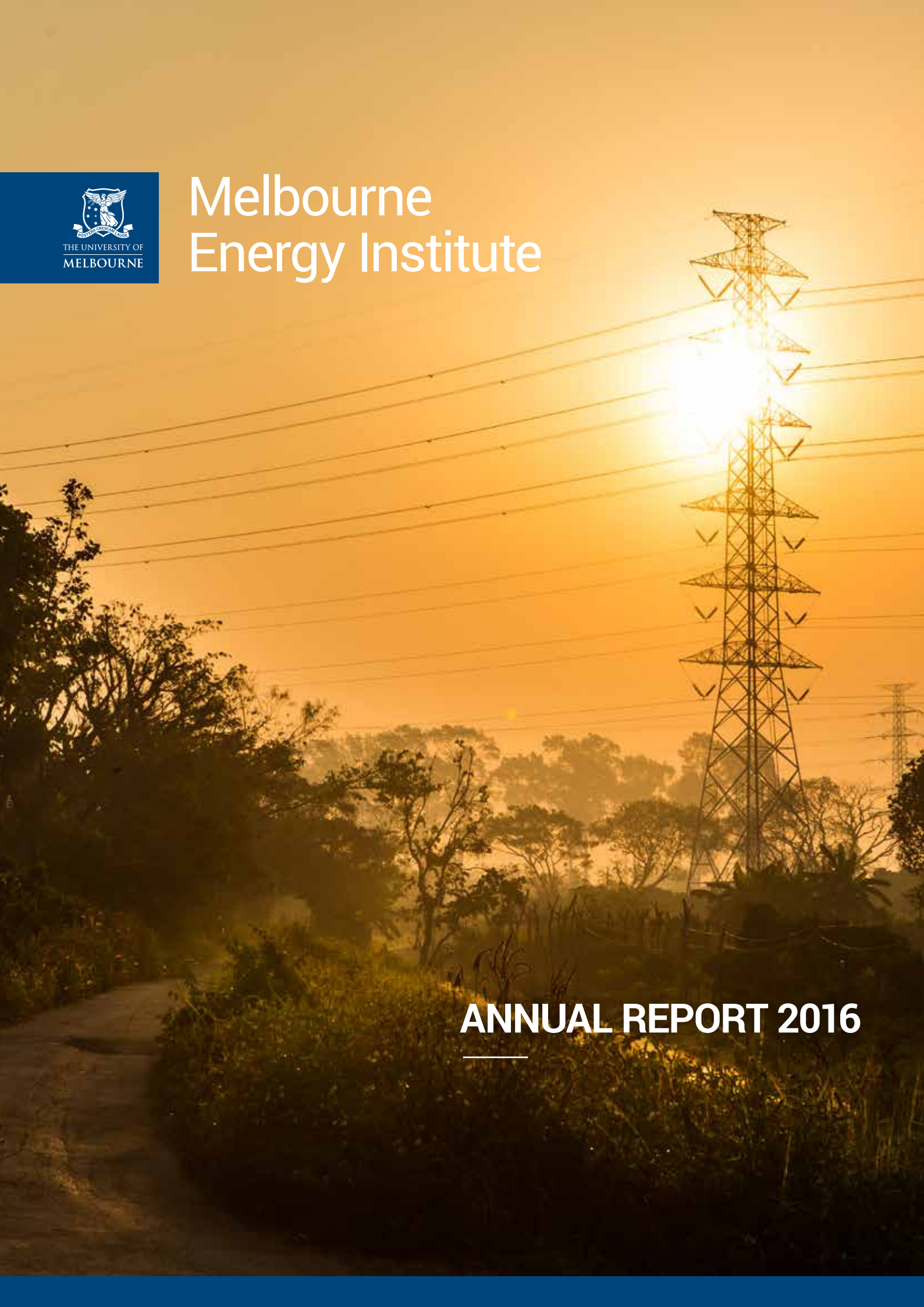
THE UNIVERSITY OF
MELBOURNE
Melbourne
Energy Institute
ANNUAL REPORT 2016

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www.energy.unimelb.edu.au

Contents

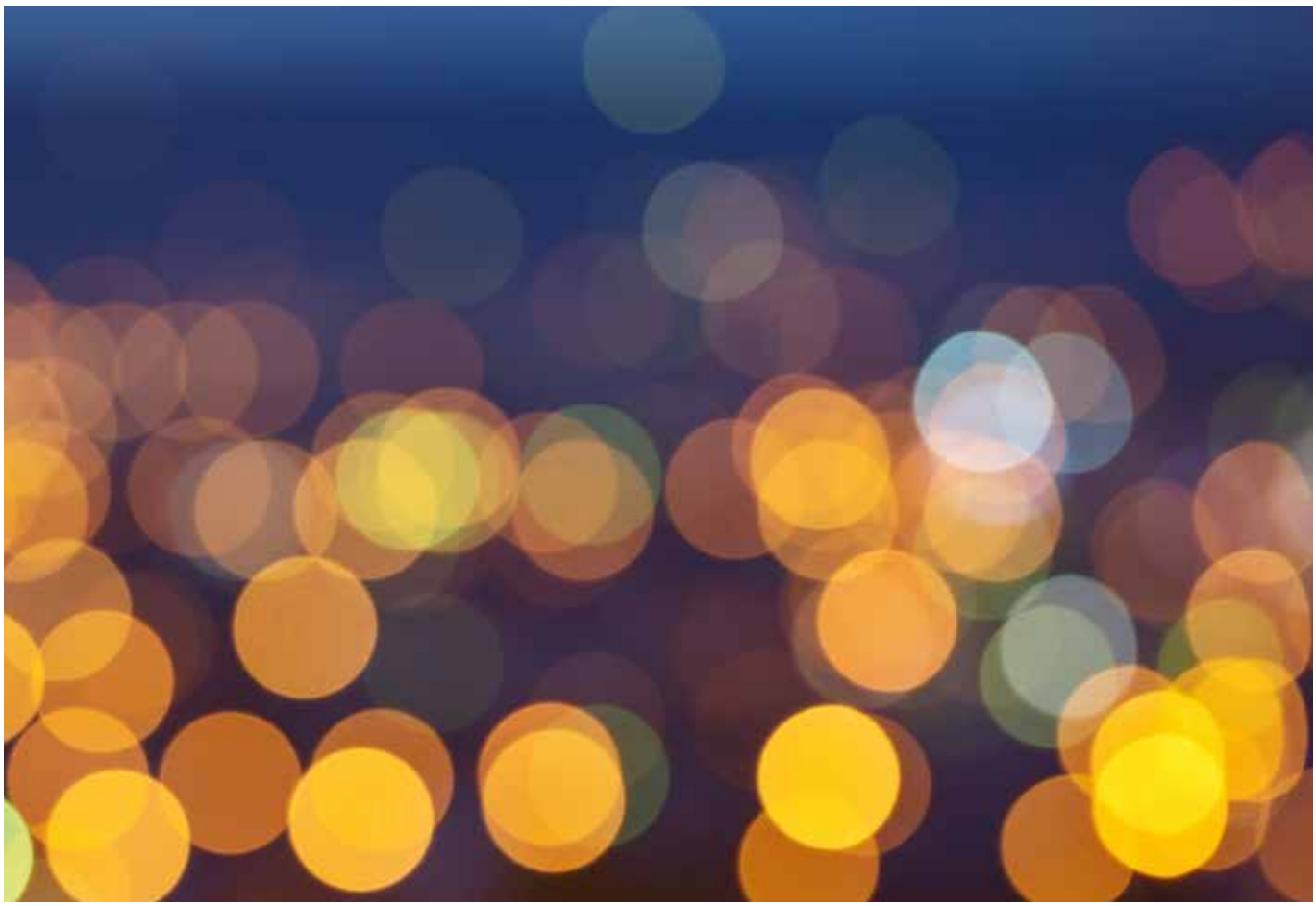
Background

Changes within the energy sector have been rapid, as new technologies, business models and policy settings emerge. Our energy system is undergoing a transformation, and this presents new opportunities and challenges that are crucial for national and global policy considerations.

The increasing recognition that our energy systems need to be more sustainable, while also providing reliable and affordable electricity supply to more people presents a daunting challenge. The prospect that rising greenhouse gas concentrations are contributing to unprecedented and potentially irreversible climate change makes redesigning our energy systems one of the most important challenges of our time.

Changes within the energy sector have been rapid since the Institute was launched in 2010. To help ensure that the emerging pathways do not lead to dead ends, we must strive for a deeper understanding of the environmental, social and economic impacts of these changes. This requires research that transcends traditional lines of enquiry and links the many different ways of thinking about how the environment and contemporary societies work and prosper.

The Melbourne Energy Institute therefore engages researchers across many disciplines at the University of Melbourne. It is one of a family of five Institutes that together comprise the Melbourne Research Institutes.



Message from the incoming Director

I started as Director of the Melbourne Energy Institute in September 2016. It is indeed an honour to commence in this role

I first take this opportunity to sincerely thank Professor Mike Sandiford for his leadership of MEI to date, and for his generosity during the handover process. Mike leaves big shoes to fill.

As I settle into the Directorship, this period of transition will be a mix of the familiar and of the new. Our outstanding public lecture series will continue; the need for open and rigorous debate on energy remains acute. As an engineer, it is of no surprise that I will also emphasise the importance of technology and industry partnerships in our future research.

Of course, we must also never forget the impacts of technology and industry on our environment and on our society. Indeed, understanding the manifold connections between different technologies, the environment and society will be a feature of much of our research that we hope will underpin better decision making and policy.

Professor Michael Brear
Director, Melbourne Energy Institute

Major initiatives

ACHIEVING COST-EFFECTIVE ABATEMENT FROM AUSTRALIAN ELECTRICITY GENERATION

By implementing a mix of wind, solar concentrating thermal energy and combined cycle natural gas turbines, an emission reduction scenario of 80-90% by 2050 is economically feasible.

FACULTIES:

Science and Engineering

LEAD ACADEMICS:

Dr Roger Dargaville, Prof Michael Brear

PARTNERS:

The University of New South Wales, Australian Energy Market Operator, GE, Bureau of Meteorology and Australian Renewable Energy Agency

Achieving deep greenhouse emissions abatement from Australia's National Electricity Market (NEM) by 2050 requires changes to the way energy is produced and consumed. Under funding from the Australian Renewable Energy Agency (ARENA), a team at the University of Melbourne with partners at UNSW identified least cost technology pathways for achieving emissions reductions in the NEM.

The project involved undertaking large-scale optimisations that consider the impact of current and future fossil plants, with and without Carbon Capture and Storage (CCS), renewable plants and nuclear as well as the performance of an extended Renewable Energy Target (RET). Electricity market modelling was also undertaken to determine the impacts of increased renewable energy on the wholesale price volatility.

This research revealed that by implementing a mix of wind, solar and combined cycle natural gas turbines, an emission reduction scenario of 80- 90% by 2050 is economically feasible without appearing to place unacceptable technical demands on the power system. However, achieving 100% renewable energy is considerably more costly due to the required overcapacity, and nuclear is observed to become an increasingly competitive form of generation as emissions targets become more challenging. Extensions of the project conducted in 2016 have investigated the role of distributed rooftop PV and storage, and showed that under some scenarios significant uptake of these technologies is already economic without subsidy.

Encouragingly, this study has shown that that optimal pathways up for 2030 are much the same for policy settings with a carbon price or with an extended RET. This suggests that current policy settings are not leading us along a sub-optimal abatement pathway, although beyond 2030, policy must directly focus on emissions rather than only renewables.

As the penetration of wind and solar PV increases, the volatility in the wholesale market is likely to increase. Some argue that high volatility makes for investment uncertainty and that other types of energy markets should be adopted. Part of this study addressed the question of whether an energy only market, as we currently have, will continue to be suitable, or whether a capacity market might also be needed. The results suggest that the need for a capacity market strongly depends on the generation mix, and that if storage and dispatchable renewables are deployed then capacity markets are unlikely to be required.

AUSTRALIAN GERMAN COLLEGE FOR CLIMATE AND ENERGY TRANSITIONS

The College addresses some of the most pressing issues facing society today — climate change and energy transitions — and strives to deliver the research capability that will bring society towards a low-emissions future.

The Australian-German Climate and Energy College, established in 2013 with a consortium of universities in Germany and with support from the Institute, is a post graduate PhD research program that seeks to address the interdisciplinary and global challenges posed by climate change and energy transitions.

The College provides a collaborative cohort-based environment in which research is undertaken across four key research clusters: energy systems, climate systems, climate impacts, and emission pathways and mitigation strategies. Topics are varied in scope, covering the integration of renewable energy into existing energy infrastructure, to evaluating societal stability during internally and externally induced transitions.

2016 was a busy and successful for the College; the curriculum was expanded, with 26 PhD candidates and 6 Associates now active across a broad range of climate and energy topics. The College has now published eighteen articles in refereed journals, these examine pertinent topics such as 'Flexible Electricity Tariffs: Power and Energy Prices Signals Designed for a Smarter Grid'. This year had a number of highlights including having a strong presence at international negotiations such as the UN Climate Change Conference, COP22; UN Conference on Housing and Sustainable Urban Development, Habitat III; and the G20 Energy Policy Workshop. The College's engagement with the public debate continues with topical seminars, round table meetings and workshops with industry and governmental stakeholders, and a media presence in key discussions surrounding climate change and energy transition issues. The College's seminar series continue to provide PhD candidates and the general public with access to insights from renowned national and international speakers across a range of fields, from within and outside of academia.

In 2016, the College strengthened collaborations with German partners through hosting a number of Potsdam Institute for Climate Impact Research (PIK) staff and students, plus hosting and organising a range of activities for the Director of the Mercator Research Institute on Global Commons and Climate Change (MCC).

It also developed a new collaboration with Karlsruhe Institute of Technology (KIT) with a joint PhD program, and has commenced working with Postdam Institute for Climate Impact Research (PIK), University of Muenster, and Mercator Research Institute on Global Commons and Climate Change (MCC), on a joint project.

For more information please visit: www.climate-energy-college.net

FACULTIES:

Science, Arts, Law, Engineering, Veterinary and Agricultural Sciences

LEAD ACADEMICS:

A/Prof Malte Meinhausen, Prof Ross Garnaut, Prof Robin Batterham, Prof Mike Sandiford, Prof Robyn Eckersley, Prof John Wiseman, Prof Brendan Gleeson, Prof David Karoly, Dr Roger Dargaville, Prof Robyn Schofield, Prof Richard Eckard, Dr Sebastian Thomas, Prof Peter Christoff, Prof Peter Rayner

PARTNERS:

Potsdam Institute for Climate Impact Research, Karlsruhe Institute of Technology, University of Muenster, Mercator Research Institute on Global Commons and Climate Change, University of Bayreuth, Humboldt University, Technical University of Berlin, University of Potsdam

Major initiatives

CENTRE FOR MARKET DESIGN

The Centre's Energy Markets Program looks at market challenges around next generation electricity with the ambition of establishing the University as an internationally recognised hub for energy economics research.

FACULTY:

Business and Economics

LEAD ACADEMICS:

Prof John Freebairn, Dr Leslie Martin, Dr David Byrne, A/Prof Renaud Coulomb

Advances in digital and information technology are radically changing the way people buy and consume energy through helping households make better informed electricity usage decisions. Under an ARC linkage grant 'Technology Transforming Markets: Large-Scale Field Experiments in Electricity Use' the Energy Markers Program is analysing this trend.

The project has drawn on a partnership with a start-up software company BillCap to provide the first published insights into the behaviour of consumers in a competitive and smart-meter enabled retail electricity market.

In 2016, the project grew with the establishment of two new engagements, a large Victorian electricity retailer with >250,000 customers and another with South East Water (with >750,000 customers). The program is now running four innovative large-scale field experiments that inform policy-relevant questions surrounding flexible electricity pricing and solar panel adoption and electricity use.

"The energy industry has long theorised on the impact of smart meters and related technologies. This research aims to deliver concrete insights to benefit both consumers and the energy industry" – Yann Burden CEO BillCap

The program is an example of the way partnerships between the University, Private Sector and government create the opportunity for research that is of high value for policy-makers and academics alike. Through the Energy Markets Program the MEI is helping the University develop the critical research capacity required to become an international leader in energy and resource economics. The MEI has supported two key strategic appointments, in 2014 the MEI provided support for Dr Leslie Martin's position, and in 2015 this support continued with the appointment of Dr Renaud Coulomb; Dr Coulomb's research focuses on issues of optimal taxation of resource-extracting firms, representing an invaluable addition to the team.

cmd CENTRE FOR MARKET DESIGN

A CONSORTIUM OF

Australian Government The Treasury

Department of Treasury and Finance

The University of Melbourne

Faculty of Business & Economics

ENERGY GEOPHYSICS CLUSTER

The Melbourne Energy Institute has worked with The Faculty of Science and the Melbourne School of Engineering to build on the University's existing capabilities in the field of geoscience to position the University of Melbourne as a world leader in knowledge of the earth's accessible crusts and resource sediments.

This energy geophysics research cluster includes the Basin Genesis Hub, the Australian Geophysical Observing System and the Peter Cook Centre for Carbon Capture and Storage capability and is unified by the goal of deepening understanding how Australia's energy needs can be met sustainably.

The Basin Genesis Hub

This project is developing quantitative, cutting edge data analysis techniques to underpin the testing of new concepts for understanding basin structures, and in the riving sustainable use of basin resources. The Australian Research Council (ARC) Research Hub for Basin Geodynamics and Evolution of Sedimentary Systems (Basin Genesis Hub) connects 'Big Data' analysis and high-performance computing in an open innovation framework. The hub will fuse data into 5D basis models (space and time with uncertainty estimates) by coupling the evolution of mantle flow, crustal deformation, erosion and sedimentary processes using open source modelling tools.

Sedimentary Basins capture the Earth's sea level, climate history, and variation of the surface topography due to geodynamic, tectonic ,and surface processes. They host a range of conventional and unconventional hydrocarbon resources of critical importance for the continued functioning of modern society. We increasingly rely on the same basins for oil, gas, geothermal energy, and water, and managing these competing uses requires much greater sophistication. The Hubs new approaches will help address a variety of issues in the context of basin structures and evolution for sustainable deep and shallow earth resource extraction and management.

The Australian Geophysical Observing System

AuScope's Australian Geophysical Observing System was funded through the Education Investment Fund (EIF3) and designed to augment existing NCRIS AuScope infrastructure with new capability that focuses particularly on emerging geophysical energy issues. It built the integrated infrastructure that facilitates maximum scientific return from the massive geo-engineering projects that are now being considered, such as deep geothermal drilling — in effect building the platform for treating these as mega geophysical science experiments. AuScope AGOS infrastructure enables collection of new baseline data including surface geospatial and subsurface imaging and monitoring data, thereby providing for better long-term management of crustal services, particularly in Australia's energy-rich sedimentary basins.

Peter Cook Centre for Carbon and Capture Research

The Peter Cook Centre for Carbon and Capture Research research underpins the development of enhanced technologies for carbon capture and storage in Australia. Working closely with our partners the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC), Rio Tinto and the State Government of Victoria's Department of State Development, Business and Innovation (DSDBI) the Centre's outputs will deliver the next generation of skills and research and development services in CCS research.

Major initiatives

GEOTHERMAL PROGRAM

FACULTIES:

Engineering and Science

LEAD ACADEMICS:

Dr Guillermo Narsilio and Prof Ian Johnson (Victorian Government Project); Dr Guillermo Narsilio, A/ Prof Lu Aye (ARC LP project); Dr A Bidarmaghz and Dr M Disfani (MMRA project)

PARTNERS:

State Government of Victoria; Geotechnical Engineering; Direct Energy; Golder Associates; The University of Cambridge; The University of Southampton; KAIST; Korea University; The University of California, San Diego; Ground Source Systems Pty Ltd; and The University of California, Berkeley.

Direct Geothermal

Direct geothermal systems provide an exciting way for homes and businesses to reduce their own energy bills and carbon footprint through using shallow ground as a heat source and sink for heating and cooling buildings.

Direct geothermal systems use shallow ground as a heat source and sign for heating and cooling buildings using ground heat exchangers and heat pumps. They provide an exciting way for homes and businesses to reduce their own energy bills and carbon footprint. The project is trialling a number of different types of instrumented, and vertical and horizontal ground loop systems, including energy piles (building foundations fitted with HDPE piping) and borehole installations to depths of 30 to 50 m.

This research is showing that substituting common heating and cooling systems with well designed and installed geothermal systems in both residential and industrial areas can significantly reduce overall energy bills, particularly in rural Victoria.

In collaboration with partners, Dr Narsilio from the Department of Infrastructure Engineering is developing new models for studying the performance of ground heat exchangers, including energy piles, energy walls (basements), and other geo-structures to improve the design and efficiency of geothermal systems for cooling and heating buildings. The trial is supported by the Victorian Government and the Australian Research Council, under the Future Fellowship scheme.

Together with industry partners Ground Source Systems Pty Ltd and Golder Associates Pty Ltd, the University of Melbourne is exploring new applications of the technology within the rural industries, that are typically deprived of easy access to natural gas, such as heating and cooling chicken brooder houses. This work is supported by the Australian Research Council, under Linkage Project scheme.

Finally, Dr Narsilio's team engaged with the Melbourne Metro Rail Authority on collaborative studies on the technical feasibility of utilising part of the geostructures to be built for the $10 billion Melbourne Metro Project as ground heat exchangers, and thus providing operational and GHG emission savings for geothermal heating and cooling of the new metro stations and adjacent buildings.

ENERGY TRANSITIONS

Social and policy science for climate change mitigation

In 2016, MEI and the Melbourne School of Government (MSoG) worked collaboratively to seed a growing research program aimed at providing robust social and policy science to support climate change mitigation. Led by Dr Sara Bice, MSoG Director of Research Translation and Westpac Bicentennial Foundation Research Fellow, the project team has expanded to welcome Ms Colette Einfeld, Dr Kate Neely and Ms Susan Wright, along with a small team of dedicated research assistants.

Sara and her team are undertaking a range of projects focussed on social licence to operate, responsibility in mining and extractives industries, and energy transitions and community engagement. Key projects include:

Managing the space beneath: Evidence based policy for underground resources management.

An offshoot of MEI's Sedimentary Basin Management Initiative, this social science project is investigating how the general public and policy makers understand and take decisions about underground resources use. This year, the team are mapping the key policies and regulations that apply to Australia's underground resources. Fieldwork with policy makers will commence later this year as the team explores how we conceptualise those resources that we cannot see and how different policy areas affect one-another.

Adoption of renewables in Victoria's agricultural industry: MEI Seed Fund

In partnership with DEDJTR Victoria and working with MEI researchers and Masters students from the UoM Office for Environment, this project is exploring the extent to which Victoria's agricultural community has adopted or is willing to adopt renewable energy. The project involves scenario building of three potential renewable energy situations and tests the ways in which agriculturalists' risk profiles and a social licence to operate for renewables influences their uptake.

MSoG Labs: Energy transitions

In 2016, MSoG's Research Translation team launched the MSoG Labs program aimed at bringing together the best research from across the University to tackle society's big challenges. The Energy Transitions lab, supported by MEI, involved researchers from Arts, Engineering, Science, Medicine, FBE and Law working together to map the key influences affecting energy transitions and decarbonisation in the state of Victoria. The lab was supported by participation of the Victorian Government (DEDJTR) and the LaTrobe City Council. In 2017, we will be working with researchers to further define and tackle the five priority research areas identified through the MSoG Labs process.

Social licence to operate and Australia's coal seam gas industry

Professors Fiona Haines (School of Social and Political Sciences and MEI Advisory Board member) and Helen Sullivan (Director, ANU Crawford School of Government) and the MSoG-based team are also now just over halfway through an ARC Discovery project in which they are exploring how a social licence to operate is defined and how the concept has affected experiences of Australia's Coal Seam Gas (CSG) industry. The project's early stages captured almost 1 million tweets about CSG from Twitter and the team are busy analysing the new forms of activism and policy platforms that have emerged as a result. This year, they are interviewing people in the field about their experiences with the industry.

The team remains busy on a number of other projects that are contributing to the efforts of MEI to understand how social risks and community engagement influence understanding and experiences of decarbonisation, energy transitions and related climate change mitigation measures. This includes a 12-month investigation into community engagement for one of Australia's largest infrastructure projects.

Researchers contributing to this program of work in 2016 include: Ruby Bell, Martin Bortz, Colette Einfeld, Chen Li, Kirsty O'Connell, Sebastian O'Connell, Catherine Smith and Susan Wright.

Want to know more? Check out Sara's 2016 book Responsible Mining or get active and join the International Association for Impact Assessment (http://www.iaia.org), for which Sara was recently named President-Elect.

Our people

CAPACITY BUILDING THROUGH EARLY CAREER RESEARCHERS

Pierluigi Mancarella

Pierluigi Mancarella is Chair Professor of Electrical Power Systems at the University of Melbourne, Australia, and Professor of Smart Energy Systems at the University of Manchester, UK. Pierluigi has been involved in and led, in the last 10 years, some 50 research projects and consultancy and professional activities in, Australia, the UK, and internationally, in the area of techno-economics and business cases for smart grid technologies, risk and resilience assessment of future networks, integrated multi-energy systems modelling, and energy infrastructure investment under uncertainty.

Nando Ochoa

Luis (Nando) Ochoa is Professor of Smart Grids and Power Systems at The University of Melbourne, Australia and part-time Professor of Smart Grids at The University of Manchester, UK. His expertise in network integration of low carbon technologies and his extensive portfolio of industrial and academic projects has led to over 130 publications and 50 technical reports, one patent filed by Psymetrix Ltd (now part of General Electric), a Scopus h-index of 18, and 1,500+ citations. Prof Ochoa is an IEEE Power and Energy Society (PES) Distinguished Lecturer and has also several leadership roles within IEEE PES, including Member-At-Large of the Governing Board and Editorial Board Member of the IEEE Power and Energy Magazine. He is also an IEEE Senior Member since 2012. In 2010, Prof Ochoa also undertook an industrial secondment with the Edinburgh-based company Psymetrix Ltd. He is also a Visiting Professor at UNICAMP (Brazil) since 2014.

Julie Dickinson

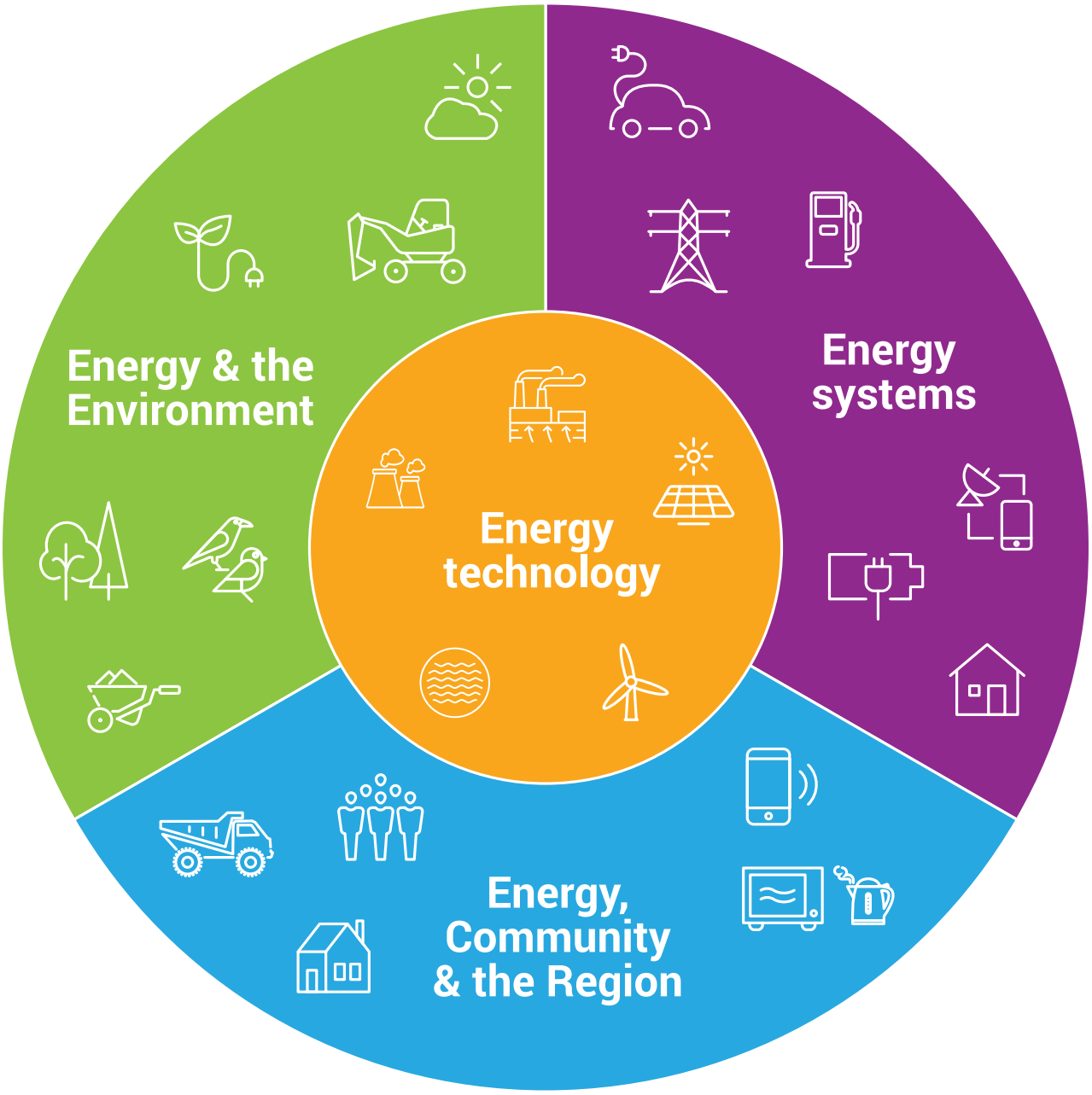
Dr Julie Dickinson has been with RPS for the last 9 years consulting to the petroleum sector, originally as a Senior Sedimentologist and then as Geohazards Manager. During this time she has been involved with numerous consulting projects ranging from core logging, reservoir characterisation and paleogeography reconstruction through to shallow drilling hazards and seabed characterisation for ground engineering in basins across Africa, Europe and SE Asia. Julie is currently working on the Distribution and Geometry of Latrobe Group intraformational seals, Gippsland Basin funded by ANLEC, which aims to provide a detailed understanding of the stratigraphy and structure of the Latrobe Group, with particular emphasis on the seal lithologies (coal and shale) within the unit. The project will provide important information for the assessment of CO_2 storage sites in near- and off-shore areas of the Gippsland Basin. Consequently, this project will provide a facies model for the Latrobe Group coals and sands that may be applied to other coal successions globally.

Stephan Matthai

Professor Stephan K. Matthäi is best known for his contributions to the understanding of multiphase flow in fractured porous media and multidisciplinary field- and numerical simulation studies. He also is the originator of the Complex System's Modeling Platform (CSMP++), a hybrid finite element - finite volume tool for the solution of multi-physics problems in geometrically complex models, enjoying a growing international user community, both in academia and the O&G industry. Stephan conducted postdoctoral research on hydrocarbon systems in the Gulf of Mexico basin at Cornell University, and fluid flow in fractured rock masses at Stanford University. At the Swiss ETH Zürich, he implemented subsurface fluid convection and heat transfer models.

New energy research training program scholarships

In 2016 The Melbourne Energy Institute was delighted to announce three PhD scholarships for students with an interest in energy research from disciplines including Science, Engineering, Arts and Economics. The Melbourne Energy Institute Scholarships are offered for the following theme areas: energy and resource economics, community engagement, and energy systems.



Public engagement

FUGITIVE EMISSIONS REPORT

Given the vast growth potential of unconventional oil and gas in Australia, this review addresses the current understanding of methane emissions by the industry, referencing recent developments in overseas jurisdictions.

The report called for fugitive emissions to be independently verified by a regulatory body funded by a levy on the industry.

Methane is a powerful greenhouse gas, 86 times more powerful than carbon dioxide when its atmospheric warming impacts are considered over a 20-year time period, and 34 times more powerful over a 100-year time period. Reducing methane emissions is therefore an important part of any strategy to avoid dangerous climate change, as agreed by world leaders at the December 2015 Paris conference.

If natural gas is to provide maximum net climate benefit versus coal, the release of methane to the Earth's atmosphere (both intentional and unintentional) must be held to less than about one per cent of total gas production. In this context, the commitment of the Australian CSG-LNG industry to limit methane emissions to no more than 0.1% of total gas production is commendable.

In the Australian Government's most-recent United Nations greenhouse-gas inventory it reported that methane emissions from the oil and gas industry amounted to 0.5% of gas production. Meanwhile in the United States unconventional gas developments have reported fugitive emissions of 2 to 17%.

These measurements have led the U.S. Environmental Protection Agency (EPA) to increase official estimates of methane emissions from the total 'upstream' oil and gas production sector by 134%, and to revise its estimates of emissions from gas production to 1.4% of total production. As a result, U.S. regulators are placing increasing scrutiny on unconventional methane emissions, with Canadian Prime Minister Justin Trudeau and former U.S. President Barack Obama agreeing to new initiatives to reduce methane emissions.

This report found that: no baseline methane-emission studies were completed prior to the commencement of the Australian CSG-LNG industry; there is significant uncertainty about methane-emission estimates reported by oil and gas producers to the Australian government, and by the Australian government to the United Nations; Australian methane-emission reporting methodologies rely to a significant extent on assumed emissions factors rather than direct measurement; the assumptions used to estimate methane emissions include some that are out-dated, and some that lack demonstrated relevance to the Australian unconventional oil and gas industry; there has as yet been no comprehensive, rigorous, independently verifiable audit of gas emissions; if methane emissions from unconventional oil and gas production are being significantly underreported, this could have a large impact on Australia's national greenhouse accounts.

WINDS OF CHANGE: AN ANALYSIS OF RECENT CHANGES IN THE SOUTH AUSTRALIAN ELECTRICITY MARKET

South Australia currently has one of the highest penetrations of wind generation in any liberalised energy-only market, and therefore provides important lessons for other jurisdictions contemplating similar transitions.

South Australia set new records set for extreme wholesale electricity pricing in June and July 2016. These events are of particular pertinence to understanding transitional issues associated with decarbonisition of the electricity sector with renewable technologies.

The authors of this report note that the South Australian experience provides a salutary forewarning of the havoc that can ensue from lack of coordinated system planning in times of transition. It bears on the question of disorderly exit that will be faced in all markets requiring substantial decarbonisation, in part because of the scale of the fossil power stations that are displaced.

The context for the developments in the South Australian energy market can be understood in terms of several intersecting factors, including the increasing penetration of renewable energy generation, the rapid and unprecedented changes in the gas market, the level of market concentration, and the degree of system-scale planning.

The addition of renewable generation capacity and its heightened impact on merit order dispatch system has contributed to downward pressure on wholesale prices, while also generating net large-scale Renewable Energy Target (RET) certificates to the annual value of about $120 million. In so doing, it has contributed to decisions to close brown coal generators, and increased South Australian dependence on imports and, in times of low wind output, gas. As one of the largest stations on the National Electricity Market (NEM) the closure of Northern Power Station in May, 2016 has tightened the demand-supply settings with consequent increases in wholesale prices.

Since the closure of Northern, South Australia is the most concentrated region in the NEM, and this was further exacerbated by the earlier decision taken by Engie to effectively mothball its Pelican Point Power Station and on-sell its contracted supply into the gas market.

The policies that have opened up of the east coast gas market to international gas pricing have had disproportionate impact in South Australia, and flag tensions between national gas market developments and the RET.

While there are no specific recommendations in this report, the authors suggest particular attention should be given to the following: potential for market power to be concentrated as a consequence of transitional arrangements; diversification of low emission generation and storage portfolios; alignment of national energy policy across related sectors, specifically the intersection of gas export markets and the RET; and coordinated system planning of transitional arrangements.

Public engagement

VICTORIAN GEOTHERMAL ASSESSMENT REPORT

The use of geothermal energy is increasing around the world in order to achieve CO2 emissions reduction, reduce energy costs and improve energy security and energy efficiency.

FACULTY:

Science

LEAD ACADEMIC:

Prof Mike Sandiford, Prof Rachel Webster

PARTNERS:

Geological Survey of Victoria

While these same drivers apply in Victoria, Victoria's unique geological and economics conditions require a unique consideration of how geothermal energy might cost-effectively address these drivers. The Victorian Geothermal Assessment Report, published in 2016, explores in detail the opportunities and challenges of geothermal energy production methods in Victoria.

Geothermal energy already represents an economic resource for direct heat in a number of Victorian locations. Warm aquifers are known to underlie many parts of the state including the Bellarine and Mornington Peninsulas, the Werribee Plains, and the Latrobe Valley.

There is strong technical potential for harvesting the heat in these aquifers, with little impact on the quantity and quality of the water itself, for direct use in a range of industrial applications. Identification of economic geothermal resources is currently limited by inadequate knowledge of aquifer temperature and distribution, sustainable extraction rates, and a lack of public awareness of the possibilities.

The Victorian climate everywhere lends itself to the deployment of energy efficient ground source heat pumps (GSHPs). GSHPs provide efficient heating in winter and cooling in summer, with additional environmental and public health benefits. Further, geothermal electrical power could be cost competitive with established technologies at scale, even though initial pilot and demonstration geothermal projects might not be cost competitive. The cost, risk and time frame for demonstrating the technology in Victoria, as well as elsewhere in Australia, have so far not proved attractive to investment markets. However, unlike in other parts of Australia, geothermal energy in Victoria also represents an opportunity to 'repurpose' existing energy infrastructure and expertise. For example, skilled power industry personnel, drilling contractors, transmission lines and large energy consumers are all co-located in the Latrobe Valley, which is also one of the most prospective locations for geothermal energy in the state.

More information about the landscape and future landscape of geothermal technology in Victoria, can be found in the Victorian Geothermal Assessment Report 2016 on the MEI website available for free download.

ENERGY HACK 2016

The inaugural Energy Hack, co-hosted by the Melbourne Energy Institute and Powershop brought together over a hundred participants from a variety of backgrounds, ages and skill-sets to participate in a weekend full of innovation, technology and community-driven power.

Team Plant Lovers won the Hack for their idea using machine learning to improve energy efficiency.

"Existing energy services don't use the full potential of big data to provide deep insights for consumers," said Plant Lovers co-founder Zahra Ghafoori.

"We will use recent breakthroughs in machine learning techniques to dig into data and improve individual and collective intelligence on energy usage."

The event harnessed the consumer-driven revolution kicking off in the global electricity sector. The rapid changes in the way energy is produced, stored and used, including the exponential uptake of solar + battery systems. It explored solutions for the Virtual Power Plant, Community Power, Electric Vehicles and what to do with the massive amounts of data Australia's power system produces.

We are proud to thank the event sponsors: Bank of Australia, City of Melbourne, Victoria State Government, Deloitte Digital, Citipower PowerCor, Future Assembly, Allens Linklaters, New Audio, BOMBA and Yerring Station.

PANEL OF JUDGES

Michael Brear,
Director Melbourne Energy Institute

Georgia Beattie,
CEO StartUp Victoria

Dominique Fisher,
Director LaunchVic

Chris Murphy,
Strategic Advisor Powershop Australia

Jason Bagg,
The Myer Family Investments

Paul Breen,
Founder Powershop Australia and Serial Entrepreneur

Public engagement

ENERGY FUTURES SEMINAR SERIES

In 2016, the Institute continued to bring together industry, government and academia around critical energy research issues through our Energy Futures Seminar Series.

Run in partnership with policy think-tank Grattan Institute, the Energy Futures Seminar Series presents a range of views on the immediate and long-term impacts of changes in energy policy and the development of novel energy technology solutions.

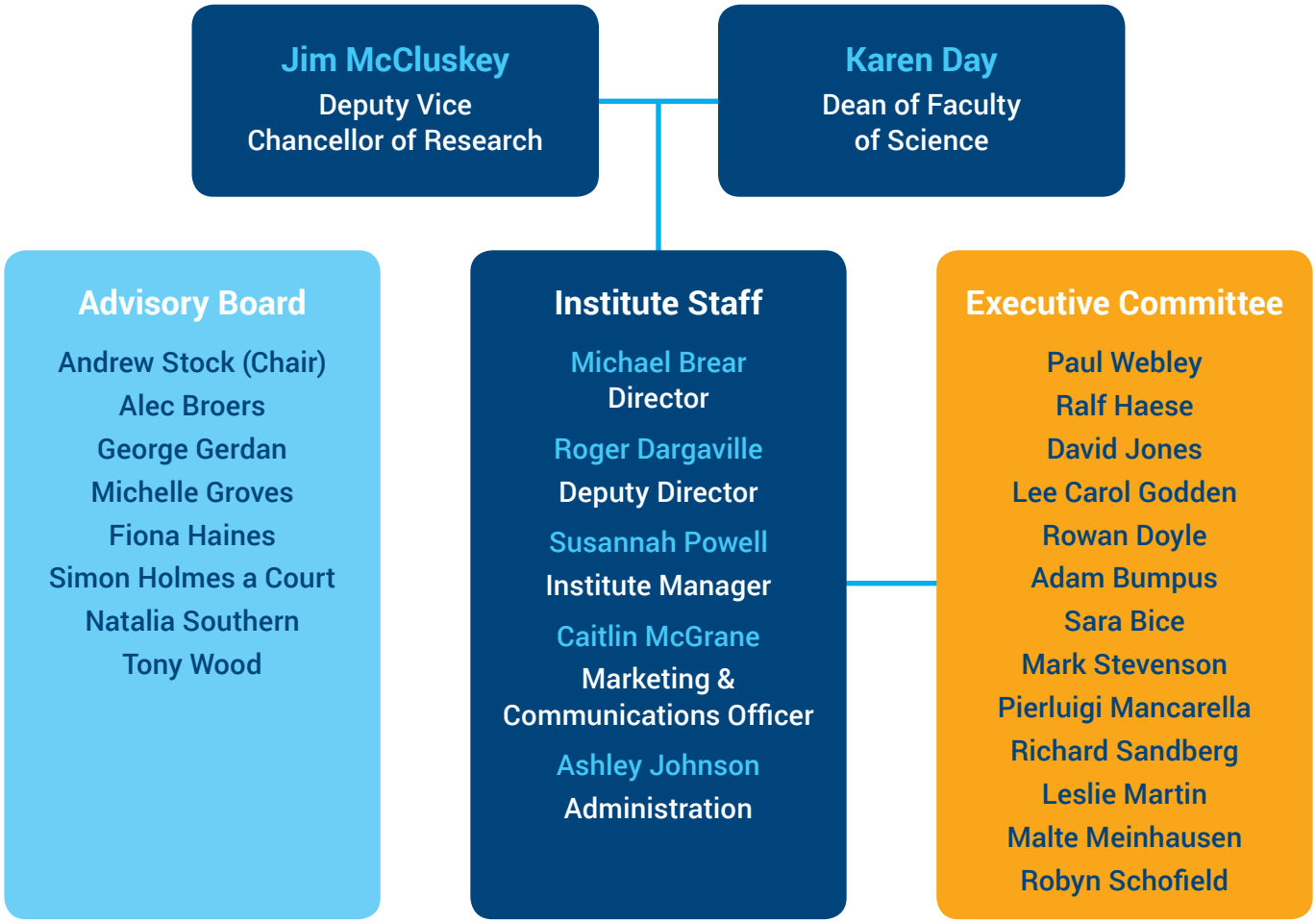
In 2016, the Energy Futures Seminars were sold-out throughout the year exploring topics including: the Future of Gas in Australia, a new paradigm; Climate Policy 2016, Has Labor got it right this time around featuring Mark Butler MP Shadow Minister for Environment Climate Change and Water; Potential Pathways to Decarbonisation; and the National Electricity Market Review Preliminary Report launched by Chief Scientist Dr Alan Finkel.

Governance

The Institute reports to the Deputy Vice Chancellor of Research, Professor Jim McCluskey, for research matters and the Faculty of Science Dean, Professor Karen Day, for operational matters.

The Director and Executive Committee govern the Institute and the Advisory Board provides strategic advice. The Executive Committee is made up of senior academics from the Faculties of Engineering, Law Arts, Science, Business and Economics and Architecture, Building and Planning.

A small team of professional staff support the Director in the implementation of Institute activities.



New funding initiatives

CONFIRMED NEW FUNDING FOR INSTITUTE LED AND SUPPORTED ACTIVITIES IN 2016

Funding source	Name	CI/proponent	Faculty	Funding Period	Total($k)
ANLEC R&D	CCS Storage in the Gippsland Basin	Ralf Haese	SCI/ENG	2016	1,600
	Characterising Stratigraphy	Malcolm Wallace	SCI	2016	500
	GIPNET Microseismic project	Mike Sandiford	SCI	2016	660
Australian Renewable Energy Agency	Renewable energy and least cost abatement scenarios	Roger Dargaville, Michael Brear	SCI/ENG	2016	100
Energy Consumer Association	Energy price data access	Dylan McConnell	SCI	2016	16
The Australia Institute	Fugitive Emissions Report	Dimitri LaFleur		2016	35
AuScope	Geophysics Capability Support	Mike Sandiford, Andrew Gleadow, Louis Moresi	SCI	2016-2017	630
Geoscience Australia	Geodynamic Ground Water Project	Mike Sandiford	SCI	2016-2017	100
Coal Innovation New South Wales Grant	Membrane system testing Vale Point	Colin Scholes, Paul Webley	ENG	2016-2017	350
Commonwealth	Energy Reliability	Michael Brear, Roger Dargaville, Pierluigi Mancarella, Matthew Jepperson	ENG/SCI	2016	25
Clean Energy Jobs Fund (Victorian Government)	Small Scale Pumped Hydro Feasibility	Roger Dargaville	SCI	2016	50
				Total($k)	**4,066**
				Multiplier	**4**

Expenditure

Operations	
Salaries	540,000
Administration and general expenses	10,000
Events and Communications	20,000
Subtotal	570,000
Research	
Capability	253,000
Project Seed Funding	69,000
Partnership development seed funding	97,000
PhD support	25,000
Other	58,000
Subtotal	502,000
Total	**1,072,000**

Notes

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