



MELBOURNE
ENERGY INSTITUTE



Melbourne Energy Institute

ANNUAL REPORT 2013

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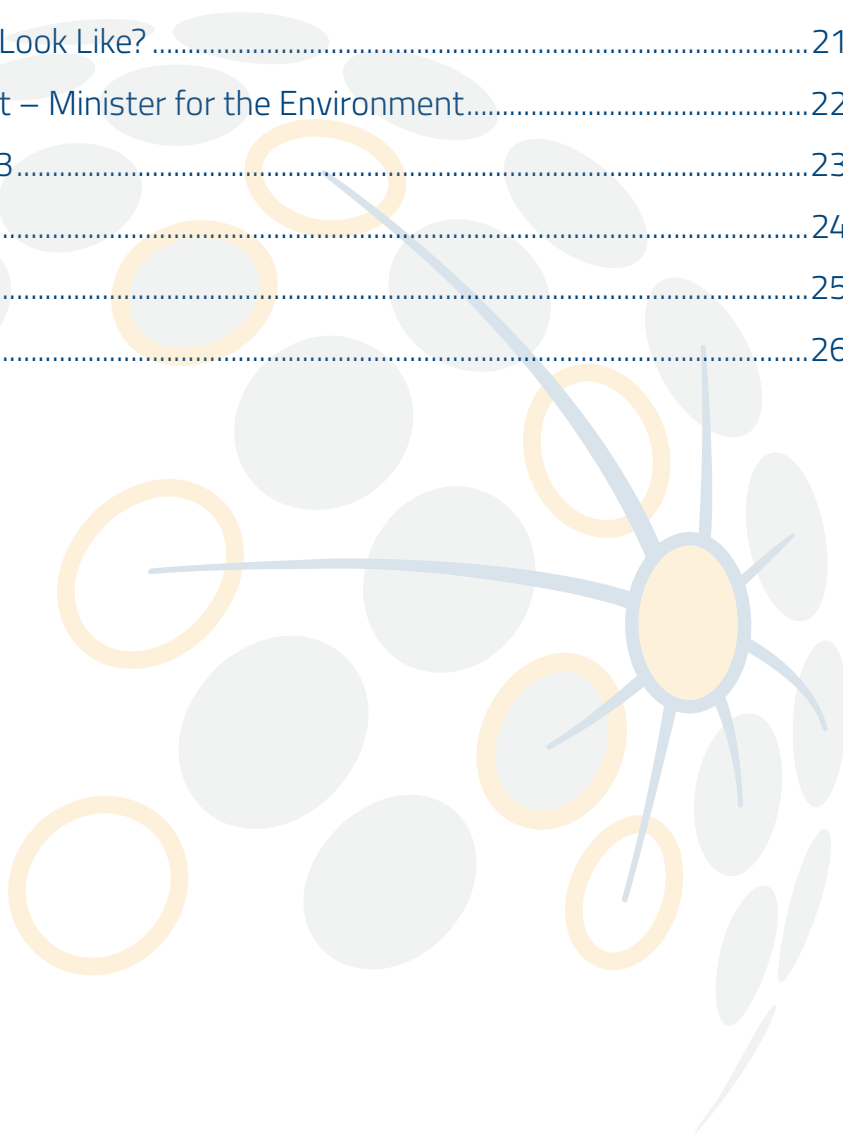
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www.energy.unimelb.edu.au

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Background

Concerns about energy resource security, the adverse environmental impacts of energy production and inequities in access to energy services are crucial to national and global policy considerations.

The increasing recognition that our energy systems need to be made more sustainable, environmentally benign and adaptable, while also providing reliable and affordable supply to more people presents a daunting challenge. In particular, 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. Framing pathways to a more certain energy future is inherently interdisciplinary. Such pathways must

be informed by a deep understanding of environmental impacts, regulatory frameworks and social equity issues. The delivery of such pathways requires new research strategies that transcend traditional lines of enquiry to link many different ways of thinking that inform how modern societies work and prosper. The Melbourne Energy Institute engages researchers across seven faculties at the University of Melbourne to help meet this challenge. It is one of a family of five institutes that together comprise the Melbourne Research Institutes.



Message from the Director

Since 2012, the University's Energy Research Institute has worked with research areas including Economics, Science, Engineering, Law, Architecture, Medicine, Arts and Environment - to help develop interdisciplinary energy research programs. New funding secured for these programs totals approximately \$32 million.



While programs have been varied in scope covering energy resources, production, distribution and consumption, waste capture and storage, and economics and policy, the connecting theme has been developing University capacity in meeting the challenges of large-scale, low-emission energy systems.

The building of significant partnerships with industry, government departments and agencies, other research institutions and non-governmental organisations has been central to the growth of the Institute's interdisciplinary energy programs.

2013 marked the Institute's fourth year of operation, where we were delighted to continue our program of expanding the University's energy research portfolio. Joining with the Postdam Institute for Climate Impact Research and the Melbourne Sustainable Society Institute, we launched our first international PhD research program the 'Australian-German College of Climate and Energy Transitions'. Another highlight in 2013 was the Institute's involvement in the successful \$51.6 million Education Research Infrastructure bid in support of the Carbon Capture Storage flagship program CarbonNet, that has secured \$11.27 million for the University. This funding will be invested in new geophysical capability, positioning the University as a leader in carbon capture and storage and clean energy research.

In 2013, engaging with the public debate around Australia's energy future continued to be an important part of the Institute's activities. The Energy Futures Seminar Series, in partnership with Grattan Institute, brings industry, government and academia together in a public forum to explore critical energy future issues. In 2013, unconventional gas, climate change policy, the Australian electricity market, the mineral resources rent tax and the challenge of poverty eradication and emissions reduction, have attracted much interest with seminars engaging audiences of 300 or more.

The Institute's international outlook has been maintained in 2013 with funding received from the Australia-India Strategic Research Fund to run two international workshops: one on Smart Functional Nanomaterials (organic solar) and the second Renewable Energy Bio-Jet Fuel. A workshop in partnership with the Yangon Technological University will take place in December 2013 in Myanmar.

Looking forward, 2014 will see a number of exciting developments including Sedimentary Basin Management Initiative, the evolution of Carlton Connect and further development of a diverse range of interdisciplinary projects, from feasibility of energy storage technologies to the ethical issues surrounding implementation of renewable energy.

Prof Mike Sandiford

Major Initiatives

SEDIMENTARY BASIN MANAGEMENT INITIATIVE

The Sedimentary Basin Management Initiative functions as a platform for the University to coordinate research that focuses on understanding the numerous issues surrounding the management of sedimentary basin resources.

Faculties:

Science, Arts, Law and Engineering

Lead Academics:

Prof Mike Sandiford, Prof Fiona Haines, Prof Michael Crommelin and A/Prof Tim Rawling

Partners:

The University of Newcastle, The University of Adelaide, NICTA, NSW Office of Chief Scientist, Geoscience Australia and NOPTA

This program is inherently interdisciplinary with Science, Arts, Law and Engineering faculties of the University all playing key roles. In the last four years, the Institute has helped to develop significant capacity applicable to technical sedimentary basin management issues including the Australian Geophysical Observing System (\$7.7 million), the Peter Cook Centre for Carbon Capture and Storage and the Education Investment Fund (providing \$11.27 million) which have helped to establish the University as a world leader in this area. Parallel developments within the Arts Faculty associated with the new School of Government in social licensing issues around emerging energy technologies, and in the Centre for Resources, Energy and Environmental Law (CREEL) place the University in a favourable position to coordinate sedimentary basin management research.

The focus of this initiative is on understanding our sedimentary basins and how they service community needs in regard to a variety of services, including: energy, groundwater, waste storage and environmental issues in an optimal way. This need is for an integrated technical, policy and regulatory program that critically assesses the interaction between competing use of sedimentary basin resources, local livelihoods and community wellbeing.

Dr Will Howard, current Associate Director in the Office of the Chief Scientist, will work with the University to engage foundation partners to grow this program into a Cooperative Research Centre bid for submission in late 2014. The University's Carlton Connect Initiative fund has played an important role in supporting the early phase of this program.



THE AUSTRALIAN-GERMAN COLLEGE OF CLIMATE & ENERGY TRANSITIONS

The Australian-German College of Climate & Energy Transitions, headed by Dr Malte Meinshausen, is a new international graduate college jointly instituted by the University of Melbourne in partnership with the Potsdam Institute for Climate Impact Research (PIK) and three universities in the Berlin/Potsdam area.

Launched in October 2013, with a strong cohort of 10 PhD students, five international and five domestic, the College gives PhD students the opportunity to pursue research in climate change and energy transitions at a world-class level. The program is based at the University of Melbourne and is complemented by a six-month exchange in Berlin at PIK. Students will focus on the overlapping of the four research clusters: energy systems and the requirements for a national transition towards a dominant contribution of renewable energies; emission pathways and mitigation strategies including trading systems, intergenerational equity, carbon budgets and mitigation costs; all aspects of the climate system itself; and, climate impacts on the global supply network of goods and services with a special focus on energy infrastructure.

Faculties:

Science, Arts, Law, Engineering and Land and Environment

Lead Academics:

Dr Malte Meinshausen, Prof Ross Garnaut, Prof Robin Batterham, Prof Mike Sandiford, Prof Robyn Eckersley, Prof John Wiseman and Prof Brendan Gleeson

Partners:

The Potsdam Institute for Climate Impact Research, The Humboldt University, The Technical University of Berlin and The University of Potsdam



Major Initiatives

CARLTON CONNECT INITIATIVE

Carlton Connect is a major University of Melbourne initiative aimed to establish a sustainable technology research and development precinct at the Parkville Campus.

Partners:

IBM Corporation, NICTA and
The Melbourne Business School

Professor Mike Sandiford and the Institute are heading the Energy Stream segment of this project.

The Carlton Connect Precinct will be housed in the former Royal Women's Hospital site. This site was acquired in 2013 and work on a portion of the building is expected to be completed in 2014. Like the University's biomedical precinct where our biomedical scientists work with hospitals to translate research progress into useful and sometimes life saving applications – Carlton Connect will provide a place where researchers can work with industry and government to translate research in areas such as water, energy and urban futures into outcomes that contribute towards a more sustainable and just society.

Melbourne Energy Institute Director, Professor Mike Sandiford is leading the Carlton Connect Energy Stream. With some Carlton Connect energy projects already in their early stages, including work on energy storage, biofuels, sedimentary basin management, renewable energy integration and climate and energy transitions – Professor Sandiford will be working with research leaders to develop these and other related programs to maturity.

The Carlton Connect Precinct while still in its initial stages presents a global network of collaborators and world-class scientists across a range of disciplines, providing a rich and unique incubator for innovation opportunities.

For more detail regarding the Carlton Connect research themes please visit: www.carltonconnect.com.au



Facing our biggest sustainability and resilience challenges



ENERGY SYSTEM MODELING INITIATIVE

The Energy System Modeling Initiative (ESMI) is a project that aims to develop a model of the Australian electrical energy system.

Faculties:

Science and Engineering

Lead Academics:

Dr Roger Dargaville and
A/Prof Michael Brear

Partners:

GE Energy, The Australian Energy
Market Operator (AEMO) and
Bureau of Meteorology

This program was launched with funding from the Australian Renewable Energy Agency (ARENA) in 2012. The ESMI fills an important gap as it allows government, industry, academia, students and the general public alike to actively participate in the debate regarding Australia's future energy supply.

The key output of the ESMI is a model of the Australian electrical energy system that includes generation, transmission, demand-side modeling and a spot market model. The model will use a high powered search algorithm to find the least cost combination of supply-side and demand-side options over a transition period from the present, with the current generation mix out, to 2050 and beyond.

The Institute has worked with GE Energy to create an interactive public interface for this model that allows users to design their own energy future system.

The prototype can be viewed via <http://alpha.futureenergy.net>



Major Initiatives

CENTRE FOR MARKET DESIGN

A partnership between the University of Melbourne, the Commonwealth Treasury and the Victorian Department of Treasury and Finance has developed the Centre for Market Design.

Faculty:

Business and Economics

Lead Academic:

Prof Peter Bardsley

Partner:

Department of Treasury and Finance (State and Federal)

The Centre's energy market program looks at market challenges around next generation electricity, including applied research in the area of market failure, market design, information and incentive problems underlying areas of public policy.

The Institute seeded the Centre's energy market program and provided support for Dr Leslie Martin's position as Lecturer in Energy Market Design. In 2012, Dr Martin began research in the project 'Real-time pricing and competition in the retail electricity market'. This project explores how regulatory policies that make detailed residential meter data available to retailers, may affect customer screening in the retail electricity market. Dr Martin's research focuses on identifying which customers will choose to switch to time-of-use pricing and how that selection will affect contracts offered to customers that want to remain on flat rates.

This project uses a cross-disciplinary approach that combines economic models of competitive screening and

market unraveling with a understating of Victoria's residential electricity markets. Research questions relating to energy have previously been studied exclusively by disciplines within Engineering. This project however examines the economical aspects of this problem, and uses structural econometric techniques.

This project is an example of the synergies between the Institute and the Department of Economics that arise from economists' methodologies for dealing with strategic interaction between firms, such as large power generators, which are a key characteristic of energy markets. Further, the technical skills of the Melbourne School of Engineering and graduate students complement the computational aspects of both estimating demand and supply elasticities and modeling strategic interaction amongst large power generators in the Australian energy market. This cooperation creates the opportunity for research that is of high value for policymakers and academics alike.



cmd CENTRE FOR
MARKET DESIGN

A CONSORTIUM OF



Australian Government
The Treasury



Department of
Treasury and Finance



FACULTY OF
BUSINESS &
ECONOMICS

THE ETHICS OF RENEWABLE ENERGY

The Ethics of Renewable Energy project is an initiative that will address gaps in industry and policy knowledge regarding ethical and social considerations arising from the development and deployment of renewable energy technology.

Faculty:

Arts

Lead Academic:

Dr Jeremy Moss

Partner:

University of Oxford

The research will rely on international engagement and apply lessons learned from Europe and China to target barriers and the development of renewables to inform future regulatory design and the development of the industry.

While renewable energy technologies have many benefits, the transition to renewable energy also faces obstacles such as the displacement of older industries and the subsequent loss of jobs; costs related to the speed of implementation; management of subsidies and research and development support; as well as broader issues surrounding the creation of 'carbon bubbles'.

This unique perspective on addressing social and ethical issues to renewable energy transitions will provide a resource for the renewable energy sector in general, as well as developers of specific technologies, local communities and policy makers. It will also facilitate a significant interdisciplinary research capability drawn from the humanities and social sciences at the University of Melbourne.

This program endeavors to increase our understanding of the impacts associated with the implementation of renewable energy and includes the following outcomes:

- the formation of an interdisciplinary research consortium comprised of experts with knowledge in a variety of issues from Europe and China;
- comparative research using international case studies to assist in the anticipation and avoidance of implementation challenges;
- an overarching analysis of the social and ethical implications of the large-scale introduction of renewable energy technology in Australia, this will be done through a moral and impacts 'map';
- the creation of a unique online 'impacts simulator tool';
- the development of industry training modules; and
- the distillation of best practice recommendations.

University of Melbourne Flagship Energy Research Programs

THE PETER COOK CENTRE FOR CARBON CAPTURE AND STORAGE RESEARCH

The Peter Cook Centre for Carbon Capture and Storage (CCS) research was established in 2012 with the aim to become a world-class research centre based at the University of Melbourne.

Faculties:

Science and Engineering

Lead Academic:

Dr Ralf Haese

Partners:

CO2CRC, Rio Tinto and the State Government of Victoria

The research supports and underpins the development of enhanced technologies for carbon capture and storage in Australia.

The Peter Cook Centre has a special relationship with the Victorian CCS industry based in the Latrobe Valley and the Gippsland Basin, which allows direct interaction with the end-users of this research, informing our research objectives. It is a centre of knowledge, analysis and services for students, industry, government and the public. The CO2 Capture Program undertakes research to reduce capital and operational costs of CO2 capture technology, and the CO2 Storage Program undertakes research with the aim to reduce risks associated with the injection and geological storage of CO2. The research is undertaken in collaboration with government, research and industry partners and is funded by Rio Tinto, the State Government of Victoria and the CO2CRC.

The CO2 Capture Program is well established with four professors and a total of approximately 30 researchers though the CO2 Storage Program is in a start-up phase and still growing. Earlier this year, Professor Haese was appointed as Chair of Geological Carbon Storage, and currently a Chair in Reservoir Engineering is sought to be filled. The successful Education Infrastructure Fund application lead by the CO2CRC will provide a total of \$11.27 million to the Peter Cook Centre for CCS Research for laboratory refurbishments and field and laboratory instruments dedicated to basin scale modelling crucial for cutting edge CCS research. The planning of designated laboratories and the recruitment of geoscience postgraduate students is currently underway with the aim to commence a range of interdisciplinary research projects in geophysics, geochemistry and sedimentology in early 2014.



VICTORIAN ORGANIC SOLAR CELL CONSORTIUM

The Victorian Organic Solar Cell Consortium (VICOSC) is involved in developing the organic photovoltaic solar cell.

Faculty:

Science

Lead Academics:

Prof Andrew Holmes
and Dr David Jones

Partners:

The State Government of Victoria,
The Commonwealth Scientific and
Industrial Research Organisation
(CSIRO), Monash University, Innovia
and BlueScope

The Solar PV cell is an energy technology that has the potential to dramatically reduce the dependence on more traditional sources of electricity in developed countries such as Australia. It also provides a cheap, easily deployable source of electric power for remote regions beyond the reach of the grid in developing countries. Unlike traditional electricity producing solar panels, organic cells offer the potential to allow printing directly onto materials such as roofing and windows, and therefore open intriguing building integrated design opportunities.

The 10plus10 challenge is to develop organic photovoltaic solar cells that can be printed in commercial settings that yield 10% efficiency and 10 years durability. In building on the work of the VICOSC, realising the challenge of printable solar organic cells would provide a wide range of specialist manufacturing opportunities in Victoria.

The VICOSC is working towards the 10plus10 challenge and thus far has achieved success in translating laboratory-based research on organic solar cells to large scale, industrially relevant printing processes. With support from federal and state government and industry, the consortium has helped position Victoria as a global leader in this field.

Program highlights for 2013 include:

- Victorian Government printing program extended to 31 March 2014. Currently optimising the printing of A4-A3 sized modules after purchase of three new printing presses;
- Victorian Government and the Australian Renewable Energy Agency (ARENA) funded a materials development and device architecture optimisation program up to 31 March 2014 (\$3.25 million over 3 years);
- ARENA funded the Australia-Germany collaboration project with Karlsruhe Institute of Technology on morphology development on organic solar cells (\$500k);
- ARENA funded Australia-USA Institute for Advanced Photovoltaics to examine over the horizon technologies to allow large-scale implementation of solar technologies and a capacity building through training and education of postgraduate students; and
- Carlton Connect workshop on the theoretical understanding materials development for the "Smart selection of high performance materials for organic photovoltaics".



University of Melbourne Flagship Energy Research Programs

FUTURE GRID LABORATORY

The Future Grid Laboratory has had a long-standing association with the power industry and an excellent appreciation of the technical problems and challenges future power grids will present.

Faculties:

Business and Economics and Engineering

Lead Academics:

A/Prof Mohammad Aldeen, Prof Iven Mareels, Prof Robin Evans, Prof Terry Caelli, A/Prof Michael Brear and Dr Tansu Alpcan

It has the technical and practical know-how to work with the power industry to address problems associated with integration and control of renewable and embedded sources of energy and the impact on voltage levels.

As well as technical advice, the Laboratory can provide financial advice on investment decisions such as optimal utilisation of assets, infrastructure condition monitoring using sensor network for data acquisition and placement and control devices. Other activity of the Laboratory includes electricity market economics and pricing. On the operation and control side, the Laboratory has had extensive experience in dynamic fault detection, fault level monitoring, demand side technologies, stability analysis, device and network modeling, smart meters data, mining and electricity pricing.

The Laboratory has capability in the following areas:

- Dynamic modelling, fault detection and identification;
- Stability analysis and control;
- Integration of renewable energy sources and embedded generation;
- Signal processing and data mining;
- Sensor networks and condition monitoring;
- Energy storage devices and systems; and
- Electricity market economics and pricing.

ELECTRIC VEHICLES RESEARCH GROUP

The Electric Vehicles Research Group is exploring the management of electricity usage in regard to electric vehicles.

Faculty:

Engineering

Lead Academics:

Prof Iven Mareels, A/Prof Marcus Brazil, Dr Tansu Alpcan, and Dr Julian de Hoog

Partners:

SP Ausnet, United Energy, Ergon Energy, CSIRO, DiUS Computing, and Axiflux

Electric vehicles show great promise as a technology that will allow greater energy security and greenhouse gas reduction in the transport sector. However, the charging of electric vehicles puts additional strain on the electricity grid, and if uncontrolled can lead to unexpected and undesirable effects.

The aim of the Electric Vehicle Research Program is:

- to identify limitations in existing distribution networks with respect to electric vehicle charging; and
- to develop optimal “smart charging” policies with respect to the increasing introduction of intermittent renewable energy sources.

To examine the impact of electric vehicle charging, the program is built on real household demand data, vehicle travel profiles and models of actual distribution networks as provided by the programs industry partners. These findings showed that with uncontrolled vehicle charging, existing networks can only sustain 10–15% penetration of electric vehicles. However, with an optimal charging policy (informed by electricity market spot price, state of charge of individual batteries, present and anticipated network loads) 80% penetration could be sustained with current network infrastructure.

The Melbourne School of Engineering researchers and the program industry partners have been working to develop the understanding the type of demand-response system required to manage high penetration of electric vehicles.

University of Melbourne Flagship Energy Research Programs

THERMODYNAMICS LABORATORY

The Thermodynamics Laboratory in the School of Engineering undertakes fundamental and applied studies of combustion and combustion engines.

Faculty:

Engineering

Lead Academics:

A/Prof Michael Brear, A/Prof Chris Manzie, and Dr Yi Yang

Partners:

AEMO, Advanced Centre for Automotive Research and Testing (ACART), California Institute of Technology, CERFACS in France, Ford Motor Company, Princeton University, The University of New South Wales, and Sandia National Laboratory: Combustion Research Facility

The Laboratory focuses on the combustion of conventional and alternative fuels and the control of conventional and hybrid systems.

The Thermodynamics Laboratory houses a large range of research facilities and a team of roughly 25 full time researchers and students. This work involves collaboration with both industry and government and several academic disciplines.

The current projects are:

- Achieving cost effective abatement from Australian electricity generation;
- Enabling low greenhouse gas emissions from road vehicles through the proper use of alternative fuels;
- Optimising flex fuel engine performance;
- Optimal design of controlled aerodynamic bodies: From concept to prototype; and
- Towards an event based model of combustion generated sound.



Melbourne Energy Institute Projects in Development

ENERGY STORAGE: PUMPED HYDRO AND LIQUID AIR

In partnership with the engineering company Arup, the Institute has researched the applicability of economic incentives for pumped hydro energy storage for Australia.

Faculties:

Science and Engineering

Lead Academics:

Prof Paul Webley, Prof Robin Batterham, Dr Roger Dargaville, and Mr Tim Forcey

Partners:

Arup, and University of Birmingham

The Institute will also investigate the feasibility of emerging technology liquid air energy storage.

Pumped Hydro Energy Storage

Significant new hydro storage facilities are under construction in China and Europe and are under consideration in the US. This is because hydro storage is seen as an economic method to complement the expansion of variable renewable electricity generation sources such as wind and solar photovoltaic. Despite the overseas activity, no large-scale hydro storage facilities have been built in Australia in the last 30 years nor is the Institute aware of any specific facilities being studied or planned. While there may be a magnitude of reasons for the lack of local activity, the most significant reasons are limited understanding of hydro storage economic benefits and a view that suitable development sites are rare. The Institute found that coastal cliff top seawater 'crows-nest' type of hydro storage plants (such as has operated on the island of Okinawa for 14 years) located at constrained 'end of the grid' locations could provide electricity market benefits and complement the further development of renewables in locations such as South Australia, Western Victoria, Western Australia, Northern Queensland and King Island Tasmania.

In the course of its research, the Institute developed innovative costing, site identification (topographical analysis) and economic benefit analysis tools. An Institute report outlining these findings is due to be published in early 2014 and the Institute is currently exploring potential partners, and ARENA funding opportunities in order to extend the Institute's hydro storage research.

Liquid Air Energy Storage

Liquid Air Energy Storage is an emerging energy storage technique that employs industry standard tools of air liquefaction, liquid air storage and gas turbines to provide potentially cheap energy storage. To investigate the feasibility of Liquid Air Energy Storage in Australia the Institute is collaborating with the UK-based Centre of Low Carbon Futures (Professor Richard Williams at the University of Birmingham), which has published early research on its applicability in the UK. With funding from the Carlton Connect Initiative Fund and industry partner Arup, the Institute will explore options and economic viability for deploying this technology in Australia.

RECOVERY OF BIODIESEL LIPIDS FROM MICROALGAL BIOMASS

This project focuses on novel technologies for extracting biodiesel lipids from microalgae that will significantly progress microalgal biofuel production.

Faculties:

Science and Engineering

Lead Academic:

Dr Greg Martin

Partner:

Aurora Algae

Large-scale cultivation of microalgae for the sustainable production of biofuels and other products is now recognised as a promising possibility for scaling biofuels. However, growth and processing of microalgae is highly complex and much technological and scientific development is required to create effective and efficient means of production. In particular, the conversion of the microalgal biomass into fuels such as biodiesel requires considerable attention.

The University will partner with one of the world leaders in developing commercial microalgae biotechnology, Aurora Algae. Aurora have the world's leading demonstration and research facility for the outdoor production of algae in Karratha, Western Australia, and plans to implement Australia's first commercial scale algal biodiesel facility. Over the last five years the University of Melbourne has developed expertise in the downstream processing of microalgae, and this project will help establish the University as an international leader in this important emerging field of research.

The goal of this project is to fully establish the feasibility of the novel process for extracting biodiesel lipids from microalgae. Central to this is the development of an effective scalable method for separating the lipid and solvent from the aqueous phase post-extraction. While reasonable separation has been demonstrated at small scale, the large quantities of product available in this project will enable this to be studied effectively for the first time. This work will involve a detailed characterisation of the colloidal properties of the suspensions and investigations into the effects of

temperature, extent of initial cell rupture, presence or absence of salt, and use of demulsifying agents on separations. Achieving good separation will be critical to maximising biodiesel yields and minimising solvent demands. This work will allow an accurate assessment of expected yields and purities that could be achieved industrially.

The project will include the following activities:

- optimise the processing conditions for Aurora's production strain of *Nannochloropsis*;
- investigate the underlying mechanisms of cell weakening that occur in the first pre-incubation step of the process;
- establish the robustness of the process by carrying out extended performance tests on the process using large batches of algae produced by Aurora at different growth conditions;
- investigate the effect of variations in the specific physiological properties (e.g. cell strength, lipid profile) of the algae arising from variations in the growth conditions on the effectiveness of cell rupture, solvent extraction, and biodiesel related characteristics of the extracted lipids; and
- to perform detailed rheological characterisation of the algal paste in relation to the different unit operations of the process.

Melbourne Energy Institute Projects in Development

GAMES AND MECHANISMS FOR SHAPING THE EVOLUTION OF POWER GRID

This proposal aims to address the problem of how to shape the future evolution of electrical power grid to achieve efficiency, resilience, and cost-effectiveness, using a market-based and game-theoretic approach.

Faculties:

Science, Business and Economics
and Engineering

Lead Academics:

Dr Tansu Alpcan, Prof Subhrakanti
Dey, Prof Rob Evans, A/Prof
Mohammad Aldeen, A/Prof Michael
Brear, Dr Simon Loertscher, Prof
Peter Bardsley and Mr Dylan
McConnell

Distribution of energy is as important as its generation. Recent developments in renewable energy, distributed power generation, and information technologies, motivate a transformational change of the existing power grid. The question of how to provide the right incentives to power generators, distributors and users to facilitate a more efficient resilient, and cost effective power grid has yet to be answered.

The problem at hand is clearly multifaceted, and concerns economists, engineers, policy experts and environmental scientists. Hence, the project aims to bring together the expertise of researchers from these diverse fields that have an interrelating interest in mechanism-design for optimal allocation of scarce resources.

Project outcomes include:

- Development of novel game theoretic mechanisms modeling actions and incentives of actors participating in the smart grid environment including regulators, generators, distributors, and users.
- Creating a synthesis of economical and engineering aspects of the problem using analytical methods.

This project is aligned with the Melbourne School of Engineering's Future Grid Laboratory and the Faculty of Business and Economics Centre for Market Design.

What will Australia's energy future look like?

The Institute expanded its Energy Futures Seminar Series in 2013 by hosting seminars in Melbourne, Sydney and Brisbane.

Run in partnership with policy think-tank Grattan Institute, the seminars bring industry, government and academia together around critical energy research issues putting them into the public domain for community debate and policy scrutiny.

In 2013, the Series joined up with the Department of Climate Change and Energy Efficiency, the Australian Energy Research Institute and the University of New South Wales to explore issues around unconventional gas, climate change policy, the Australian electricity market, the mineral resources rent tax and the twin challenges of poverty

eradication and emission reduction. The topics explored have attracted the attention of audiences of more than 300, with a growing online audience via the seminar live web-stream.

Prior to the September 2013 Federal election, the Institute hosted a special seminar looking at the Coalitions Climate Change Strategy. The Hon. Greg Hunt MP joined the seminar to discuss his Direct Action Plan. With the debate around Australia's climate change policy taking central international stage, MEI asked Greg Hunt to provide his view on Australia's energy future.



Commentary by The Hon. Greg Hunt – Minister for the Environment

Protecting and improving our environment is a key focus of the new Coalition Government, and we believe business and industry have a major role to play.

We do not see protection of the environment and economic growth as mutually exclusive objectives. Rather, they are two essential elements of a single goal – to build a stronger Australia with an even better quality of life in all its dimensions.

We know that business and sustainability go hand in hand. We cannot sustain growth without clean air, safe and reliable water supplies and access to natural resources.

We also recognise what the scientists are telling us about the impact of rising emissions of greenhouse gases, and are committed to cutting Australia's emissions by 5% by 2020, compared with 2000 levels.

Unlike the previous Labor government, we will not attempt to achieve this by means of a punitive carbon tax. We know this simply doesn't work.

Instead, we will implement our Direct Action Plan to reduce Australia's domestic emissions. At the heart of that plan is the Emissions Reduction Fund (ERF).

The ERF will provide positive incentives for industry to innovate and invest in new technologies to reduce their emissions. There will be significant opportunities for the energy sector.

With an initial allocation of \$300 million, \$500 million and \$750 million over the forward estimates period, the Fund will provide a pool of capital to create a market for abatement.

The lowest cost abatement may involve projects to clean up waste coal mine gas, clean up power stations or to capture landfill gas.

It may be a mix of energy efficiency improvements in Australian buildings and industrial facilities.

It may be reforestation of marginal lands, or revegetation, or improvement of soil carbon.

Innovation will also play an important role in developing the low emissions technologies needed for Australia to reduce emissions and grow the economy.

One such example being developed here in Australia is the Direct Injection Carbon Engine (DICE) that could reduce emissions from brown coal electricity generation by up to 50 per cent, helping to protect the environment while supporting and creating jobs in the power generation sector.

In reducing emissions, the focus for the government is not where the abatement is achieved, but rather that it is real, measurable and additional to business-as-usual.

We are not being prescriptive about where the reductions will come from. We are working with organisations from across the Australian economy to explore opportunities for real, practical, and simple ways to meet our target, without hindering our continued growth.

We are committed to cutting emissions, but unlike Labor we won't sacrifice the economy in the process – there's simply no need. Environmental sustainability and economic growth can go hand in hand, and the Government is absolutely determined to achieve both.

The Hon. Greg Hunt
Minister for the Environment

Energy Futures Seminar Series 2013

Planning for low-carbon development: the twin challenges of poverty eradication and emissions reductions – 6 February 2013

Prof Harald Winkler	Energy Research Centre, University of Cape Town
Mr David Green	Chief Executive, Clean Energy Council
Mr Tony Wood	Energy Program Director, Grattan Institute
Dr Malte Meinshausen	Honorary Senior Fellow, School of Earth Sciences, University of Melbourne and Potsdam Institute for Climate Impact Research

Are Australian Energy Markets Functioning Efficiently – 22 April 2013

Prof Mary O'Kane	Chief Scientist & Engineer, New South Wales
Mr Andrew Reeves	Chair, Australian Energy Regulator
Mr Tony Wood	Energy Program Director, Grattan Institute
Prof Mike Sandiford	Director, Melbourne Energy Institute
A/Prof Iain MacGill	Joint Director (Engineering) Centre for Energy and Environmental Markets, University of New South Wales

How are renewables impacting the price of electricity? – 27 June 2013

Mr Kane Thornton	Deputy Chief Executive, Clean Energy Council
Mr Dylan McConnell	Research Fellow, Melbourne Energy Institute, University of Melbourne
Dr Jenny Riesz	Research Fellow Centre for Energy and Environmental Markets, University of New South Wales
A/Prof Iain MacGill	Joint Director (Engineering) Centre for Energy and Environmental Markets, University of New South Wales

Unconventional Gas – energy savior or environmental problem? – 2 July 2013

Prof Peter Cook CBE, FTSE	Chair, ACOLA Working Group on Engineering Energy, Professorial Fellow University of Melbourne
Ms Deb Kerr	Manager, Natural Resource Management, National Farmers Federation
Prof Mike Sandiford	Director, Melbourne Energy Institute
Mr Tony Wood	Energy Program Director, Grattan Institute

The Coalitions Climate Change Strategy – 16 July 2013

Hon Greg Hunt MP	Environment Minister and Federal Member for Flinders
Mr Erwin Jackson	Deputy CEO, The Climate Institute
A/Prof Michael Brear	Mechanical Engineering, University of Melbourne
Mr Tony Wood	Energy Program Director, Grattan Institute

Minister Mark Butler on Labor's Climate Change Strategy – 28 August 2013

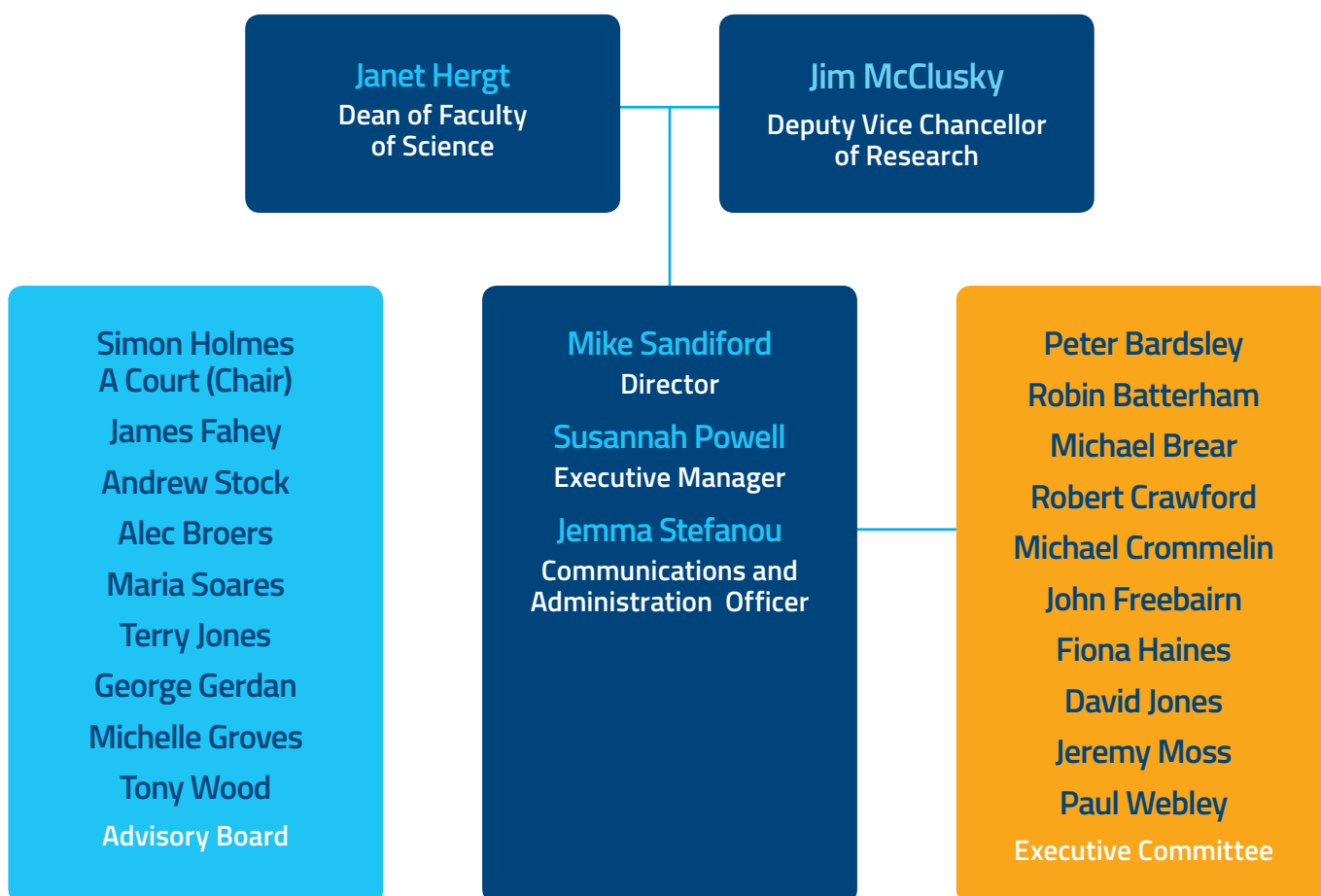
Hon Mark Butler MP	Minister for Climate Change, the Environment, Heritage and Water
Mr Tony Wood	Energy Program Director, Grattan Institute

Governance

The Institute reports to the Deputy Vice Chancellor of Research, Professor Jim McClusky, for research matters and the Faculty of Science Dean, Professor Janet Hergt, 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 supports the Director in the administration of Institute activities.



New Funding Initiatives

Confirmed new funding for (non ARC) Institute led and supported activities in 2013

Funding Source	Name	CI/proponent	Faculty	Funding Period	Total (\$k)
Education Investment Fund (Fed Gov)	CarbonNet	Prof Mike Sandiford A/Prof Sandra Kenitsh	SCI/MSE	2013	11,270
Consortium Partners	Sedimentary Basin Management Initiative	Prof Mike Sandiford/ Prof Fiona Haines	SCI/ARTS	2013	306
AISRF	Renewable Energy Bio-Jet Fuel	Dr Greg Martin	MSE	2013	28
AISRF	Smart Functional Nanomaterials	Dr David Jones	SCI	2013	35
Total (\$k)					11,648
Multiplier					11.2

Expenditure

Melbourne Energy Institute 2013 Budget

Operations	
Salaries	\$399,000
Administration and general expenses	\$35,000
Events and communications	\$17,000
Subtotal	\$451,000
Research	
Capability	\$185,000
Project Seed Funding	\$120,000
Partnership development seed funding	\$175,000
Subtotal	\$480,000
Total	\$931,000

FOR MORE INFORMATION VISIT OUR WEBSITE AT
WWW.ENERGY.UNIMELB.EDU.AU
OR CONTACT

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Administration Officer**

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