica Milanović** from the University of Manchester, and included presentations by:

- **Dr Mehdi Ghazavi Dozein**, University of Melbourne;
- **Dr Ahvand Jalali**, Australian Energy Market Operator;
- **Russell Frost**, Australian Energy Market Operator;
- **Farhad Billimoria**, University of Oxford;
- **Christiaan Zuur**, Australian Clean Energy Council; and
- **Professor Pierluigi Mancarella**, Energy Systems Program Leader at MEI

### **Net-zero distribution networks**

24 November 2022

MEI on 24 November 2022 hosted a public lecture by **Professor Jovica Milanović** from the University of Manchester. Discussion was moderated by **Professor Pierluigi Mancarella**, Program Leader in Energy Systems at MEI.

In this presentation, Professor Milanović introduced the characteristics and challenges of the distribution network environment, now and into the future. First, the presentation briefly introduced the key characteristics of future net-zero distribution networks and summarised the key challenges associated with their operation, modelling and control. Second, examples were discussed of the latest research results in distribution network modelling and operation. Finally, the presentation ended with a brief summary of current developments in the UK related to the Electricity Distribution Price Control 2023-2028 (RIIO-ED2). The RIIO-ED2 price control sets the outputs that the 14 electricity Distribution Network Operators need to deliver for their consumers and the associated revenues they are allowed to collect for the five-year period from 1 April 2023 to 31 March 2028. Lessons drawn for operation, modelling and control of future net-zero distribution networks.

### **Delivering net zero: Challenges and opportunities of the next industrial revolution**

14 December 2022

An economy-wide transformation to net-zero emissions is a national commitment. It will require the planning, building and financing of infrastructure at a scale and pace unprecedented outside wartime.

MEI and Grattan Institute on 14 December hosted a public seminar on the challenges and opportunities that lie ahead.

The expert panel included MEI Director **Professor Michael Brear**, Grattan Institute's Energy and Climate Change Program Director **Tony Wood**, and **Zoe Whitton**, Managing Director of specialist climate change consultancy Pollination. The panel discussion and audience Q&A was moderated by ABC presenter **Patricia Karvelas**.





## Popular articles

The following articles were authored by MEI researchers and Fellows. The articles appeared in *Pursuit*, the University of Melbourne's academic research publication, and *The Conversation*, a news platform that publishes stories written by academics and researchers.

### **Energy poverty in the climate crisis: what Australia and the European Union can learn from each other**

*The Conversation*, 23 February 2022

**By Dr Sangeetha Chandrashekeran and Dr Dylan McConnell, University of Melbourne, and Johanna Cludius, Viktoria Noka, David Ritter, Oeko-Institut**

As the transition to clean energy unfolds, some fear the decarbonisation of the electricity sector will mean higher prices. And high prices can lead to energy poverty: when a household cannot afford the essential electricity services needed for a decent standard of living, such as heating.

### **What is petrol excise, and why does Australia have it anyway?**

*The Conversation*, 16 Mar 2022

**By Prof. John Freebairn, University of Melbourne**

Our fuel tax is only a rough approximation of the cost of using roads, and it will get worse.

### **Clear skies and longer lives**

*Pursuit*, 9 August 2022

**By Dr Kerry Nice, A/Prof. Jason Thompson, Dr Sachith Seneviratne and Prof. Mark Stevenson, University of Melbourne**

Global COVID-19 pandemic restrictions provided a natural experiment in understanding the relationship between transport and air pollution.

### **How to get to full employment: Ross Garnaut's address to the jobs summit**

*The Conversation*, 1 September 2022

**By Prof. Ross Garnaut, University of Melbourne**

Australia hasn't tried hard enough to deliver full employment. We are well-placed, if we play to our natural strengths – including having the best solar and wind resources in the developed world.

### **Smart fertilisers for food security**

*Pursuit*, 20 October 2022

**By Dr Shu Kee Lam, Dr Emma (Xia) Liang, Prof. Uta Wille, Dr Hangwei Hu, Prof. Frank Caruso, A/ Prof. Kathryn Mumford, Prof. Bill Malcolm, Dr Baobao Pan, Prof. Ji-zheng He, A/ Prof. Helen Suter and Prof. Deli Chen, University of Melbourne**

Fertilisers that increase nitrogen efficiency are being designed to boost crop productivity while reducing farming costs and environmental impact.

## Government submissions

### **Clean Economy Workforce Development Strategy - Submission to the Victorian Department of Education and Training**

**Date of submission:** 14 April 2022

**Lead Academic:** Prof. Michael Brear and Prof. Jacqueline Peel

The University of Melbourne was given the opportunity to contribute to the development of the Victorian Government's Clean Economy Workforce Development Strategy.

## Advisory to Government

### **Hydrogen Guarantee of Origin project**

MEI was contracted by the Clean Energy Regulator (CER) to facilitate a Technical Advisory Panel (TAP), comprised of technical specialists from MEI and Princeton University, to advise the CER on the development of a robust and practical methodology for its proposed Guarantee of Origin (GO) scheme for hydrogen and derived products. The CER requested that the TAP's work should build on the discussion paper A Hydrogen Guarantee of Origin scheme for Australia and consider hydrogen production via the following three pathways:

- electrolysis;
- gasification of coal with carbon capture and storage (CCS); and
- steam methane reforming (SMR) of natural gas with CCS.

The TAP's work on these three hydrogen production pathways provided analysis and suggestions on GO scheme design. This work was essentially in four parts:

- provision of process maps for representative hydrogen production plants with all inputs, outputs, and flows within, including the potential GHG emission sources, given our own experience, views from industry that were tabled in the CER's workshops, and publicly available information;
- assessment of indicative process emissions intensities, sensitivity of the emissions intensity to key performance parameters, and an indication of the maximum process efficiencies and minimum emissions intensities;
- identification of the minimum measurements required to determine the process' emissions intensity, including suggestions of measurement apparatus and required precision/accuracy; and
- analysis of potential co-products and approaches to their emissions allocation.



The TAP also delivered a detailed review of a calculator tool prepared by an external consultant for the CER to be used by industry for data gathering and reporting. Significant improvements were identified by the TAP and incorporated by the CER into the final version of the tool.

The proposed GO scheme is potentially very significant as it is intended to enable certification of the greenhouse gas emissions intensity of hydrogen in the first instance, with plans to expand it to ammonia and other, internationally traded commodities. The trial of the GO scheme is ongoing and MEI have been retained on this project as advisors.

## Communications and media

Through the following communications channels, MEI aims to contribute to the national energy debate by presenting a range of views on relevant and critical industry issues.

### NEWSLETTERS

#### [energy@melbourne](mailto:energy@melbourne)

MEI's monthly external newsletter, [energy@melbourne](mailto:energy@melbourne), is our key communication tool. With a subscriber list of over 5,500, information about MEI's research as well as important news and events is sent directly to stakeholders in industry, government, community and academia.

### MEDIA

#### [Money Today Networks - Korean Media delegation](#)

May 2022

In May 2022, MEI hosted TV journalists from South Korean media outlet *Money Today Networks*. The journalists interviewed MEI's Power Generation and Transmission Program Leader **Prof. Richard Sandberg** and his research team for a documentary on hydrogen conversion, storage and use, co-fired power generation, and liquefied hydrogen safety.

#### [Here's everything that's cheaper than petrol right now](#)

*The Australian*, 24 May 2022

MEI Director **Prof. Michael Brear** was interviewed by *The Australian* on the drivers behind the escalating price of fuel.

#### [Australia's energy crisis](#)

*ABC Radio Melbourne*, 16 Jun 2022

**Prof. Michael Brear** was interviewed by ABC Radio Melbourne about Australia's energy crisis and whether Victoria will face outages due to inadequate generation.

#### [As the eastern states face an energy crisis, Victoria may be in a slightly better position. Here's why](#)

*ABC News*, 16 Jun 2022

In this interview with ABC News, **Prof. Michael Brear** discussed Victoria's coal generation and price of generating electricity.

#### [No home solar battery rebates on offer in Queensland as the government opts for large-scale projects](#)

*ABC News*, 26 Jun 2022

**Prof. Michael Brear** was interviewed regarding the advantages of residential batteries and solar panel installations.

#### [Conservatives blame the energy crisis on net zero climate goals – but what is really going on?](#)

*The Guardian*, 7 July 2022

**Prof. Michael Brear** was interviewed by *The Guardian* regarding the factors behind the rise in Australia's electricity prices.

#### [Alcoa faces fury over 'dying' Great Ocean Rd river](#)

*The Australian*, 8 July 2022

MEI Fellow **Prof. Ralf Haese** was mentioned in an article in *The Australian* about the need for an independent panel of experts to examine the impacts of a defunct power station on the Anglesea River.

#### [Banning coal and gas not the answer to lower emissions](#)

*The Australian*, 21 July 2022

In an interview with *The Australian*, **Prof. Michael Brear** was interviewed for his opinion on whether banning new Australian coal and gas projects lower global gas emissions.

#### [A neighbourhood battery could solve Apollo Bay's energy woes, but it's more than the town can afford](#)

*ABC Ballarat*, 7 August 2022

In this interview with ABC Ballarat, MEI's Energy Systems Program Leader **Prof. Pierluigi Mancarella** explained how battery energy storage systems are a crucial step in the decarbonisation of the electricity grid, as supply and storage becomes more decentralised.

#### [Hundreds of Victorian renewable energy projects in limbo after program funding ceases](#)

*ABC Ballarat*, 7 August 2022

**Prof. Pierluigi Mancarella**, was interviewed by ABC Ballarat about the important role community renewable energy projects will play in Victoria's renewable energy transition.

#### [Could MCEC's roof be the key to unlocking a decarbonised energy system in Southbank?](#)

*Southbank News*, 10 August 2022

In this interview with Southbank News, **Prof. Pierluigi Mancarella** discussed the Power Melbourne project, and commented on the government's potential plans for an "inner-city solar farm" to be installed on the roof of the Melbourne Convention and Exhibition Centre.

#### [How do you keep chickens cool in a warming climate?](#)

*Cosmos Magazine*, 22 August 2022

MEI Fellow **Prof. Guillermo Narsilio** was interviewed about an ARENA-funded research project that will support the development of a thermal ground source heat pump system to replace LPG as a fuel for heating and cooling sheds for housing chickens.

### Radio interview, ABC Riviera

ABC Riviera, September 2022

During this radio interview, **Prof. Pierluigi Mancarella** discussed the technical and economic considerations around the HumLink energy transmission project.

### Vic coal power plant likely to close early

Multiple publications, 21 October 2022

The Australian Associated Press interviewed **Prof. Pierluigi Mancarella** about the likelihood of Victorian coal-fired power plants shutting down earlier if ambitious renewable energy targets were met. The article was syndicated across several publications.

### Energy spotlight remains on Vic election

Multiple publications, 14 November 2022

In this interview, **Prof. Pierluigi Mancarella** discussed the Victorian energy landscape and how renewable will guarantee security of power supply. The article was syndicated across multiple publications.

### Media activity surrounding the Net Zero Australia project

There was significant media interest following the launch of the Net Zero Australia interim results on how Australia might achieve net zero emissions for both its exports and domestic energy systems. Members of the project's Steering Committee, **Prof. Robin Batterham** and **Prof. Michael Brear** (University of Melbourne), **Dr Chris Greig** and **A/Prof. Simon Smart** (University of Queensland), **Richard Bolt** (Nous Group), and **Katherin Domansky** (Woodside), were interviewed by various media publications. Some of these interviews included:

#### Net zero will be a huge task – but it is also an achievable one

- Opinion piece by **Prof. Robin Batterham** and **Richard Bolt**

*Australian Financial Review, 24 August 2022*

#### Report reveals the staggering scale of Australia's net-zero path

- Quote from **Richard Bolt**

*Australian Financial Review, 25 August 2022*

#### Super should fund green steel in the Pilbara

- Interview with **Prof. Michael Brear** and **A/Prof. Simon Smart**

*Australian Financial Review, 25 August 2022*

#### Terawatts of solar and a million new jobs: New report crunches net-zero numbers

- Quote from **Prof. Robin Batterham**

*Renew Economy, 25 August 2022*

#### Australia needs massive renewable energy expansion to hit net zero by 2050 - study

- Interview with **Prof. Michael Brear**

*Reuters, 25 August 2022*

This article was syndicated across several publications.

#### Report reveals massive renewable energy expansion needed to hit net zero target

- Quotes from **Prof. Robin Batterham**, **A/Prof. Simon Smart** and **Richard Bolt**

*PV Magazine, 26 August 2022*

#### Want to see our energy future? Just look at Britain's mess

- Article quotes the Net Zero Australia study

*The Australian, 27 Aug 2022*

#### 1.3m new workers required to hit net zero by 2050, report reveals

- Quotes from **Prof. Robin Batterham** and **Prof. Michael Brear**

*Investor Daily, 30 August 2022*

#### What are green jobs? How do I train for a career in clean energy?

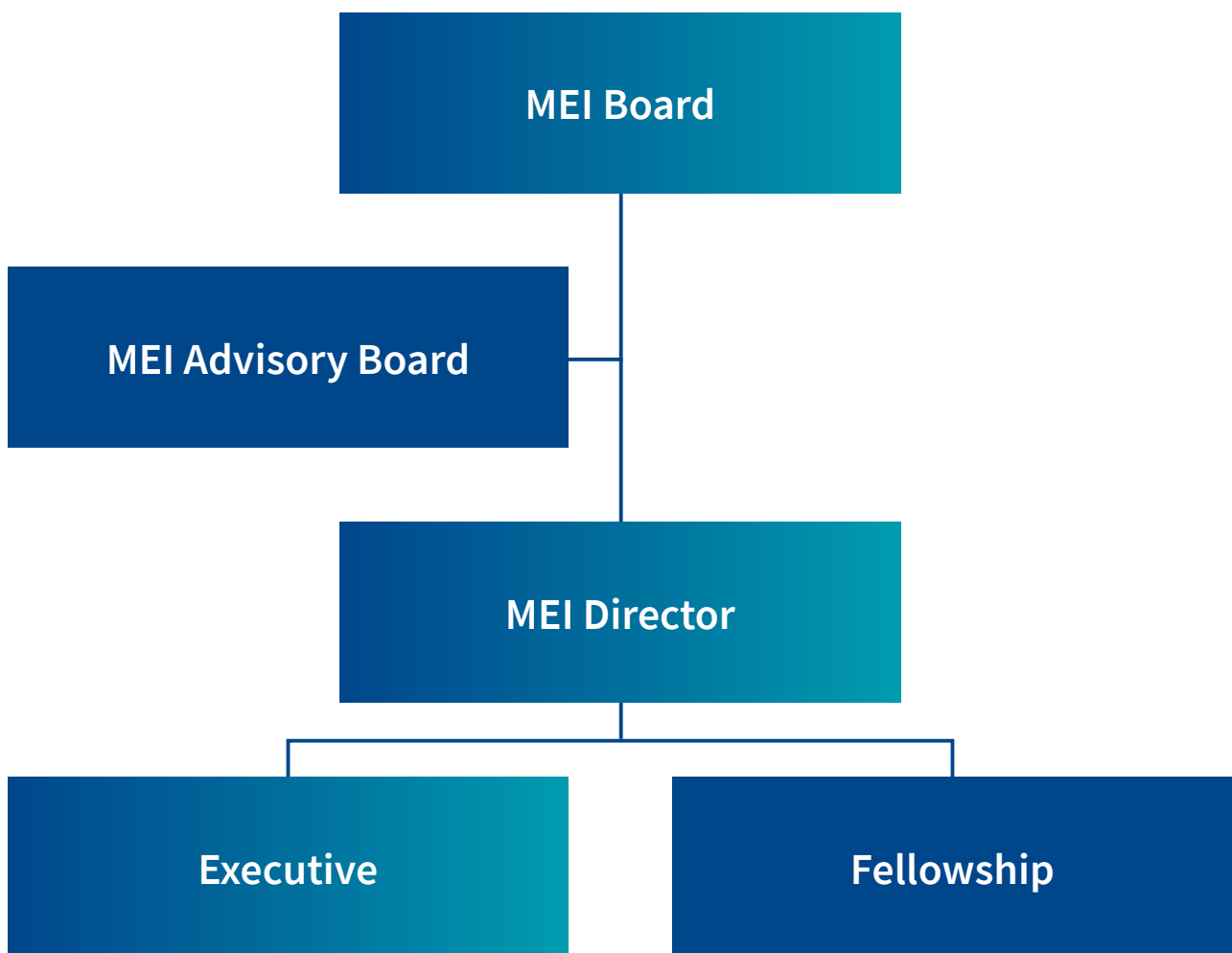
- Interview with **Prof. Michael Brear**

*ABC, 11 September 2022*



# Governance

The Melbourne Energy Institute reports to the MEI Board for operational matters. The Institute Director, a team of professional staff and the Executive Committee work together to operate MEI, and the Advisory Board and Fellows provide strategic advice.



## MEI Board

**Professor Mark Hargreaves**, *Pro Vice-Chancellor (Research Partnerships and Infrastructure) (Chair)*

**Professor Stuart Wyithe**, *Associate Dean, Research, Faculty of Science*

**Professor Frank Vetere**, *Deputy Dean (Engagement), Faculty of Engineering and Information Technology*

## Advisory Board

**Mr Andrew Stock**, *Councillor, Climate Council (Chair)*

**Mr Michael Bielinski**, *CEO Siemens Energy*

**Ms Mel Cutler**, *Head of Purpose, Strategy and Environment, ANZ*

**Ms Sally Farrier**, *Company Director*

**Mr John Theunissen**, *Manager Network Innovation, Regulated Energy Services, AusNet Services*

**Mr Tony Wood**, *Energy Program Director, Grattan Institute*

## Executive Committee

**Professor Michael Brear**, *Director, Melbourne Energy Institute (Chair)*

**Ms Anita La Rosa**, *Institute Manager, Melbourne Energy Institute*

**Professor Pierluigi Mancarella**, *MEI Program Leader Energy Systems, and Chair Professor of Electrical Power Systems*

**Associate Professor Kathryn Mumford**, *MEI Program Leader Hydrogen and Clean Fuels, and Associate Professor in the Department of Chemical Engineering*

**Dr Adrian Panow**, *Director Major Projects, Melbourne Energy Institute*

**Professor Richard Sandberg**, *MEI Program Leader Power Generation and Transport, and Chair of Computational Mechanics*

**Associate Professor Wallace Wong**, *MEI Program Leader Energy Materials, and Senior Lecturer in the School of Chemistry*

# Financial summary

<b>Internal Income</b>	<b>\$</b>
Core funding from Deputy Vice-Chancellor (Research)	\$1,000,000
Other income	\$220,447
<b>TOTAL INTERNAL INCOME</b>	<b>\$1,220,447</b>
<b>Expenditure</b>	
Institute staff salaries	\$752,732
Administration & general costs	\$10,200
Events & communication	\$10,200
Research project support salaries	\$275,590
Research project seed funding	\$501,014
Partnership development	\$40,111
<b>TOTAL EXPENDITURE</b>	<b>\$1,589,847</b>
<b>External Income</b>	
ARC	\$1,770,000
Industry – direct contract and leveraged	\$14,901,000
Government	\$3,280,000
Philanthropy	\$0
Other	\$490,000
<b>TOTAL EXTERNAL INCOME</b>	<b>\$20,441,000</b>



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## CONTACT US

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