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Almost a century ago, Sir John Monash set in motion Victoria’s first energy transformation during his tenure as the Chairman of the State Electricity Commission of Victoria. This was the beginning of an electricity supply industry that was to become the lifeblood of industrial and economic development throughout the State.

Our world today is going through a second transformation in the history of the electricity and more broadly the energy sector. We are observing a phenomenal period of change in the way we harness and use energy. As a result, the urgency for this change continues to make headlines in the popular press and gets debated at the highest levels of government and global alliances. Yet, we still don’t know how to transition to an energy future that addresses climate change issues while also ensuring that people have access to reliable and affordable energy sources. This is why we need the best minds working together to develop and translate new insights and innovations that pave the way for a sustainable energy future.

At Monash University, we have set ourselves ambitious goals to discover the fundamental science behind new energy resources, materials, devices and systems, with a view to create a more efficient and sustainable energy future. The uptake of new energy innovation is dependent on market appetite, regulatory and policy frameworks, and ultimately the way people choose to engage with technologies that depend on or provide energy.

We have over 150 leading academics and staff working on major research programs, including three Australian Research Council funded Centres of Excellence in the field of energy, ACES, ACEx and FLEET, with a focus on a wide range of topics that range from the fundamentals of new energy fuels through to socio-economics and regulatory aspects of energy.

In addition to exceptional research, strong industry research partnerships are one of the most important elements of what we do, as they enable us to translate our knowledge and create impact. Programs like the Woodside Monash Energy Partnership, Net Zero Initiative and the Grid Innovation Hub have enabled us to work with energy sector leaders to focus on research and education topics that are of value to the sector, whilst demonstrating new technologies and research outcomes in a living laboratory environment that our Clayton campus has become.

This conference brings together energy leaders, professionals and researchers from industry and across Monash University to share the latest research insights and discuss new ideas with a view to accelerate transition towards a sustainable energy future.

I welcome you to the inaugural Monash Energy conference.

Jacek J. Jasieniak
Director, Monash Energy Materials and Systems Institute (MEMSI)
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<th>Time</th>
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<td>8.00</td>
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| 8.30  | Opening                                                             | Boon Wurrung Foundation  
Associate Professor Jacek Jasieniak, Director, MEMSI  
Professor Marc Parlange, Provost and Senior Vice-President |
| 8.50  | Keynote Speaker                                                      | Dr Amanda Caples, Victorian Lead Scientist |
| 9.10  | Energy Leaders Panel Discussion: 'The Role of Universities in the Energy Sector' | Moderator:  
Ms Chloe Munro AO, Energy Transition Hub  
Panel Speakers:  
Dr Amanda Caples, Victorian Lead Scientist  
Professor Simon Wilkie, Dean of the Faculty of Business and Economics  
Mr Neil Kavanagh, Chief Science & Technology Manager, Woodside Energy  
Mr Kevin Hart, Asia Regional Leader GE Power Digital |
| 10.10 | Morning Tea                                                         |                                                                            |
| 10.40 | 'The Control of Excitonic Materials for Solar Energy Harvesting'    | Professor Udo Bach,  
Chief Investigator, ARC Centre of Excellence (CoE) in Exciton Science (ACEs) |
| 11.10 | 'Energy Research in the Australian Centre for Electromaterials Science' | Professor Doug MacFarlane,  
Chief Investigator, ARC CoE for Electromaterials Science (ACEs) |
| 11.40 | 'Light-Transformed Materials for Low-Energy Electronics'            | Professor Kris Helmerson,  
Chief Investigator, ARC CoE in Future Low-Energy Electronics Technologies (FLEET) |
| 12.10 | Lunch                                                               | Dr Tony Marxsen, Chairman, Grid Innovation Hub |
| 13.10 | Keynote Speaker: 'Building Australia's New Energy Sector'          |                                                                            |
| 13.40 | Academic Panel Discussion                                           | Moderator:  
Professor Rob Raven,  
Deputy Director of Research, Monash Sustainable Development Institute  
Panel Speakers:  
Associate Professor Megan Farrelly,  
Human Geography, Faculty of Arts  
Associate Professor Arthur Campbell,  
Economics, Faculty of Business and Economics  
Professor Maria Garcia de la Banda,  
Chief Examiner, Faculty of Information Technology |
| 14.30 | Afternoon Tea                                                       |                                                                            |
| 15.00 | Monash Net Zero Initiative                                          | Mr Scott Ferraro, Program Director, Net Zero Initiative |
| 15.20 | 'Translating Novel Battery and Supercapacitor Technologies Through Industry Partnerships' | Professor Mainak Majumder,  
Faculty of Engineering |
| 15.40 | 'Engaging Households Towards the Future Grid: A Strategy for the Energy Sector' | Dr Larissa Nicholls, Senior Research Fellow, Emerging Technologies Lab,  
Faculty of Information Technology |
| 16.00 | Wrap-up                                                             | Associate Professor Jacek Jasieniak, Director, MEMSI |
| 16.10 | Presentation by the Monash Energy Club  
Networking Over Student Poster and Photo Competition |                                                                            |
| 17.00 | Student Awards: Photo and Poster Competition                       |                                                                            |
| 17.30 | End                                                                 |                                                                            |
8.30: INTRODUCTION

ASSOCIATE PROFESSOR JACEK JASIENIAK
Director, MEMSI

Jacek Jasieniak is the Director of the Monash Energy Materials and Systems Institute. He completed a Bachelor of Science (1st Class Honours) from Flinders University (2003, University Medal) and PhD from the University of Melbourne (2008, Chancellor’s Prize). He then undertook postdoctoral work at CSIRO (2008-11), and was a Fulbright Fellow at the University of California Santa Barbara (2011-12). He returned to CSIRO, progressing to a Senior Research Scientist and then Group Leader before moving to Monash University as an A/Professor in 2015. His research interests include the development of nanomaterials and their use in various next-generation energy technologies.

8.30: ENERGY RESEARCH AT MONASH UNIVERSITY

PROFESSOR MARC PARLANGE
Provost and Senior Vice-President

Professor Marc Parlange is the Provost and Senior Vice-President of Monash University and a Professor in the Department of Civil Engineering. As Provost, Marc leads the ten Monash Faculties and is responsible for the development and oversight of the University’s student profile and for the performance of academic staff. Marc also oversees the development, implementation and continuous improvement of the University’s research vision, within the context of Focus Monash.

Prior to his appointment at Monash in 2017, Professor Parlange was Dean of the Faculty of Applied Science at the University of British Columbia (Canada). He served as Dean of the School of Architecture, Civil and Environmental Engineering (2008 - 2013) and Director of the Institute of Environmental Engineering (2004 - 2007) at the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland.

8.50: KEYNOTE

DR AMANDA CAPLES
Victoria’s Lead Scientist

Dr Amanda Caples BSc Hons PhD GAICD is Victoria’s Lead Scientist, a ‘catalyst’ responsible for working across the Victorian Government to identify opportunities for economic outcomes by building relationships between business, the research sector and government. Amanda brings to the role broad experience in technology commercialisation, public policy development and governance of public and private entities.

Amanda joined the Victorian public service in 2002 as the inaugural Director of Biotechnology and subsequently was appointed as the Executive Director Science and Technology and Deputy Secretary Sector Development and Programs to drive the state’s science agenda. In these roles, Amanda has led the development of industry sector strategy plans, delivered research-led health initiatives, regulatory and legislative scientific reforms and established international business development and research alliances. Amanda has worked with Commonwealth agencies on national science and innovation policies and programs, including the Australian Synchrotron and the National Collaborative Research Infrastructure Scheme.
9.10: ENERGY LEADERS’ PANEL DISCUSSION: ‘THE ROLE OF UNIVERSITIES IN THE ENERGY SECTOR’

Moderator:
Chloe Munro (Monash Professorial Fellow).

Panel Speakers:
Dr Amanda Caples, Victoria’s Lead Scientist, Neil Kavanagh (Woodside Energy), Professor Simon Wilkie (Faculty of Business and Economics) and Mr Kevin Hart

MODERATOR

MS CHLOE MUNRO AO
Monash Professorial Fellow

A leader in energy policy and regulation, Ms Munro is actively engaged with the energy and financial services industries through a number of board positions. She is also the independent Chair of the Energy Transition Hub expert advisory panel. She was previously Chair of the Clean Energy Regulator and a panel member of the Independent Review into the Future Security of the National Electricity Market (Finkel Review).

PANEL SPEAKER

MR NEIL KAVANAGH
Chief Science & Technology Manager

Mr Neil Kavanagh is responsible for Woodside Energy Ltd.’s Strategic Technology Plan and innovation and technology planning through the company. Woodside is Australia’s largest publicly traded oil and gas exploration production company and one of the World’s leading producers of Liquefied Natural Gas.

PANEL SPEAKER

MR KEVIN HART
Asia Regional Leader GE Power Digital

As Asia Regional Leader for GE’s Power Digital business, Kevin’s focus is on developing GE’s digital growth strategies and business activities in the power generation and T&D sectors across Australia, New Zealand, Asia and India. In addition, he continues to lead GE’s overall activities in New Zealand.
PANEL SPEAKER

PROFESSOR SIMON WILKIE
Dean of the Faculty of Business and Economics

Professor Simon Wilkie is Dean and Head of Monash Business School. His previous academic appointments include Professor of Economics and Communications Law at USC Department of Economics and Gould School of Law, Chair of the Department of Economics at USC and Executive Director of the USC Center for Communications Law and Policy. His academic research focuses on game theory its application to business strategy, economic policy design, and the tele-communications industries. He is cofounder of Competition Economics, and in that capacity has advised corporate and government clients on; spectrum auctions, strategy, competition policy and regulatory issues, and several start-ups on strategy. He has also held the roles of Chief Economist at the US Federal Communications Commission and Chief Economic Strategist for Microsoft.

10.10: MORNING TEA

10.40: ARC CENTRE OF EXCELLENCE IN EXCITON SCIENCE (ACEx):

PROFESSOR UDO BACH,
Chief Investigator, ARC Centre of Excellence in Exciton Science (ACEx)

Professor Bach is a full professor at Monash University, the Deputy Director of the ARC Centre of Excellence in Exciton Science and an ANFF-VIC Technology Fellow at the Melbourne Centre of Nanofabrication (MCN). Bach is a solar energy expert who has worked with numerous solar industry partners including: Hoechst, Ntera, Bluescope Steel, Bosch, Innova, Suntech, Trina Solar. In November 2005 he established his own research group at Monash University in the area of photovoltaics and nanofabrication. He is involved in fundamental and applied research in the area of perovskite and dye-sensitised solar cells. He has additional research activities in the area of nanofabrication, DNA-directed self-assembly, nanoprinting, plasmonics for sensing, photovoltaic applications and combinatorial photovoltaic materials discovery.

The ARC Centre of Excellence in Exciton Science (ACEx) carries out cutting edge research across 5 Australian Universities in close collaboration with CSIRO and international teams. Our ambition is to achieve the control of excitonic materials for solar energy harvesting and improved energy efficiency in security, lighting and sensing applications. Our research on solar energy harvesting spans from fundamental studies, modelling and characterisation to complete device fabrication and big data analysis, resulting in a strong network boosting the progress of this technology. This talk will cover the most exciting advances of ACEx in three main topics; Luminescent Solar Concentrators, Photon Upconversion and Next Generation Solar Cells.
11.10: ENERGY RESEARCH IN THE AUSTRALIAN CENTRE FOR ELECTROMATERIALS SCIENCE

PROFESSOR DOUG MCFARLANE
Chief Investigator, ARC Centre of Excellence for Electromaterials Science (ACEs)

Professor Doug MacFarlane is an Australian Laureate Fellow at Monash University’s School of Chemistry and leader of the Energy Program in the Australian Centre for Electromaterials Science. He is the Australian Academy of Science’s Craig Medalist 2018 and winner of the Victoria Prize for Science and Innovation 2018. His interests cover a broad range of materials chemistry for renewable energy generation and storage. He has published more than 650 papers and 30 patents, including papers in Science and Nature. Professor MacFarlane was elected to the Australian Academy of Science in 2007 and the Academy of Technological Sciences and Engineering in 2009. He is a member of the Editorial Advisory Boards of Chemical Communications, Green Chemistry, Sustainable Energy and Fuels, ACS Sustainable Chemistry and Engineering and ChemSusChem.

The ARC Centre of Excellence in Electromaterials Science has a major focus on ‘new energy’ science and technology including batteries, thermocells and solar fuels. The Centre is spread across 8 nodes in South Eastern Australia, however, the main energy projects are based at Monash and Deakin Universities. In the ‘Solar Fuels’ area, efficient production of ammonia from renewable energy represents an important technology for future means of global transportation of renewable energy from remote land and marine areas where it can be generated inexpensively at massive scale. The direct electrochemical nitrogen reduction reaction (eNRR), coupled with the oxygen evolution reaction (OER), is an attractive approach to the generation of ammonia from renewables and this talk will overview the technology options in respect of this process. The eNRR as carried out in traditional solvents is of relatively low efficiency under ambient conditions compared to other energy storage mechanisms and this is currently limiting the technology. One of the reasons for this low efficiency is the very poor solubility of N₂ in many electrochemical solvents. Fortunately, some non-aqueous electrolyte systems offer considerably higher nitrogen solubility, up to 20 times or more than in water, and this has allowed us to demonstrate breakthrough levels of selectivity in this reaction. In the battery area, the Centre has focussed on metal batteries including next generation sodium and magnesium batteries, these being cheaper and safer alternatives to lithium. High voltage flow battery systems are also under development. We will discuss recent progress in these areas and the likely trajectories for future development.
11.40: LIGHT-TRANSFORMED MATERIALS FOR LOW-ENERGY ELECTRONICS

PROFESSOR KRIS HELMERSON
Chief Investigator, ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET)

Professor Kristian Helmerson has performed ground-breaking experiments in the fields of ultracold collisions of atoms, matter-wave optics, nonlinear dynamics with atoms, superfluidity of atomic gases and atomtronics; he was instrumental in establishing the field of nonlinear atom optics. He leads FLEET’s Research Theme 3 on Light-transformed materials. His team uses ultracold atoms interacting with light as a model system to investigate dissipation in dynamic systems, and creation of topological states in multi-dimensional extensions of these systems.

The ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET) addresses a grand challenge: reducing the energy used in information and communication technology (ICT), which already accounts for up to 8% of the electricity use on Earth and is doubling every 10 years. The ‘internet of things’ would drive this energy demand even higher. Within a decade, the financial and environmental cost of electricity use will limit the growth of computing. The current, silicon-based technology (CMOS) is 40 years old, and reaching the limits of its efficiency.

FLEET’s solution will be a new generation of ultra-low energy electronics that will allow computing to continue to grow. FLEET will develop electronic devices in which electrical current can flow with near-zero resistance and dissipation of heat. This presentation will give an overview of FLEET research programmes and Centre’s capabilities at Monash, as well as one of the Centre’s approach to achieving dissipationless transport, dynamically.

12.10 LUNCH

13.10: KEYNOTE SPEAKER: BUILDING AUSTRALIA’S NEW ENERGY SECTOR

DR TONY MARXSEN
Chairman Grid Innovation Hub

Dr Tony Marxsen worked in all aspects of electricity transmission and distribution engineering and business management. He held CIO roles in major public and private sector organisations in energy, manufacturing, insurance and retail sectors. He is former Chairman of Australian Energy Market Operator.

Australia’s energy sector is facing a wave of change greater than any other in its history. New technology, new sustainability imperatives, and rust-belt infrastructure are combining to create a burning platform of national scale. Urgent action is required. The path ahead is most unclear and every element of the status quo is fiercely defended by vested interests. How can universities like Monash best deploy their unique capabilities to de-risk this transition and resolve the national trilemma of energy cost, security and sustainability for the long term? This is a challenge worthy of our best efforts, one which may demand radical innovation in how we think and work.
13.40: ACADEMIC PANEL DISCUSSION

Moderator:
Professor Rob Raven (Monash Sustainable Development Institute).

Panel Speakers:
Dr Megan Farrelly (energy transitions), Associate Professor Arthur Campbell (energy markets) and Professor Maria Garcia de la Banda (optimisation).

MODERATOR

PROFESSOR ROB RAVEN
Deputy Director of Research, Monash Sustainable Development Institute

Rob Raven is Professor of Sustainability Transitions and deputy director (research) at Monash Sustainable Development Institute and professor at the Copernicus Institute of Sustainable Development at Utrecht University. His long-term interest is in understanding the dynamics and governance of sustainability transitions and socio-technical innovation. Rob has made major contributions to multi-level theories of transformative change, socio-technical experimentation and strategic niche management. His empirical work has covered urban, energy and mobility transition processes in Europe and Asia. He co-authored over 70 scientific articles and two books, including The Experimental City (Routledge), and was editor of six special issues in Research Policy, Technological Forecasting & Social Change, Environmental Innovation and Societal Transitions, Local Environment, and Global Challenges. In 2012 he co-founded the global Sustainability Transitions Research Network and won the EASST Chris Freeman award for a significant collective contribution to the interaction of science and technology studies with the study of innovation. He holds editorial roles at the journals Nature Urban Sustainability and Technological Forecasting And Social Change. His current research agenda is focused on analysis of transformative change in urban context such as smart and sustainable cities. Recent projects include NATURVATION and Smart Cycling Futures, which involve substantial partnerships and living labs with urban and industry actors. A key question is how socio-technical experimentation, institutional change and incumbent urban regimes co-produce city futures.

PANEL SPEAKER

ASSOCIATE PROFESSOR MEGAN FARRELLY
Human Geography, Faculty of Arts

Dr Megan Farrelly is an Associate Professor in the School of Social Sciences (Human Geography) in the Faculty of Arts. Her research asks the question, what are the critical processes and pathways that underpin the delivery of sustainable urban transformations. Her work focuses on exploring the role and influence of sustainability experimentation and innovation (technical and governance) in helping to promote and deliver changes in technology, policy, and on-ground practices. Over the last twelve years Megan has worked within the urban water sector, and has more recently used these insights within the energy sector. Her research has involved examining numerous demonstrations and innovations related to trialling innovative alternative water systems, green infrastructure and decentralised energy technologies. Her body of work draws on sustainability transitions, socio-ecological systems and a new institutionalism scholarship, to unpack the patterns and processes associated with expediting the delivery of socio-technical change. Megan’s body of research sees her active at the policy-science interface and has led to more than 35 academic publications.
ASSOCIATE PROFESSOR ARTHUR CAMPBELL  
Faculty of Business and Economics

Arthur Campbell joined Monash University as an Associate Professor of Economics in January 2017. Arthur’s research interests include: Industrial Organisation, Strategy (Pricing, Marketing, Information), Organisational Economics, Market Design, and the Energy Economics. His research has appeared in leading economic journals such as American Economic Review, American Economic Journal: Microeconomics, Rand Journal of Economics and Economic Theory. Before joining Monash Arthur has previously worked as an Associate Professor of Economics at Yale University in the School of Management, Senior Data Scientist at Uber Technologies and Consultant at Frontier Economics. He graduated from Massachusetts Institute of Technology with a PhD in Economics in 2009. He has 6 years of teaching experience to Undergraduate, Graduate and MBA students across a number of subject areas - Competitive Strategy, Energy Market Strategy and Game Theory.

PROFESSOR MARIA GARCIA DE LA BANDA  
Chief Examiner, Faculty of Information Technology

Maria Garcia de la Banda is a Professor at the Faculty of Information Technology, at Monash University and has more than 25 years of experience as an academic. In 1997 she was awarded the first and only prestigious Logan Fellowship for the Faculty of Information Technology at Monash University, a role she held for 6 years. From 2013 to 2016, she was the Deputy Dean of the Faculty of Information Technology at Monash University, and prior to this she was the Head of its Caulfield School of Information Technology. Prof. Garcia de la Banda has extensive research experience in the modelling and solving of combinatorial problems, with particular emphasis on the (semi-)automatic analysis and transformation of constraint programming models, and has been involved in different real-world problems, including the optimisation of the layout of LNG plants, and the optimisation of Melbourne’s water flow system.

14.30: AFTERNOON TEA
15.00: MONASH NET ZERO INITIATIVE

MR SCOTT FERRARO
Program Director, Net Zero Initiative

As Program Director of Monash University’s Net Zero Initiative, Scott and his team are focused on transitioning Monash’s Australian operations to net zero emissions by 2030. The program aims to find translatable solutions to enable the broader transition to net zero emissions required under the Paris Agreement.

Monash University has committed to achieving net zero emissions by 2030 across its four Australian campuses. Scott will provide an update of the UN award winning program, highlighting achievements and next steps.

15.20: TRANSLATING NOVEL BATTERY AND SUPERCAPACITOR TECHNOLOGIES THROUGH INDUSTRY PARTNERSHIPS

PROFESSOR MAINAK MAJUMDER
Department of Mechanical and Aerospace Engineering, ARC Research Hub on Graphene Enabled Industry Transformation

Mainak Majumder is a professor of Mechanical and Aerospace Engineering at Monash University. He applies fundamentals of materials science, notably Carbon, to emerging and multidisciplinary areas of separation engineering and energy storage and in doing so, creates scientific and business opportunities. He has created an ‘innovation eco-system’ involving early stage corporate investment, competitive public funding, scientific discovery, patenting and licensing intellectual property, joint-venturing with end-users and commercialisation, generally in the order stated. He is member of the founding board-of-directors of several graphene-related national activities including the ARC Hub on Graphene Enabled Industry Transformation.

With the growing demand for energy requirements in our daily life, energy storage technologies such as batteries and super-capacitors are critical components in overcoming the intermittent nature of renewable energy sources such as wind and solar power, particularly in grid-level, stationary applications. The growing market of electric vehicles also demands lighter and more efficient energy storage systems to extend the driving range and reduce infrastructure costs for frequent charging requirements. Endowed with natural resources such as Lithium, Cobalt, Nickel, Manganese, and Graphite which are critical components of energy storage technologies, Australia has a real opportunity to establish itself as a ‘smart’ country which can generate intellectual properties, and create new opportunities in this area.

In our team, we have over the years, developed an innovation ecosystem which develops, nurtures, promotes, creates business opportunities and commercialises these technologies. In particular, I will highlight our work with Industry partners, Ionic Industries and Clean Future Energy, Australia in successfully developing a sustained partnership and our efforts in translating graphene-based super-capacitor technologies and energy-dense Li-S battery technologies. Our efforts are truly multidisciplinary involving many departments of Engineering at Monash University ensuring Monash remains the engine-room driving the innovation alongside a broad a suite of strategic collaborations across Europe (Fraunhofer Institute for Material and Beam Technology, Dresden, Germany; Swansea University, UK; Greenmat, University of Liege, Belgium), Asia (Tsinghua University, China; Enserv Power Co., Thailand, Jianghai Capacitor Co. Ltd, Nantong City, China), and Australia (University of Adelaide, Deakin University).
15.40: ENGAGING HOUSEHOLDS TOWARDS THE FUTURE GRID: A STRATEGY FOR THE ENERGY

DR LARISSA NICHOLLS
Senior Research Fellow, Emerging Technologies Lab, Faculty of Information Technology

Larissa’s research brings deeper understandings of household practices and concerns into Australia’s policy debates about energy consumption, affordability, sustainability and reliability. The impacts of energy policy and emerging technologies for vulnerable and disadvantaged households are a key research focus. Having worked extensively in the areas of home energy efficiency and demand management, Larissa is currently investigating how emerging digital technologies may impact future energy demand and infrastructures. Her applied projects involve in-home ethnographic research to explore interactions between energy (technologies, usage, pricing, communications) and social, physical, and financial wellbeing.

The Future Grid is characterised by increasing distributed energy resources and demand response, facilitated by household participation, home batteries and other emerging technologies. This presentation will provide an overview of an electricity sector-wide engagement strategy that was the outcome of the Future Grid Homes project funded by Energy Consumers Australia. The research involved qualitative research with Australian households and industry stakeholders, analysed household engagement materials produced by the sector, and drew inspiration from other related sectors. The findings provide a range of opportunities for engaging households towards the Future Grid. The Engagement Strategy highlights the need for differentiated, flexible and inclusive approaches, which are illustrated through a series of experimental program example ideas intended to help put it into practice. The Engagement Strategy and associated project reports can be downloaded from: http://www.futuregridhomes.net/

16.00: WRAP-UP: ASSOCIATE PROFESSOR JACEK JASIENIAK

16.10: PRESENTATION BY THE MONASH ENERGY CLUB. NETWORKING OVER STUDENT POSTER AND IMAGE COMPETITION.

Be introduced to the newest addition to Monash’s energy portfolio: A student run non-profit facilitating energy industry careers as well as a forum for students across all faculties to learn about energy investments, technology, and policy. A great way for companies to have some face-time with Monash’s most talented energy-focused students.

17.00: AWARDS
**MONASH ENERGY CONFERENCE 2019**

**PROGRAMME DAY 2**

**THURSDAY 19TH SEPTEMBER**

**NEW HORIZONS BUILDING,**
**20 RESEARCH WAY, CLAYTON CAMPUS**

**MORNING**

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<td>8.30</td>
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<td>9.00</td>
<td>Creating grid interactive precincts (chair) - Scott Ferraro</td>
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<td>9.15</td>
<td>Indra Onesait AGM Platform - German Burbano and Andres Molnar</td>
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<td>9.35</td>
<td>Monash Microgrid Transactive Energy Market - Donald Azuatalam,</td>
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<td>Robert Glasgow, and Mohsen Khorasany</td>
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<td>10.00</td>
<td>Q&amp;A/Panel</td>
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<td>10.15</td>
<td>Morning Tea*</td>
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<td>Tour A: Visualising the Monash Microgrid and Indra demonstrations</td>
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<td>(Future Control Room Tour) (45 mins)</td>
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<td>10.45</td>
<td>Woodside Monash Energy Partnership- Rachelle Doyle (Woodside)</td>
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<td>11.05</td>
<td>Tour B: The Monash Microgrid Tour (45 mins)</td>
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<td>11.25</td>
<td>Hydrogen Research, Development and Demonstration (RD&amp;D) Opportunities - Vivek Srinivasan (CSIRO)</td>
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<td>11.45</td>
<td>Hydrogen - Part of the energy mix - Noel Dunlop (ANT)</td>
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<td>12.05</td>
<td>Separation and Storage of Hydrogen with Porous Materials - Matthew Hill (CSIRO/Monash)</td>
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* New Horizons, Level 4, Collaboration Lounge
### Grid Innovation Hub - 2019 Workshop
Enquiries: ariel.liebman@monash.edu

This half-day workshop is a forum for Monash researchers and our industry and government partners who work in the electricity grid innovation area including smart grids, transmission system planning and operation, generation and storage investment and renewable transition modelling.

**Location:** New Horizons, Level 4, Collaboration Lounge

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<td>13.30</td>
<td>GH Introduction- Tony Marxen, Ariel Liebman and Behrooz Bahrani</td>
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<td>FCR Overview and sample demos - Sarah Goodwin</td>
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<td>5-minute project ‘collaboration pitch’- Chair - Behrooz Bahrani</td>
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<td>Q&amp;A Collaboration Panel - Facilitated by B. Bahrani</td>
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<td>15.30</td>
<td>5-minute project ‘collaboration pitch’- Chair - Ariel Liebman</td>
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<td>Q&amp;A Collaboration Panel-Facilitated by A. Liebman</td>
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### ACEx
Enquiries: sonia.ruizraga@monash.edu

This half-day symposium will be focused on sharing Monash’s most exciting research advances in the field of new energy materials. This event is aimed at ACEx members from Monash, the University of Melbourne and CSIRO.

**Location:** New Horizons, Ground Floor, G30

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<td>Back-contact perovskite solar cells - Xiongfeng Lin</td>
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<td>Hot Deposition of Perovskite Solar Cells with Polymer Additive Using Slot Die Coater for Improving Processing Reliability- Jueng-Eun Kim</td>
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<td>14.15</td>
<td>Perovskite solar cells: new prospects beyond lead- Narendra Pai</td>
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<td>14.30</td>
<td>Energy Transfer and Release in Luminous Nanomaterials- Wenping Yin</td>
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* New Horizons, Level 4, Collaboration Lounge
THE MONASH MICROGRID
New Horizons, 20 Research Way, Level 4 Collaboration Lounge, Clayton Campus.

This half-day forum will showcase the development of the Monash microgrid, part of the Net Zero Initiative. This event is aimed at leaders and representatives from the energy sector, Monash staff and students.

9.00: CREATING GRID-INTERACTIVE PRECINCTS (CHAIR)

MR SCOTT FERRARO
Program Director, Net Zero Initiative

As Program Director of Monash University’s Net Zero Initiative, Scott and his team are focused on transitioning Monash’s Australian operations to net zero emissions by 2030. The program aims to find translatable solutions to enable the broader transition to net zero emissions required under the Paris Agreement.

Scott will provide an overview of the Monash Microgrid currently under development at the Clayton campus to help deliver on Monash’s Net Zero Initiative. Covering both the development of the microgrid system in partnership with Indra through the ARENA funded Smart Energy City project, and the business model for commercialisation through the Victorian Government funded Microgrid Electricity Market Operator project.

ABSTRACT

Indra leads the design and implementation of the monitoring and control IoT infrastructure for Clayton Campus Ring 3 and the delivery of a centralised Power Quality Management system, automating the continuous monitoring and control of the microgrid’s power quality parameters. Edge intelligence is connected to each of the applicable buildings and DER resources, enabling energy management strategies ranging from direct monitoring and control of connected DERs up to the dispatch of resources’ participation in a transactive energy market. Indra’s solution maintains safe and reliable technical operation through the matching of buildings loads and flexibility with available resources and market obligations.

9.15: INDRA ONESAIT PLATFORM

MR GERMAN BURBANO
Manager Energy/Oil&Gas Solutions

German is a Senior IT Manager with vast experience in IT and IoT systems with more than 10 years of consulting background in the energy space and expertise in systems architecture. German is currently leading the integration and delivery of Indra’s AGM solution for the Monash Smart Energy City project. He is interested in how innovation and new technologies can be leveraged to face industry challenges.

MR ANDRES MOLNAS
Manager, Head of Energy at Indra Australia

Andres is a Senior Executive in the business of marketing, integration and delivery of IT solutions and consulting services to Energy companies, as well as a Program/Project Manager. He has been working with the Energy and Utilities industry since 1996. Throughout this period, Andres has helped decision-makers and managers in Energy companies in a dozen countries to outline their IT strategies, pick the right solutions and deploy them to their business.
9.35: MICROGRID TRANSACTIVE ENERGY MARKET

DR DONALD AZUATALAM
Program Director, Net Zero Initiative

Donald Azuatalam received a M.Sc. degree in sustainable energy systems from the University of Edinburgh, Edinburgh, U.K. in 2015, and a PhD degree (in view) in electrical engineering from the University of Sydney, Sydney, Australia in 2019. He is currently a Research Fellow with the Faculty of IT, Monash University, Melbourne, VIC, Australia. He also works in conjunction with the Monash eResearch Centre (MeRC), where he is involved in the development of a transactive energy market platform for the Monash microgrid project. His research interests include grid integration of renewable energy systems, energy management of distributed energy resources, distribution network cost allocation, and building energy modelling.

MR ROBERT GLASGOW
Research Engineer

Robert is a skilled software architect with 20 year’s experience designing and delivering innovative software solutions. Prior to joining Monash University in 2018, he spent the majority of his career in the energy sector where he held positions from software engineer to company director. He has successfully delivered numerous projects ranging from industrial IoT platforms to enterprise data solutions. Now based in the Monash eResearch Centre, Robert is leading the NetZero TEM Platform R&D and through this has embraced the opportunity to join Monash’s pursuit of energy innovation and sustainability.

DR MOHSEN KHORASANY
Research Fellow

Mohsen holds a B.Sc. degree and M.Sc. degrees, both in Electrical Engineering. He completed his Ph.D. studies in the same field at Queensland University of Technology at 2019. He is currently a Postdoctoral Research fellow in the Engineering Faculty at Monash University. His research interests include distributed energy resources, transactive energy market, and distributed optimisation.

In this talk, the design, requirements, and different mechanisms of a transactive energy market will be discussed.

10.00: Q&A/PANEL
10.15: MORNING TEA
10.45: MICROGRID TOURS

TOUR A.
VISUALISING THE MONASH MICROGRID AND INDRA DEMONSTRATIONS (FUTURE CONTROL ROOM TOUR)

TOUR B.
THE MONASH MICROGRID TOUR

12.30: LUNCH
GRID INNOVATION HUB
New Horizons, 20 Research Way, Level 4 Collaboration Lounge, Clayton Campus

This half-day workshop is a Monash Grid Innovation Hub event. This workshop is a forum for Monash researchers and our industry and government partners who work in the electricity grid innovation area including smart grids, transmission system planning and operation, generation and storage investment and renewable transition modelling.

About the Grid Innovation Hub (GIH)
MEMSI and external partnership initiative bringing together Monash researchers to undertake high-quality interdisciplinary research to address increasingly complex challenges faced by the Australian energy sector. The GIH is a partnership between industry, innovators and researchers across the Monash University research community to develop and execute a three-year research agenda from 2019.

Monash Researchers or their industry partners will present 5-minute overviews of their research in the following technical areas applied to energy grids:

Smart Energy Systems
- AI, optimisation, data science and ml
- Energy demand and generation forecasting
- Transport electrification
- Remote energy access and indigenous communities
- Energy-aware smart buildings
- Energy markets and systems
- Policy and regulation
- Competition economics
- Just energy transitions
- Consumers and social equity
- Social equity and customer-centric regulation
- Data privacy and ownership

12.30: LUNCH
13.30: GIH INTRODUCTION

DR TONY MARXSEN  
Chairman, Grid Innovation Hub

Dr Tony Marxsen worked in all aspects of electricity transmission and distribution engineering and business management. He held CIO roles in major public and private sector organisations in energy, manufacturing, insurance and retail sectors. He is former Chairman of Australian Energy Market Operator and is the current Chair of the Grid Innovation Hub.

ASSOCIATE PROFESSOR ARIEL LIEBMAN  
Director, Grid Innovation Hub

Associate Professor Ariel Liebman is an energy markets specialist with 20 years’ experience across most aspects of the electricity supply chain. He is a Director of the Monash Grid Innovation Hub, Associate Professor at the Faculty of IT and leads Monash’s Digital Energy initiatives. He brings together researchers from across disciplines such as AI and Electrical Engineering to help integrate new energy technologies and is also Deputy Director of the Monash Energy Materials and Systems Institute.

DR BEHROOZ BAHRANI  
Director, Grid Innovation Hub

Dr Behrooz Bahrani received his PhD degree from the Ecole Polytechnique Federale de Lausanne (EPFL), Lausanne, Switzerland, in 2012, in electrical engineering. He is currently a Lecturer in the Electrical and Computer Systems Engineering Department, at Monash University, and a Director of the Monash Grid Innovation Hub. Prior to joining Monash, he was a postdoctoral researcher at several institutes including Purdue University, Georgia Institute of Technology, and the Technical University of Munich. His research interests include power electronic converters and their applications in power systems, and grid integration of renewable energy resources.
13.45: FUTURE CONTROL ROOM: OVERVIEW AND SAMPLE DEMOS

DR SARAH GOODWIN
Lecturer, Immersive Analytics Lab (IALab)

Dr Sarah Goodwin is a Lecturer with the Immersive Analytics Lab in the Faculty of Information Technology. Her research explores visual analytic solutions for complex, multi-dimensional and geospatial data sets. She seeks to create novel visualisation techniques and improve user-centred visualisation design methodologies. Sarah is focusing on the exploration of new visualisations for the energy sector at different levels, from individual consumers to control room scenarios. She completed her PhD research at City, University of London, where she focused on residential consumer segmentation and smart home data analysis.

The Future Control Room (FCR) is a co-creation of Monash Energy Materials and Systems Institute (MEMSI) and Grid Innovation Hub (GIH), funded and operated by the Faculty of IT, the Faculty of Engineering, and MIVP. The FCR is principally designed to be a Digital Twin of grid and other energy system control rooms of the near future, enabling (1) graduate and professional training purposes, and (2) research into improved monitoring and control systems, reaching into advanced data integration and Human in the loop AI, and ultimately the autonomous operation of smart energy systems.

14.00: 5-MINUTE PROJECT ‘COLLABORATION PITCH’ - CHAIR - DR BEHROOZ BAHRANI
14.30: Q&A COLLABORATION PANEL, FACILITATED BY DR BEHROOZ BAHRANI
15.00: AFTERNOON TEA
15.30: 5-MINUTE PROJECT ‘COLLABORATION PITCH’, CHAIR – A/PROF ARIEL LIEBMAN
16.00: Q&A COLLABORATION PANEL, FACILITATED BY A/PROF ARIEL LIEBMAN
16.30: DRINKS
17.30: CLOSE
This half-day workshop will be a forum for discussion of hydrogen-related initiatives at Monash, CSIRO and local industry. This event is aimed at leaders and representatives from the hydrogen energy sector.

CHAIR: DR JACINTA BAKKER

8.30: REGISTRATIONS OPEN

9.05: OPENING INTRODUCTION

PROFESSOR DOUG MACFARLANE
Chief Investigator, ARC Centre of Excellence for Electromaterials Science (ACES)

Professor Doug MacFarlane is an Australian Laureate Fellow at Monash University’s School of Chemistry and leader of the Energy Program in the Australian Centre for Electromaterials Science. He is the Australian Academy of Science’s Craig Medalist 2018 and winner of the Victoria Prize for Science and Innovation 2018. His interests cover a broad range of materials chemistry for renewable energy generation and storage. He has published more than 650 papers and 30 patents, including papers in Science and Nature. Professor MacFarlane was elected to the Australian Academy of Science in 2007 and the Academy of Technological Sciences and Engineering in 2009. He is a member of the Editorial Advisory Boards of Chemical Communications, Green Chemistry, Sustainable Energy and Fuels, ACS Sustainable Chemistry and Engineering and ChemSusChem.

9.15: THE CHALLENGES OF TRANSPORTING AND STORING HYDROGEN FOR A GLOBAL MARKET

ASSOCIATE PROFESSOR JACEK JASIENIAK
Director, MEMSI

Jacek Jasieniak is the Director of the Monash Energy Materials and Systems Institute. He completed a Bachelor of Science (1st Class Honours) from Flinders University (2003, University Medal) and PhD from the University of Melbourne (2008, Chancellor’s Prize). He then undertook postdoctoral work at CSIRO (2008-11), and was a Fulbright Fellow at the University of California Santa Barbara (2011-12). He returned to CSIRO, progressing to a Senior Research Scientist and then Group Leader before moving to Monash University as an A/Professor in 2015. His research interests include the development of nanomaterials and their use in various next-generation energy technologies.

ABSTRACT

Great excitement exists for the emergence of a global hydrogen market. However, the notion of a hydrogen economy has been around for almost half a century. What has changed? Is it a passing phase? These questions have to be considered from the perspectives of global supply and demand, with indicators clearly highlighting a need for costs of production to be drastically reduced and the global supply chains to be developed in order to supply emerging markets, largely concentrated in Asia. Critical to this will be the development of hydrogen and transport options for hydrogen at an unprecedented scale. In this talk, I will outline the state-of-the art in both of these critical areas, as well as provide clarity on the major challenges that need to be resolved across these in going forward.
9.35: HIGH-PERFORMANCE AND ROBUST ELECTROCATALYSTS FOR RENEWABLE HYDROGEN GENERATION

DR ALEXANDR SIMONOV
Research Fellow

Alexandr obtained PhD degree (2007) from the Boreskov Institute of Catalysis. Initially, his research focused on monosaccharide chemistry, but since 2008, he directed his attention to electrochemistry and electrocatalysis. In 2012, he joined Monash University as a postdoctoral fellow, and then took up an academic appointment in 2018. His research interests are in the design of catalytic and photovoltaic electromaterials, and investigating their properties using advanced electroanalytical and ex situ / in situ spectroscopic techniques.

Water electrolysis presents an energy-efficient and versatile pathway towards the production of truly green hydrogen fuel. The technological importance of the electrolytic hydrogen generation has been now recognised by both industry and academia, which supports a rapid progress in the development of new high-performance catalysts facilitating two half-reactions of the process: the hydrogen and oxygen evolution reactions. However, most research on electrochemical water splitting has focused on catalyst discovery with the use of often prohibitively sophisticated synthesis methods, and with not sufficient attention paid to the robustness of materials in operation under industrially relevant conditions. Our work specifically focuses on these two technologically important aspects. The present talk will highlight some of the recent research undertaken at Monash University and more broadly within the Australian Research Council Centre of Excellence for Electromaterials Science (ACES) towards the aim of the design of low-cost, high-performance and robust water splitting catalysts.

9.55: GLOBAL CHALLENGES NEED GLOBAL SOLUTIONS

PROFESSOR DAMON HONNERY
Deputy Head, Department of Mechanical and Aerospace Engineering

Damon Honnery is a Professor in the Department of Mechanical and Aerospace Engineering Monash University. He is the deputy head of department, the co-director of the Laboratory for Turbulence Research in Aerospace and Combustion, Director of Entrepreneurship and Design in the Faculty of Engineering and a lead researcher in the Woodside Monash Energy Partnership. He has had a long involvement in research in the areas of energy systems and climate change mitigation, involving lead authorship in the most recent UN IPCC Climate Assessment Report.

The most recent assessments of the impact of human induced climate change suggest we have less than five decades to reduce our global emissions of greenhouse gases to zero. Achieving this will require us to develop solutions that can be implemented at a global scale, are widely acceptable, and, given the time frame, not sufficiently different from our current primary energy sources that we must radically alter the operation of our energy system. This talk investigates the role that hydrogen could play in meeting the challenges posed by climate change, as well as giving an overview of the challenges we face.
RACHELLE DOYLE
New Energy Program Manager, Woodside Energy

Rachelle Doyle is the New Energy Program Manager in Woodside’s Technology Function and has over 20 years’ experience within global businesses including Woodside, Chevron, BHP Billiton and Alcoa. Rachelle has worked in system design, commissioning and operations in complex and profit conscious environments. Roles have included process engineering and project management for operations and projects for the minerals, and oil and gas sectors; technology development and implementation and strategic improvement projects for process safety. Rachelle also chairs the Standards Australia ME-093 Hydrogen Technologies committee.

The Woodside Monash Energy Partnership was launched in July 2019. This is a multi-year research partnership builds on the existing FutureLab collaboration. It will enable students and researchers to embrace innovation, design and cutting-edge technology to change global attitudes on sustainability and support Australia’s low-carbon energy transition. This presentation will share the vision and research themes of this exciting new partnership.

VIVEK SRINIVASAN
Manager, CSIRO Futures

Vivek is a Manager in CSIRO Futures, the strategic advisory arm of CSIRO. As part of this role Vivek has worked with government and commercial customers in a diverse range of industries to help senior decision makers understand long-term opportunities and risks and develop strategies to address them using science, technology and innovation. Vivek has conducted analysis and led workshops on different hydrogen technologies and pathways for government and commercial customers. For example, Vivek led CSIRO analysis to support the Western Australian Renewable Hydrogen Strategy. He is currently leading CSIRO’s Hydrogen Research, Development and Demonstration (RD&D) opportunities study.

Research, development and demonstration (RD&D) can contribute to all aspects of the hydrogen industry value chain through lowering costs, aiding scale and rollout, increasing safety, informing community acceptance and minimising harm to the environment. To understand the role of Australian hydrogen RD&D efforts, CSIRO is developing a follow-on report to its 2018 National Hydrogen Roadmap which focuses on identifying the opportunities for RD&D to enable an Australian hydrogen industry. This talk will discuss key themes from the 2018 National Hydrogen Roadmap and share preliminary findings from the Hydrogen RD&D Opportunities study which will be launched in late 2019.
11.25: HYDROGEN - PART OF THE ENERGY MIX

DR NOEL DUNLOP
Executive Director - ANT Energy Solutions

Dr Noel Dunlop received his doctorate from The University of Melbourne in Chemistry and Chemical Engineering, sponsored by Rio Tinto’s energy group, and has an MBA in international management. He has 20 years of experience in translation of science and engineering products and processes both nationally and internationally. Noel is a co-founder of ANT Energy Solutions, which is now a leading hydrogen-based application company driving the uptake of hydrogen for energy, transport and industrial applications.

Hydrogen, whilst not a silver bullet, is a crucial part of the energy mix of the future. Hydrogen has multiple applications including export which is driving down the cost of hydrogen-based energy systems. ANT has developed 100% renewable hydrogen-based energy solutions that are economically viable right now. This presentation will provide examples of these in application and discuss the future direction of how ANT is continuing to make hydrogen-based solutions cheaper, faster and better.

11.45: SEPARATION AND STORAGE OF HYDROGEN WITH POROUS MATERIALS

ASSOCIATE PROFESSOR MATTHEW HILL
ARC Future Fellow

Associate Professor Matthew Hill is an Australian Research Council Future Fellow and the Winner of the Australian Prime Minister’s Prize for Science. Matthew leads an interdisciplinary team of researchers that are actively involved with industry partners to bring exciting discoveries in the laboratory to market. He has 17 patents and more than 100 publications. He graduated from UNSW chemistry in 2006 with a PhD under Prof Robert Lamb and presently holds a joint position between Monash and CSIRO.

The Hydrogen economy is a fast-evolving area with many possible paths to widespread application. Germaine to all of these are several central technological challenges. Two such challenges will be addressed in this presentation. Firstly, the means to purify the hydrogen, either from the complex mixture created during its formation, or following its distribution, within ammonia, produced from methane, or distributed within natural gas infrastructure will be discussed in light of our recent developments with gas separation membranes. Secondly, the storage of hydrogen at lower pressures enables the use of non-cylindrical tanks and hence new use cases, and adsorption within porous materials is a high priority option for delivering this. Our recent results in the adsorptive storage of hydrogen will also be discussed.

12.05: PANEL DISCUSSION
13.00: CLOSE
ARC CENTRE OF EXCELLENCE IN EXCITON SCIENCE (ACEX)
New Horizons, 20 Research Way, Ground floor, G 30, Clayton Campus.

13.00-16.30;
This half-day symposium will be focused on sharing Monash’s most exciting research advances in the field of new energy materials. This event is aimed at ACEx members from Monash, the University of Melbourne and CSIRO.

CHAIR: DR SONIA RUIZ RAGA

13.30: REGISTRATIONS OPEN, WELCOME AND INTRODUCTION

13.35: BACK-CONTACT PEROVSKITE SOLAR CELLS

DR XIONGFENG LIN
Research Fellow

Dr Xiongfeng Lin is currently a postdoctoral research fellow in the Department of Chemical Engineering, Monash University. He completed his Bachelor degree (with honours) at Central South University (China) and Monash University (Australia). He received his Ph.D. from Monash University working in the research group of Prof Udo Bach in 2019. His research interests focus on interfacial modification and back-contact perovskite photovoltaic devices.

ABSTRACT

Hybrid organic-inorganic halide perovskites are low-cost solution-processable solar cell materials that rival those of crystalline silicon. Perovskite typically needs to be “sandwiched” between thin charge transporting layers to perform properly. This configuration affords high-efficiency solar cells, but it features intrinsic drawbacks, such as parasitic light absorption and reflection associated with the charge transporting layers and electrodes. This limits the further improvement of such device towards the theoretical limit. Incorporation of a back-contact architecture provides a solution to these issues and provides a route towards improving device performances to the limit.

Our research group has been a pioneer in the field of back-contact perovskite devices. Several back-contact designs were proposed by our group, including the use of interdigitated electrodes, quasi-interdigitated electrode and honeycomb quasi-interdigitated electrode. This talk will give an overview of the research work carried out regarding back-contact perovskite solar cells in the Renewable Energy group at Monash University.
13.55: HOT DEPOSITION OF PEROVSKITE SOLAR CELLS WITH POLYMER ADDITIVE USING SLOT DIE COATER FOR IMPROVING PROCESSING RELIABILITY

DR JUENG-EUN KIM
Research Fellow

Jueng-Eun Kim received an MS and Ph.D. supervised by Prof. Dong-Yu Kim at the School of Materials Science and Technology, Gwangju Institute of Science and Technology (GIST), Korea. Her research focused on organic-inorganic hybrid solar cells, device processing with slot-die printing and up-scaling solar cell devices. Currently, she is a postdoc at Monash University supervised under Prof. Jacek Jasieniak and co-working on the manufacturing of roll-to-roll printed perovskite solar cells, collaborating with Dr. Doojin Vak at CSIRO.

Heating-assisted deposition is an industry-friendly scalable deposition method. This manufacturing method was employed together with slot die coating to fabricate perovskite solar cells via a roll-to-roll process. The feasibility of the method was demonstrated after initial testing on a rigid substrate using a benchtop slot die coater in air. The fabricated solar cells exhibited power conversion efficiencies (PCEs) up to 14.7%. A non-electroactive polymer additive was used with the perovskite formulation and found to improve its humidity tolerance significantly. These deposition parameters were also used in the roll-to-roll setup. The perovskite layer and other solution-processed layers were slot die-coated, and the fabricated device showed PCEs up to 11.7%, which is the highest efficiency obtained from a fully roll-to-roll processed perovskite solar cell to date.

14.15: PEROVSKITE SOLAR CELLS: NEW PROSPECTS BEYOND LEAD

DR NARENDRA PAI
Research Fellow

Dr. Narendra Pai concluded his PhD research on developing solution processible bismuth-based thin-film solar cells at Monash University in 2019 under the guidance of Dr. Alexandr Simonov and Late Prof. Leone Spiccia. Adjunctive to PhD research, he was awarded post-graduate publication scholarship by School of Chemistry. And before the PhD research, he has spent time on developing photoanodes for dye-sensitised solar cells as part of master’s research. Currently, Narendra is enthusiastic about developing novel lead-free perovskite materials as part of his research fellow position in Bach group.

Perovskite solar cells (PSC) have achieved outstanding progress in the last decade. Unfortunately, the impressive properties come at the price of yet unsatisfactory stability of PSCs and extreme toxicity of lead (II), which is readily soluble in water and can severely damage the human health and environment. In the light of water contamination incidents with Pb2+ across the world, it is unlikely that lead-based PSC will pass regulations in eco-friendly countries like Australia. These considerations promote the research on non-toxic and stable alternatives to hybrid lead perovskites with similarly favourable optoelectronic properties. From this perspective, cheap, abundant, and non-toxic systems based on homovalent and heterovalent lead substitution with promising optoelectronic properties are attracting increasing investigative attention. In this talk, a perspective on the most exciting innovations and challenges in the material science of lead-free perovskites and perovskite-derivatives will be shared.
14.35: ENERGY TRANSFER AND RELEASE IN LUMINOUS NANOMATERIALS

DR WENPING YIN
Research Fellow

Wenping has completed the master and Ph.D. combined course in Engineering, from the Department of Energy Science, Sungkyunkwan University (SKKU), S. Korea, in 2017. During her whole Ph.D. course, Wenping has kept focusing on the dynamic mechanisms study in LEDs and solar devices by time-resolved spectroscopy. After one year of postdoctoral study in SKKU, she moved to Monash University and currently working as a research fellow in the Materials Science and Engineering department and ARC Centre of Excellence in Exciton Science, with research interests in photoluminescent chemical sensors and organic-inorganic hybrid perovskite.

ABSTRACT
Green–red (GR) and blue–red (BR) bilayer stacked quantum dots (QDs) were fabricated using electrospray deposition. Along with steady state and time-resolved photoluminescence (PL), subnanosecond donor PL decay and corresponding acceptor PL rise signals were observed, which are ascribed to the energy transfer between different visible QDs (heterotransfer). The heterotransfer rates were estimated as $(0.57 \pm 0.01 \text{ ns})^{-1}$ and $(0.65 \pm 0.02 \text{ ns})^{-1}$ for GR and BR systems, respectively. Owing to their geometrical proximity, mixed QD layers with GR and BR showed qualitatively higher heterotransfer efficiencies of 64% and 81%, compared to stacked QD layers, which have efficiencies of 23% and 64%, respectively. Based on those mechanism studies, the highly efficient white LED was designed and fabricated.

14.55: TOWARDS SINGLE-CRYSTALLINE PEROVSKITE DEVICES

DR WENXIN MAO
Research Fellow

Dr. Wenxin Mao is currently a postdoc research fellow working with Prof. Udo Bach. He received his PhD at the Department of Chemical Engineering of Monash University at 2019. His research interest including the study of photoelectronic properties of lead halide perovskites and the fabrication of single-crystalline perovskite based optoelectronic devices.

ABSTRACT
Organo-lead halide perovskites (OHPs) have recently emerged as a new class of exceptional optoelectronic materials, which may find use in many applications, including solar cells, light emitting diodes, and photodetectors. However, despite the thorough studies into lead halide perovskites during over past 10 years, there are still many unknowns concerning both the device performance and the stability, which are strongly related to their crystal quality as well as their optoelectronic properties. The first part of this presentation introduces the fabrication of a single-crystalline perovskite based electric-optical modulator device through a novel solution-processed perovskite crystal growth method. The second part of this presentation explores the much-debated mechanism of light induced phase segregation in mixed halide perovskite single crystals.

15.00: AFTERNOON TEA
15.30: HIGH-THROUGHPUT SEARCH FOR ENERGY MATERIALS

DR KEVIN RIETWYK
Research Fellow

Dr Kevin Rietwyk concluded his PhD studies on the electronic properties of semiconductor surfaces at La Trobe University in 2014. He has since enjoyed a 3.5 year post-doctoral appointment at the Zaban laboratory in Bar-Ilan University in Israel, investigating new metal oxide compounds for photovoltaics before joining the Bach group. At Monash, Kevin will employ combinatorial tools to rapidly explore the properties of mixed hybrid organic-inorganic perovskite compounds.

ABSTRACT

Throughout human history material science has been the defining characteristic of each age, it delineates the technology of that time. Designers and inventors are limited by the materials available and must make compromises based on the requirements on the application and suitable materials. To achieve new breakthroughs, particularly in renewable energies it is essential to accelerate the rate of the material development process from the discovery of new materials, to the optimisation of their properties and the commercialisation of applications using these materials. In this talk I present a vision for a high-throughput energy material platform that will use robots and machine learning for rapid material discovery and characterisation. Robots will prepare precursor solutions, grow thin-films of materials of interest with a wide range of fabrication parameters to identify optimal growth conditions and investigate the films with an extensive range of analytic tools to determine the structural and optoelectronic properties.

15.55: SOLUTION-PROCESSED PEROVSKITE TANDEMS AND MULTI-JUNCTION SOLAR CELLS

DR DAVID McMEEKIN
Research Fellow

Dr. David P. McMeekin received his Master’s degree from the Swiss Federal Institute of Technology (EPFL, Switzerland) in Microengineering, under the joint supervision of Prof. Henry Snaith and Prof. Christophe Ballif. He later completed his PhD in Physics from the University of Oxford, working in the research group of Prof. Henry Snaith. His research is focused on integrating novel hybrid organic-inorganic perovskite absorber in monolithic perovskite/silicon and all-perovskite tandem architectures for solar cell applications.

ABSTRACT

Multi-junction device architectures can increase the power conversion efficiency (PCE) of photovoltaic (PV) cells beyond the single-junction thermodynamic limit. One concept for improving the efficiency of photovoltaics (PVs) is to create a ‘tandem junction’; by placing a wide–band-gap ‘top cell’ above a silicon (Si) ‘bottom cell.’ Metal halide perovskite photovoltaic cells could potentially boost the efficiency of commercial silicon photovoltaic modules from 20% toward 30% when used in tandem architectures. Another multi-junction approach is to fabricate a monolithic all-perovskite multi-junction solar cell. By combining a wide-band gap perovskite junction with a narrow band gap junction, we could potentially reach PCE that are beyond the Shockley-Queisser limit. Here, we explore perovskite absorbers in hopes of achieving large-scale, low-cost, printable perovskite multi-junction solar cells.
16.15: SEMI-TRANSPARENT PEROVSKITE SOLAR CELLS (ST-PESCS) FOR BIPV

DR JAE CHOUL YU
Research Fellow

Jae Choul Yu received his Ph. D (February 2018) in Materials Science and Engineering from Ulsan National Institute of Science and Technology (UNIST) and was a postdoctoral researcher in Prof. Myoung Hoon Song’s group in UNIST. He is currently a research fellow with the Department of Materials Science and Engineering at Monash University. His research focuses on perovskite optoelectronic devices such as light-emitting didoes, solar cells, semi-transparent and monolithic tandem devices.

Semitransparent solar cells (ST-SCs) have received great attention due to their promising application in many areas, such as building integrated photovoltaics (BIPV), tandem devices, and wearable electronics. In the past decade, perovskite solar cells (PeSCs) have revolutionised the field of photovoltaics (PVs) with their high efficiencies and facile preparation processes. Due to their large absorption coefficient and bandgap tunability, perovskites offer new opportunities to ST-SCs. In this presentation, I provide a general overview of ST-PeSCs from materials and devices to applications.

16.35: HOW ELECTROLYTE ADDITIVES DEFINE THE PERFORMANCE OF COPPER BISPHENANTHROLINE ELECTROLYTES

DR SEBASTIAN FÜRER
Research Fellow

Sebastian O. Fürer is a postdoctoral researcher in the group of Prof. Udo Bach at Monash University. He received his PhD from the University of Basel (Switzerland) in 2015 working in the research group of Prof. Catherine E. Housecroft and Prof. Edwin C. Constable. In 2016 he received an Early Postdoc.Mobility fellowship from the Swiss National Science foundation and joined the group of Prof. Udo Bach in 2017. Dr. Fürer has a strong background in materials chemistry for photovoltaic and charge transport applications. His current interests are in hole-transporting materials and interface engineering in the area of perovskite solar cells.

In recent years, dye-sensitised solar cells have emerged as an excellent candidate for energy generation in diffuse and low light conditions. The introduction of electrolytes and solid hole-transport materials based on earth-abundant copper with efficiencies over 11% have opened up new pathways to commercialisation. While electrolyte additives have been shown to be crucial for the high performance of these electrolytes, so far, their chemical interaction with the copper redox couples have been poorly understood. Here, we present new insights into this interaction and their consequences on the solar cell performance.

16.55: CONCLUDING REMARKS

17.00: CLOSE
About Monash Energy Materials and Systems Institute

The Monash Energy Materials and Systems Institute (MEMSI) brings top minds in energy together to accelerate the transition towards a sustainable energy future through impactful interdisciplinary research and education programs for Monash University and its trusted partners.

MEMSI builds on a community of over 150 researchers actively working in the broad field of energy and the Monash University’s world leading capabilities in fields including economics, energy materials, and data science to deliver local and global impact.

MEMSI has enabled the development of several key interdisciplinary initiatives including the United Nations Momentum for Change award winning Net Zero Initiative, the Grid Innovation Hub, and the Woodside Monash Energy Partnership.

Trusted industry partnerships underpin MEMSI’s vision to bring people together to solve global energy problems. We welcome opportunities to discuss partnership pathways for interdisciplinary research, engagement with our vibrant student community, and professional development for industry professionals.
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Net Zero Initiative

Monash was the first Australian university to commit to an energy reduction target and we’re proud to be a leader in taking action on climate change. Our strategy encompasses five key pillars: energy efficiency measures, campus electrification, addressing our residual emissions through offsetting, deployment of on-site and off-site renewable energy, and a sustainable Microgrid, all with the aim of achieving net zero emissions for Monash’s built environment by 2030. This program received the United Nations Momentum for Change Award at the COP 24 meeting in 2018.

Net Zero Precincts

An ambitious opportunity to develop a research, education and training program using the Net Zero Initiative and Monash Technology Precinct as a living lab to generate transformative solutions that accelerate deep decarbonisation of our urban energy systems. We will develop and test a coordinated transition approach for decarbonising our cities starting at the precinct level through smart energy systems, net zero mobility and liveable buildings and places. The Net Zero Precincts program will utilise interdisciplinary research to support industry transformation that brings together Monash’s capabilities across technological, financial, behavioural and policy changes.

For more information visit monash.edu/net-zero-initiative
Grid Innovation Hub

The Grid Innovation Hub at Monash University is fostering partnerships between industry and Monash University to undertake high quality interdisciplinary research to address increasingly complex challenges faced by the Australian energy sector.

The program brings together industry, innovators, and researchers to explore the following overarching questions in three key areas.

**National Energy Systems**
How can the system be planned for economic efficiency, reliability and security on the way towards 100% renewables?
How do we manage the operation of the bulk energy system with large penetration of variable renewables securely?

**Regional and Local Energy Systems**
How do we integrate new digital technologies, small scale storage while absorbing large amounts for rooftop PV with existing investment?
What is the mix of grid-side and customer side technologies needed in the distribution grid and how do you formulate policy and markets to economically adapt these grids to the rapid investments by customers in storage and DER?

**Customers and their Energy Systems**
How can the electricity sector work collaboratively with customers as they become empowered prosumers enabled by the distributed energy revolution?
What is the effect of customer choice and empowerment?

For more information visit [monash.edu/memsi/grid-innovation-hub](http://monash.edu/memsi/grid-innovation-hub)
Sustainable Energy Access Program

One of the United Nations’ Sustainable Development Goals is to ensure access to affordable, reliable, sustainable, and modern energy for all. In response, Monash University and the Indian Institute of Technology Bombay have established a global network of researchers from multiple disciplines, entrepreneurs from international social enterprises, philanthropists, and policymakers to address these challenges.

We are working to accelerate the uptake of sustainable energy access through international partnerships between the world’s leading researchers, and private, philanthropic, public and not-for-profit organisations for impact.

There are three key characteristics of this initiative that make it impactful.

**Multidisciplinary**
Research breakthroughs and effective solutions in this area depend on the integration of multiple disciplines and perspectives.

**Industry linked**
The program brings researchers together with external partners from the not-for-profit, government, and private sectors to translate knowledge into impact.

**International**
PhD candidates are part of an international PhD cohort with opportunities for international placement as part of the degree program.

This initiative is commencing in 2019 with a multidisciplinary PhD program in areas of Business and Economics, Engineering, Information Technology, and Social Sciences.

For more information visit [monash.edu/memsi/initiatives/sustainable-energy-access](http://monash.edu/memsi/initiatives/sustainable-energy-access)
Woodside Monash Energy Partnership

Woodside Energy has joined forces with Monash University to develop a state-of-the-art ‘living laboratory’ and long-term research partnership to support Australia’s low-carbon energy transition.

Through the Woodside Monash Energy Partnership, Monash and Woodside will explore the possibilities for achieving affordable hydrogen and valuable carbon solutions. Bringing together experts in material processing, electro-chemical and thermal chemical research, as well as biological systems and behavioural economics, with national and international collaborators and industry partners, Monash’s outstanding research teams will use the world-leading Monash Technology Research Platforms to get the answers first.

As part of the partnership, a new landmark building, the Woodside Building for Technology and Design has already began construction within the Monash Technology Precinct. As one of the most efficient and innovative teaching buildings of its type in the world, together with Woodside Energy, students and researchers will embrace innovation, design and cutting-edge technology to solve tomorrow’s questions for the good of current and future generations.

For more information visit monash.edu/it/woodside-building
**ACEx**

The Centre of Excellence in Exciton Science is funded by the Australian Research Council to bring together researchers and industry to discover new ways to source and use energy.

We are a collaboration of the best researchers in Australia at the University of Melbourne, Monash University, RMIT, University of NSW and the University of Sydney. We work with our Industry Partners - Reserve Bank of Australia, CSIRO, Melbourne Centre of Nanofabrication and the Department of Defence: Defence Science & Technology Group - to transform our research into practice.

We research better ways to manipulate the way light energy is absorbed, transported and transformed in advanced molecular materials to find innovative solutions for renewable energy in solar energy conversion, energy-efficient lighting and displays, and security labelling and optical sensor platforms for defence.

We are aiming for a future where all types of light transform into renewable energy. A future where light powers our world.

website: [https://excitonscience.com/](https://excitonscience.com/)

**ACEs**

At the ARC Centre of Excellence for Electromaterials Science (ACES), we turn our fundamental knowledge of cutting-edge materials into the next generation of ‘smart devices’ for the benefit of the community. But what exactly does that mean? We think of a smart device as a game-changing application, utilising the advanced materials we make in our laboratories to create new health and energy solutions that improve people’s lives. Our Centre of Excellence incorporates collaborators from across Australia and the world, known for their expertise in advanced materials and device fabrication. ACES is generating options for the future, with our researchers creating new knowledge to deal with some of the great challenges of the 21st century.

website: [https://electromaterials.edu.au/](https://electromaterials.edu.au/)

**FLEET**

The ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET) is developing electronic devices that operate at ultra-low energy, enabling revolutionary new technologies to drive future electronics and computing, while meeting society’s demand for reduced energy consumption.

FLEET is linking a highly interdisciplinary team of high-profile Australian and international researchers in atomic physics, condensed matter physics, materials science, electronics, nanofabrication and atomically thin materials.

With over $40M investment from the ARC and contributing organisations, FLEET is poised to make significant global impact in the electronics and energy sectors. By building strategic and strong partnerships with Australian and international industry, research institutions and government, FLEET aims to build capacity for advanced electronics research in Australia and train the workforce for the next generation of electronic materials researchers and future semiconductor industry. To learn more about FLEET, please visit:
