Great research into sustainability

Our Mission

To provide leadership in research and engagement with industry, government and communities to create integrated structural, technological and behavioural solutions for sustainably managed communities and natural environments.
2013 was a year of growth and consolidation for the Barbara Hardy Institute. Now in its second full year as an integrated and operational Institute we have been able to establish and enhance a large number of the Institute’s operational policies and procedures, whilst increasing its research and community profile.

As with the previous research reports, here we have provided details on the outcomes of our research activities, public profile events and member support activities (otherwise known as our Foundation Programs) and have again profiled a selection of our members and highlighted successes. The most notable Institute successes in 2013 included the commencement of a Citizen Science research unit, Category 1 Grains Research & Development Corporation (GRDC) and Australian Research Council (ARC) research funding success and, in particular, some amazing success with the Australian Renewable Energy Agency (ARENA) in obtaining funding and Fellowships for our renewable energy research.

The Institute continues to grow in membership, prominence and impact both within the University and within the wider community. This could not have happened without the hard work and dedication of three important groups. Firstly, the Administration team consisting of Leanne Haller, Hannah Thwaites, Elena Del Moral and Kylie Fairbank now operate the Institute from our brand new headquarters in Building A at the Mawson Lakes campus. We moved into our newly refurbished offices in March 2013 which includes a living ‘green’ wall as a major feature of our office accommodation. The team provides support for all members on a wide range of administrative and research related activities, and also conducts the day-to-day activities of the Institute, including collating the content for this research report. They are a fabulous team.

Secondly, I am very grateful to the Executive group. Comprising members from all Schools in the Division of Information Technology, Engineering and the Environment (ITEE), School of Education, Adjuncts and also research leaders, the Executive group have met bi-monthly to effectively oversee the direction of the Institute. I am enormously grateful to John Fielke, Wasim Saman, John Boland, David Bruce, Peter Majewski, Jacqui Balston, Kathy Paige, Matthew Rofe, Frank Bruno, Peter Pudney, Philip Weinstein and Leanne Haller (with administrative assistance from Hannah Thwaites) for sharing the responsibility of leading the Institute.

Thirdly, I also wish to acknowledge the support and leadership of the Barbara Hardy Institute Advisory Board. Superbly chaired by Richard Thomson (now in his third year as inaugural Board Chair) and comprising external members, Barry Brook, Martin Thomas, Alan Branch, Mark Goldsmith, and internal members, DVC:R&I Richard Head, acting PVC: ITEE Brenton Danse and subsequently PVC: ITEE Robert Short and Dean of Research: ITEE Kutluyl Dogancy. The Advisory Board provided important strategic leadership throughout 2013 and in particular I acknowledge the pivotal role played by Richard Thomson. I consider myself extremely fortunate to count Richard as my mentor and friend and continue to be very grateful to both the Executive and Advisory Board teams for their insights and commitment to the cause.

The Barbara Hardy Institute has grown both in membership and research output in 2013 with many successes achieved during the year. Notably, these included: Delene Weber and her team who were successful in their Australian Research Council (ARC) Linkage Project bid, ‘Bushfires and Biodiversity: optimising conservation outcomes in peri-urban areas at risk’. Tom Raimondo who was part of a research team that were successful in their ARC Linkage Infrastructure, Equipment and Facilities (LIEF) funding bid for a micro-sampling Thermal Ionisation Mass Spectrometry (TIMS) facility, administered by the University of Adelaide (project partners include University of Tasmania, Curtin University, and the Government of South Australia’s Department of Manufacturing, Innovation, Trade, Resources and Energy). Funding success came to John Boland who was part of a CSIRO-led research team that were successful in their ARC Linkage Infrastructure, Equipment and Facilities (LIEF) funding bid for a micro-sampling Thermal Ionisation Mass Spectrometry (TIMS) facility, administered by the University of Adelaide (project partners include University of Tasmania, Curtin University, and the Government of South Australia’s Department of Manufacturing, Innovation, Trade, Resources and Energy). Funding success came to John Boland who was part of a CSIRO-led research team that was awarded $3 million in funding from the Australian Solar Institute (ASI) for their project, ‘Australian Solar Energy Forecasting System (ASEFS) – Phase 1’. Additionally, grants awarded in late 2012 have compounded to bring further success in 2013 including ASI
Category 1 funding to Barbara Hardy Institute solar thermal researchers as a part of the Australian Solar Thermal Research Initiative (ASTRI), now ARENA. This is a collaborative research program between a number of Australian institutions, CSIRO and US organisations to carry out research on solar thermal electricity generation. The University’s share is $1.08m in the first four years with a further $3.6m in the following four years for lead researchers, Wasim Saman, Frank Bruno and their solar energy research team.

The Barbara Hardy Institute has lead roles in two Cooperative Research Centres (CRCs), the Automotive Australia 2020 CRC, led by Rocco Zito and the CRC for Low Carbon Living led by Wasim Saman and Michael Taylor. These CRCs have a combined worth of $54 million. June 2013 saw the launch of ‘Creating Biophilic Cities through Citizen Science’, a research unit dedicated to citizen science. This is a $1.5m multi-partnered program over three years. The launch included a workshop event attended by key stakeholders including government, industry and education representatives from South Australia and New Zealand with a Memorandum of Understanding (MOU) signed between the University of South Australia and the Victoria University of Wellington.

There were also a number of important awards to members in 2013. Martin Belusko was awarded an ARENA Fellowship, Philip Roetman was awarded the inaugural Barbara Hardy Institute 2013 PhD to Research Fellowship position and Peter Pudney was named the 2013 Unsung Hero of South Australian Science Communication. The most important congratulations must however, go to our patron Dr Barbara Hardy AO, who in late 2013 was named Senior South Australian of the Year for 2014 in recognition of her environmental and scientific work!

Congratulations and thank you to all our members for contributing to a highly successful 2013.

Prof. Chris Daniels
Institute Director
During 2013 the Barbara Hardy Institute has had the opportunity to focus more strongly on increasing its research and community profile. This has been a pleasing change as many of the key foundations to guide the Institute’s future and measure its progress were put in place in the previous year.

This Research Report provides evidence of the change in focus, reflecting the growing membership and highlights the notable successes of the Institute and its members.

The Advisory Board has led a drive to ensure the Institute strengthens its links both internally and externally to provide a strong environment for multi-disciplinary research and strong connection with industry, government and the community. To this end our Director, Chris Daniels, has been addressing ways to improve our linkages with Schools and other Institutes which will continue in the coming year. The Advisory Board also provided the DVC:R&I with views on improving the focus and quality of research outputs by relating the activities of research concentrations to the University of South Australia’s overall strategic plan, and its support for a coordinated approach to the promotion of funding and research opportunities within industry and government.

A major challenge for the Institute in 2013 and beyond is the reduction in government funding for universities. This will place a strain on the growth in research activity and in our case, reduce the growth of the Institute at a critical time in its development. It has been the Board’s desire, as I noted in last year’s report, to:

- Attract several outstanding Researchers/Fellows to support research capability
- Broaden our energy research capabilities
- Improve our capabilities in urban ecology and environmental research; and
- Grow our research facilities

While the Board and our Director have been actively pursuing means to achieve these goals, the reduction in funding is blunting our capacity to deliver.

On a brighter note, our Director has detailed the successes that we have recorded with particular reference to the commencement of a Citizen Science research unit. I must commend Chris and all the members of the Institute on their achievements during 2013. We look forward to a continuation of these successes in the coming year.

I would like to acknowledge the tireless efforts of Chris Daniels in his role as Director, managing the activities of the Institute but more importantly injecting enthusiasm and inspiration into all that he does. Much of what he does reflects his passion for our brand, one of our most important assets. In this regard we also congratulate Dr Barbara Hardy AO being named Senior South Australian of the Year for 2014, who is not only our Patron but also our brand!

Appreciation also goes to the Institute’s Administration team for the tremendous support that I in particular, and the Board as a whole receive from their continued efforts in producing what is required in a timely fashion and with good humour.

It has been a privilege to serve as Chair of the Advisory Board of the Barbara Hardy Institute for another year, as we deliver great research into sustainability.
It gives me great pleasure to have the opportunity of writing a Foreword for the 2013 Research Report of the Barbara Hardy Institute, University of South Australia. It never ceases to amaze me to hear about the work of Barbara Hardy Institute researchers, and to think how honoured I am to be its Patron.

My life continues to be very interesting and busy, and I have just been awarded the honour of being Senior South Australian for 2014. This, hopefully, will give me the opportunity to emphasise my firm belief that our economy very much depends upon the health of the natural environment. Clean air, pure water, healthy plants and animals are the basis upon which the natural environment, and therefore the State’s economy, depends.

I know that much of the research being performed by the Barbara Hardy Institute is indeed related to improving the state of the natural environment, thus ensuring that our economy, as well as the health of people living within South Australia will thrive.

Research of particular interest for me this year at the Barbara Hardy Institute has been the work of Professor David Ness as a contributor in a book on “The Green Economy” with respect to activities in China, a close and important neighbour of Australia and is nationally important. I understand that other work that also relates to Australia’s relationship with Asia is being carried out by our member Dr Adam Simpson. Thus it is good to see that UniSA is playing an important role in broadening South Australia’s role in the Asia-Pacific region.

Research plans for 2014 are already taking shape with the University of South Australia sponsoring a series of Planet Talks seminars involving the Director of the Barbara Hardy Institute, Professor Chris Daniels that will include exploring the challenges that ecosystems will face in the future due to overpopulation and climate change. This will particularly interest me in view of the fact that I wear another ‘hat’ in the form of being Patron of the Nature Foundation SA Inc., a not-for-profit organisation which devotes a great deal of its time raising funds to assist in nature conservation, of which a property named Hiltaba in the remote northwest of this State is a focus.

There are many other projects happening in the Barbara Hardy Institute and across the University of South Australia that are not only exciting, but also demonstrate the breadth of its research and the many differing opportunities for students who register to study within this excellent tertiary institution.

Barbara Hardy
Patron of the Barbara Hardy Institute
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Efforts undertaken in previous years to develop a Strategic and Mid-Term Plan have once again positioned capabilities of the Barbara Hardy Institute in good stead for 2013 and progress to achieving our targets continued in an upward trajectory.

Revenue has remained stable in 2013 with $3,623,000 in income achieved compared with $3,583,000 in the previous year. The Institute continued to focus on Category 1 research income which has increased significantly by 21.1%. Funding related to Cooperative Research Centre’s has also achieved significant growth of 38.8% in 2013 which augurs well for future funding opportunities in 2014-2016.

Membership numbers for the Institute have remained steady overall in 2013 with full and associate membership numbers remaining unchanged. The number of adjunct members increased by 24.3% and completion rates of research students supervised by Institute members increased by 25%. We are particularly fortunate to have increased the number of Adjunct Emeritus Professors to a total of four.

Significant growth in research outputs relating to HERDC publications shows a 34.3% increase with book chapters seeing the largest increase of 42.3%. Other key results include an:
- Increase in researcher membership in total by 7.6%
- Increase in publications per full and adjunct members by 27.6%

The Barbara Hardy Institute Advisory Board met on three separate occasions and the Executive group have met four times. A final meeting held in December brought the Advisory and Executive members together in a collaborative forum to review the year and develop priorities for 2014.

Executive membership continues to be comprised of representatives from affiliated Schools, Adjuncts and Research Leaders with strategic leadership support provided by Advisory Chair Richard Thomson and our Board members.

The Institute’s Foundation Program has matured, providing ample opportunity to develop our researcher’s capabilities in communicating and managing their complex research expertise and outputs in practical and solutions-based ideas. Having set internal benchmarks and identified areas of development for our membership, the Barbara Hardy Institute staged the inaugural Director’s Hot Topics series with 50 attendees learning various aspects of media training, legalities of research and University processes and improved research management.

The Distinguished Lecture program, as part of the Public Profile Foundation Program consisted of two high profile champions for sustainability. Led by Professor Robert Costanza, the first lecture, ‘Solutions for a sustainable and desirable future’, was attended by more than 200 people. Twenty research students were privileged to attend a Higher Degree by Research Master Class on the ‘Value of natural capital relative to the global economy’. A workshop for 50 participants on ‘Leveraging the economic valuation of ecosystem services’ completed Prof. Costanza’s Distinguished Lecture program.

Our second Distinguished Lecture led by Professor Stuart White was held in collaboration with the SA Zero Waste Centre for Sustainable Design and Behaviour (sd+b). This Distinguished Lecture program included a PhD Colloquium, ‘Collaborating for sustainability’ attended by 40 people, followed by the lecture ‘Sustainable cities: from possible futures to preferred futures’ attended by over 100 people.

Notable Institute successes in 2013 include the continuation of two Cooperative Research Centres (CRCs): The CRC for Low Carbon Living, led by Professor Wasim Saman and Professor Michael Taylor; and the Automotive Australia 2020 CRC, led by Dr Rocco Zito. These CRCs have a combined worth of $54 million.

The creation of a Citizen Science Unit, ‘Creating Biophilic Cities through Citizen Science’ was established by Dr Philip Roetman as part of a one year Institute Fellowship following on from his PhD success and has formulated strong collaborative links with a signed Memorandum of Understanding (MOU) between the Barbara Hardy Institute and the Victoria University of Wellington, New Zealand. In addition to internal funding, this new research unit has succeeded in obtaining industry and government funding totalling $1.5M over three years.

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Other achievements for individuals included a multi-year Senior Research Fellowship for Dr Martin Belusko from the Australian Renewable Energy Agency and awarding of an
Institute PhD scholarship for Mr Bjørn Dueholm, dual PhD student of the Top 50 University, University of Copenhagen and the University of South Australia.

A focus on the growth and development of the Institute in recognised areas of need were addressed in 2013 and will continue in 2014. These included:

- Opportunities for independently funded Research Fellows within the Institute
- Attraction of sabbatical and other research visitors to the Institute
- Potential for growth in environmental research through new funding sources
- Targeted increase in grant funding from full members who have applied for Australian Research Council (ARC) funding
- Improved relations with Schools to continue development of the Teaching-Research nexus and research facilities
- Collaborating in strategic academic appointments by Schools to boost research income and outputs in areas of Institute strength
- Targeted increase in research student intake and completion rates

Overall, the Barbara Hardy Institute has again shown significant improvement in research outputs, stakeholder relationships and new research initiatives and will continue to support its members to achieve targeted growth in the areas described above.

1.1 Institute Snapshot

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<th>Membership</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tr>
<td>Associate members</td>
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<tr>
<td>Adjunct members</td>
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<tr>
<td>Professional staff</td>
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<tr>
<td>Administrative staff</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>Research students</td>
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<td>135</td>
<td>121</td>
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<td>TOTAL</td>
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<tr>
<td>Book chapters</td>
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<tr>
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<td>181</td>
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<tr>
<td>Refereed conference papers</td>
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<td>87</td>
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<td>TOTAL</td>
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<td>228</td>
<td>347</td>
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<th>Income</th>
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<th>2013</th>
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<tr>
<td>Category 1: Australian Competitive Grants</td>
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<td>Category 2: Other public sector funding</td>
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<td>$636,000</td>
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<td>Category 3: Industry and international research income</td>
<td>$337,000</td>
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<td>Category 4: CRC income</td>
<td>$286,000</td>
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<td>Consultancy, Royalties, Trademarks &amp; Licenses, Other research</td>
<td>$315,000</td>
<td>$428,000</td>
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<tr>
<td>Strategic research allocation</td>
<td>$410,000</td>
<td>$487,000</td>
<td>$429,000</td>
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<tr>
<td>Other internal and external income</td>
<td>$358,000</td>
<td>$158,000</td>
<td>$157,000</td>
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<tr>
<td>TOTAL</td>
<td>$3,390,000</td>
<td>$3,583,000</td>
<td>$3,623,000</td>
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</table>

Table 1: Institute Snapshot
1.2 Our Patron: Dr Barbara Hardy AO

The mission, aims and goals of the Barbara Hardy Institute reflect those of its patron, Dr Barbara Hardy AO. Barbara is an inspirational advocate for the natural environment and sustainable living. Since the early 1970s, she has championed a multitude of environmental and educational initiatives.

Barbara has been a Commissioner of the Australian Heritage Commission, President of the National Parks Foundation of South Australia (now the Nature Foundation SA), Founding President of the Investigator Science and Technology Centre and Chair of the South Australian Landcare Committee among a number of other roles. In addition, Barbara holds a science degree and two honorary doctorates.

Appointed an Officer of the General Division of the Order of Australia (AO) in 1987, other awards are numerous and include the Advance Australia Award 1991, SA Great Award 1992, Institution of Engineers Medal 1992, ABC Eureka Award for the Advancement of Science 1994 and was named South Australian Citizen of the Year in 1996. Barbara is now a Companion of the Institution of Engineers Australia and a Fellow of the Australian Institute of Energy.

A leader in science education, environmental advocacy and charity activities, Barbara has led an exemplary public life and has initiated many changes to public policy, practice and even the way people think about science and the environment. In 2013, Barbara was announced as Senior South Australian of the Year for 2014 for her role as a scientist and environmental leader.

Barbara has a long and valued association with the University of South Australia and was a founding board member of the Institute for Sustainable Systems and Technology from 2006 to 2009. In 2009, Barbara became patron of UniSA’s Barbara Hardy Centre for Sustainable Urban Environments and subsequently patron of the Barbara Hardy Institute in 2011.

Through our research, the Institute champions Barbara’s vision for the ‘widespread adoption of sustainable principles and environmentally correct practices’.

Barbara was announced as Senior South Australian of the Year for 2014 for her role as a scientist and environmental leader.
As part of a globally competitive university system, UniSA delivers fundamental advances in knowledge, which contribute to a strong knowledge-based economy and cohesive society, furthering the development of a skilled workforce and delivering innovation to support:

- Developmental trajectory to grow the next generation of research concentrations
- Capacity to build scale and focus around researchers making national or international contributions to their research field
- Aspirations of academic staff who are research productive at early, mid and later career stages
- Environments where research students are supported by a critical mass of researchers, are stretched to address significant research questions and can witness high calibre research leadership in action
- Environments in which there is evidence of a strong Teaching-Research nexus
- Active engagement between end user groups and researchers resulting in knowledge transfer and demonstrable outcomes for industry, government and the community
- High national and international visibility and identity for the University of South Australia research brand

The Barbara Hardy Institute continues to build on its strengths and those of the Division of ITEE and the University by ensuring:

1. Clear focus of activity
2. Credibility as indicated by well-cited academic outputs
3. Visibility and a high profile within government, industry and community
4. Global networks to attract new researchers and research support
5. Strong engagement and investments with stakeholders to deliver research outputs
6. Sustained growth in grants, external income and all forms of peer acknowledgement
7. Visionary leadership demonstrating scale and focus
8. Recognition and fostering of emerging talent
9. Vibrant internal culture
10. Open accountability

Through multidisciplinary membership, institutional commitment and stakeholder support, the Barbara Hardy Institute has continued to build on its strengths to achieve these targets.

The research of the Institute is focused on real-world problems, tackled in partnership with government, industry and non-government organisations, locally, nationally and internationally. This partnership approach to tackling practical problems is the standout characteristic of the Barbara Hardy Institute which is highly valued by our stakeholders.
Research concentrations provide scale and focus for the research effort and output of the University of South Australia (UniSA) and support the research of its best researchers. The University is recognised for its research links with industry partners and the application of knowledge to solve contemporary problems. Research and research education takes place within a cohesive structure under well-defined policies and procedures guided by an international best-practice framework. UniSA’s research concentrations strategy, ReNEW guides the development of research concentrations to focus research strengths and support researchers.

The Barbara Hardy Institute is one of seven flagship research Institutes at the University of South Australia, with researchers from diverse disciplinary backgrounds. The Institute was established to conduct research focused on the sustainability of our communities.

With a multidisciplinary approach that utilises the different skill-sets and methodologies of our scientists, engineers and social scientists, our research is strongly aligned with the University’s recognised areas of research strength. Our research allows the Institute to cross boundaries and bring together a great diversity of ideas, generating significant advances in technologies, theories and applications of knowledge.

Among the Barbara Hardy Institute research membership, we are proud to have strong links and leadership roles with nationally focused Cooperative Research Centres (CRC’s) that include the Automotive Australia 2020 CRC and CRC for Low Carbon Living.

As a world-class Research Institute that demonstrates relevance, excellence, engagement, innovation and reputation, the Barbara Hardy Institute has continued to develop our energetic and committed members into the next generation of researchers and leaders. Our researchers continue to do what they do best … great research into sustainability!

### 3.1 Historical Snapshot

The Barbara Hardy Institute was not created at a single point, rather the Institute has substantially grown and developed from a number of previous research concentrations focusing on sustainability.

With history dating back to 1984 through the formation of the Agricultural Engineering Research Group, the Institute was officially launched in November 2011 with the merger of the Institute for Sustainable Systems and Technology and the Barbara Hardy Centre for Sustainable Urban Environments. During this time, the Institute has seen significant growth in research outputs that continue to align with the Medium Term Plan 2012-2014.

The existing structure of the Barbara Hardy Institute was developed to help support research and to achieve its mission, recognising that the Institute must:

- Provide a clear and transparent strategy for growth
- Provide a culture and research profile that identifies and knows its strengths and limitations
- Use internal funding to support research growth
- Deliver multidisciplinary large-scale research projects from within the Barbara Hardy Institute with allied organisations
- Develop programs that assist its members with their research growth and activity

![Figure 1: Historical origins of the Barbara Hardy Institute](image-url)
3.2 Administration Team

The administration team provides a broad range of research services to our members that includes finance, grant applications and support, marketing and events, human resources, work health safety, UniSA policies and procedures, publications and research, membership, general management and administration.

Director

Institute Manager

Senior Academic Services Officer

Academic Services Officer

Personal Assistant

Figure 2: Administrative Team

3.3 Contract Research and Consultancy

The Barbara Hardy Institute continued to operate an extensive and sought-after technical and advisory service for clients in both government and industry. Research and consultancy forms a part of the Institute's income strategy with many of our researchers undertaking consultancy, testing and evaluation work as part of their research.

The Sustainable Energy Industry Support Centre (SEISC)

Provision of independent advice, physical testing, product development and computer modelling. Researchers are working on projects to commercialise solar heating and solar cooling systems.
- Testing of solar and heat pump water heaters
- Calculation of energy savings of solar and heat pump water heaters
- Testing of air conditioning systems in a balanced ambient calorimeter room
- Thermal resistance rating of building elements

The National Laboratory for Transport Network Analysis (NLTNA)

Utilisation of state-of-the-art computer hardware and software products for traffic simulation, transport network modelling, signalised intersection design and analysis and related urban traffic issues.

The NLTNA’s well-equipped laboratories and information technology facilities are an invaluable resource for modelling and analysis of options for traffic management and surveillance.

Engineering for Sustainable Agriculture

Undertaking research and development in mechanisation and cleaner production processes for agriculture and related industries.
- Design of tillage and seeding equipment
- Evaluation of hydraulic cylinder performance
- Expert witness examining airseeder performance
- Maintenance of South Australian Research and Development Institute (SARDI) soil processing equipment
- Design and certification of a Falling Object Protective Structure (FOPS) for forklifts
- Review of processing technologies for almonds
3.4 Advisory Board

Research concentrations at UniSA benefit significantly from Advisory Boards that support their development. The Barbara Hardy Institute is greatly assisted by the contributions of its Advisory Board members who are relevant research leaders within the University and representatives from government and industry stakeholders. The Institute Advisory Board is appointed by the Pro Vice Chancellor of the Division: ITEE and meets a minimum of three times per year.

The 2013 Advisory Board saw some change in membership with Associate Professor Brenton Dansie acting as Pro Vice Chancellor for the Division of ITEE until Professor Rob Short commenced the role in March. Membership of the Board consisted of:

- Mr Richard Thomson (Chair, External)
- Mr Martin Thomas (External)
- Mr Mark Goldsmith (External)
- Mr Alan Branch (External)
- Professor Barry Brook (External)
- Professor Richard Head (Deputy Vice Chancellor & Vice President: Research & Innovation)
- Assoc. Professor Brenton Dansie (acting Pro Vice Chancellor: ITEE) to March 2013
- Professor Rob Short (Pro Vice Chancellor: ITEE)
- Professor Kutluyil Dogancay (Assistant Dean, Research Education: ITEE)
- Professor Chris Daniels (Institute Director)

3.5 Executive and Foundation Programs

The Barbara Hardy Institute Executive is chaired by the Institute Director. The Executive meets on a bi-monthly basis and consists of Institute research leaders, representatives from partner Schools as well as ‘champions’ for Icon Projects (refer Table 2). The role of the Executive is to:

- Co-ordinate and manage the strategic and operational plans of the Institute
- Liaise with nominated Schools to promote the teaching-research nexus
- Take responsibility for the conduct of the Foundation Programs

The Executive group also has responsibility for ensuring the Foundation Programs (refer Table 3 on page 28) continue to address the internal benchmarks set by the Barbara Hardy Institute as follows:

- Increase in research income (with emphasis on Categories 1 and 4)
- Increase in high-quality publications
- Increase in membership
- Improvement in the recruitment of excellent research students
- Improvement in facilities to enhance research
- Expansion of multidisciplinary Icon Projects; and
- Increase engagement with schools

As a developing research concentration, a large proportion of the Barbara Hardy Institute’s members are relatively new in terms of their research career. The Institute has a number of emerging leaders and talented junior researchers who through the Foundation Programs are provided with opportunities that encourage collaboration and support the individual needs of researchers.
The Barbara Hardy Institute undertakes a ‘project-driven’ research philosophy, driven by the sustainability research of its members. It is the researchers themselves that determine the projects and take responsibility for the funding and the conduct of their research. For a project-driven philosophy to operate, the following rules are applied to the Institute’s research:

▸ **A simple, shared vision: ‘sustainability’**
  All projects must consider some aspect of sustainability.

▸ **Researcher-driven research, not topic-driven**
  The researchers themselves determine the research projects from their own research areas which must involve the best possible science.

▸ **Allows for different skill sets and methodologies**
  Multidisciplinary teams are encouraged across Schools and Divisions with a particular emphasis on Icon Projects. The Institute will actively support good quality multidisciplinary research to allow all members to continually expand their intellectual and technical skills.

▸ **Foundation Programs: structural support to encourage and develop research capability**
  Project-driven research philosophy is dependent on the research skills of the academics. The Institute must invest much of its resources into supporting the continual learning and improvement of its membership with the Foundation Programs being essential supporting component to this philosophy.

▸ **Icon Projects: a plan to build research – quality, quantity, scale, focus and impact**
  Selected, competitive, high-profile, multidisciplinary projects will greatly increase the reputation of the Institute. They will engage a large number of Institute members and be constructed by the best researchers in the Institute. Winning and successfully conducting an Icon Project will be of enormous assistance in promotion and career advancement at the higher levels.

▸ **A tiered approach towards research**
  By grouping projects into low (three) and middle (two) ‘tiers’, research scale and focus can be managed and developed regardless of the topic. Icon Projects constitute the top tier (one).

▸ **Develop the next generation of researchers**
  The Barbara Hardy Institute has only a few very senior research leaders. A project-driven philosophy, supported by Foundation Programs to develop research skills will aid in the internal development of the next generation of leading researchers.

By opening up the Institute around the very broad topic of ‘sustainability’ we are able to welcome all good researchers with an interest in the area and support quality research on any topic within the theme. This philosophy encourages the natural formation of teams around the interests and opportunities discovered by the members and in turn allows for initiative and the demonstration of leadership.
5.1 Supporting Our Membership

The Barbara Hardy Institute provides support and encouragement to our members to develop their research activities, profile, quality and quantity of research within the focus and mission of the Institute. As a recognised leader of research in sustainability, the Institute engages opportunities to:

- Conduct globally significant research
- Collaborate internally, nationally and internationally
- Engage stakeholders and build partnerships
- Attract investment and recognition
- Produce research involving members that is beyond the scale possible for individuals or small groups to achieve
- Engage in multidisciplinary research projects
- Enable members to increase their intellectual and technical skill sets
- Build on research strengths with collaborators and research students
- Work collaboratively to improve research facilities and equipment

The Institute provides administrative support to our members, encompassing human resources, marketing, facility planning and utilisation, financial and project management. Targeted funds and mentoring are also provided through the Foundation Programs to assist members in securing grant funding, career development, research student supervision and dissemination of their research.

Membership of the Institute and opportunities to undertake a leadership role also provides for career advancement and promotion.

5.2 Membership Overview

The Barbara Hardy Institute has 251 members (Figure 4). Academic members are classified into the following categories (according to the UniSA research concentration development strategy ReNEW):

- **60 Full Members**
  - Academics at UniSA who contribute at least 30% of their workload to research at the Institute and have produced at least five HERDC recognised research outputs in the last three years
  - Early Career Researchers (ECRs)
  - Independently and externally funded research-only staff managed by the Institute
- **22 Associate Members**
  - Members of other research concentrations who contribute to research at the Barbara Hardy Institute or who are developing their research profile
- **37 Adjunct Members**
  - Adjunct UniSA researchers aligned with the Institute
  - External members who work in areas of direct relevance for the research concentration
- **7 Professional and Research Support Staff**
  - Technical assistants and research support staff
    (to avoid double-counting, one professional staff member is not counted here as they are enrolled as a research student)

In addition, the Institute supports the supervisors of:

- **121 HDR Research Students**
  (higher degrees by research, e.g. PhD or Masters by Research)

![Figure 4: Membership by member category](image)

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Members</td>
<td>60</td>
</tr>
<tr>
<td>Associate Members</td>
<td>22</td>
</tr>
<tr>
<td>Adjunct Members</td>
<td>37</td>
</tr>
<tr>
<td>Professional and Research Support Staff</td>
<td>7</td>
</tr>
<tr>
<td>HDR Students</td>
<td>121</td>
</tr>
<tr>
<td>Administrative Staff</td>
<td>4</td>
</tr>
</tbody>
</table>
The Barbara Hardy Institute is made up of four administration staff in the positions of Institute Manager, Senior Academic Services Officer, Academic Services Officer and Personal Assistant.

Membership in the Barbara Hardy is primarily derived from the Division of Information Technology, Engineering and the Environment (ITEE) with individual members also coming from another four Divisions/Units (Figure 5) across 14 Schools/Units (Figure 6).

The Barbara Hardy Institute has research members from a wide range of academic positions. Figure 7 demonstrates that 75% of staff are at early or mid-career level (Research Associate/Research Fellow/Senior Research Fellow and Lecturer/Senior Lecturer). Being composed of a primarily academically ‘young’ membership provides the Barbara Hardy Institute with opportunities for significant growth in the coming years. A project-driven philosophy supported by practical training programs will also provide a substantial opportunity to support the research and technical development of these staff.

Of the 119 full, associate and adjunct research members, 30 can be classified as senior researchers (Associate Professor, Professor and/or Emeritus Professor). This cohort of senior researchers provides mentoring to develop our next generation of research leaders from within the Institute.
5.3 Member Profiles

To support and develop the profile of Barbara Hardy Institute’s early, mid-career and adjunct researchers, a selection of the Institute membership have been interviewed to showcase their career and current research.

Frank Bruno

Research area specialisation
Phase change materials, air conditioning, refrigeration, thermal storage, heat pumps, heat transfer and solar thermal.

Research abstract
Frank is involved in establishing a world-class high temperature thermal storage test facility to test prototype high temperature storage systems up to 900°C. This project also involves designing, constructing and testing two thermal storage systems that incorporate new phase change materials and heat transfer techniques with the aim of reducing the cost of high temperature and high density storage systems.

Work is also underway on the project, ‘Patterns of Electricity Use for Medically Required Cooling by Australians with Multiple Sclerosis’. This project analyses the energy consumption of air conditioning in homes of people with Multiple Sclerosis to determine if they use more energy for air conditioning.

Frank is collaborating with Uniting Communities, Lin Andrews Real Estate, Sustainable Focus, SA Power Networks, South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy and Community Data Solutions on a project funded by the Low Income Energy Efficiency Program. His research includes the monitoring of energy for air conditioning in 200 homes across Adelaide.

Contributing to a better and sustainable environment
The next decade is an exciting period for research in Concentrating Solar Power (CSP), the first renewable energy power generation technology with low cost storage. With future power plants needing to store heat at high temperature, Frank is leading the development of thermal storage systems using phase change materials, which is recognised as the most promising cost-effective solution for CSP.

Frank is also leading the development of phase change storage systems for low energy refrigeration and air conditioning applications. Recently, one such refrigeration application is now being commercialised and Frank is involved in monitoring a full scale plant installed in a farming environment.

Within five years, Frank’s expectations are to have phase change thermal storage systems commercialised for a wider range of refrigeration and air conditioning applications and to have developed significant intellectual property for using phase change materials in thermal storage systems.

Research areas of interest
- Thermal storage
- Air conditioning
- Energy efficiency in buildings

Barbara Hardy Institute
Working in the Barbara Hardy Institute provides opportunities to learn about and collaborate with other researchers within the Institute on new research projects.

Keywords to describe Frank’s research
- Phase change materials
- Air conditioning
- Thermal storage
- Energy in buildings

Statement
The development of thermal storage systems using phase change materials is the most promising cost-effective solution to store heat in power plants.
Working in the Barbara Hardy Institute provides opportunities to learn about and collaborate with other researchers on new projects.
Nicholas Chileshe

Research area specialisation
Total Quality Management (TQM) focuses on the development and application of the assessment and monitoring of quality management initiatives among small and medium sized constructional related organisations. Now with an inter-disciplinarily approach, Nicholas explores how some of the concepts – such as quality management, risk management and reverse logistics – can act as catalysts for the evaluation of sustainability issues within construction and project management.

Nicholas also uses his expertise in modelling techniques such as structural equation modelling (SEM) in understanding the interactions among the sustainability constructs.

Research abstract
Nicholas is currently collaborating with the Zero Waste SA Sustainable Design and Behaviour Centre (sd+b) in the project ‘Designing for Reverse Logistics (DfRL) within the building life cycle: practices, drivers and barriers’.

While there are numerous studies associated with waste management practices in Australia, some reverse logistics best practices associated with resource recovery in the SA construction industry are still problematic and under explored. This study will provide suggestions on what is required to improve the proper disposal of the waste stream from the ‘point of origin’ to the ‘point of consumption’.

Contributing to a better and sustainable environment
The current premise within the sustainability agenda is structured around two themes. The first theme focuses on the end result (process and impact), whereas the second is associated with the management processes and practices (means to achieve results). However, the conceptualisation of sustainability has its drawbacks as the relationships among these different levels are not normally captured.

Nicholas’ research will contribute to a better and sustainable environment through redressing the identified drawbacks. By using statistical modelling techniques such as Structural Equation Modelling (SEM), better outcomes such as cost savings and material efficiency can be achieved through effective assessment of the levels and strength of relationships among the various indicators of a sustainability measurement system.

In the future, Nicholas’ work will shift towards the application of Strategy as Practice (SAP) frameworks when conducting research in a number of areas such as project management, sustainability and risk management. This will entail a shift from a prescriptive oriented research agenda, whose research questions are embedded within the ‘What’s and ‘How’s to the ‘Why’s’ issues associated with the praxis and phronesis of research related to the built environment.

Research areas of interest
- Impacts and measurement of sustainability on project outcomes
- Integrating Quality Management (QM) and Project Risk Management (PRM) principles into the sustainability agenda
- Development of assessment and rating instruments for sustainability initiatives
- Reverse logistics

Barbara Hardy Institute
Members of the Barbara Hardy Institute have the opportunity to showcase their research outputs, networking with other researchers within the University, unlocking the doors to industry engagement and building stronger industry partnerships. Members receive support for potential research grant submissions and most importantly, we are able to contribute to the University’s aspiration of being a ‘World Class University’. On a personal level, the Institute also provides opportunities for capacity building through research workshops and seminars specifically developed for members of the Institute.

Keywords to describe Nicholas’ research
- Total Quality Management (TQM)
- Project and Risk Management
- Strategy and Practice
- Cultural Change Agents

Statement
By using statistical modelling techniques, such as Structural Equation Modelling (SEM), better outcomes for costs savings and material efficiency usage can be achieved.
Kym Fraser

Research area specialisation
Kym has researched and published in a number of management related areas: operations management, manufacturing management, maintenance management, service quality, disability management, facilities management, higher education, and the green economy. His research, with its strong empirical grounding, seeks to provide practical solutions to a number of stakeholders, which includes management practitioners, national governments, the research community and society in general.

Research abstract
Kym’s current research project is exploring the perceived gap between academic research and its usefulness to society. Millions of dollars of private and publicly funded money is spent on academic research each year and many questions surround the value of academic research to solve real world problems. The study is based on a large scale survey undertaken in Australia involving practitioners from three professions: accounting, engineering and medicine. It is hoped the research findings will provide a sustainable model to help governments, funding bodies, research institutions and academics to give greater focus to practically excepted outcomes.

Contributing to a better and sustainable environment
Kym’s research has focused on providing effective and sustainable management outcomes in a number of specific areas. These areas include: improving teamwork and labour flexibility within cellular manufacturing; reducing organisational disruptions through better maintenance management; improving service quality outcomes in new car dealerships; developing strategies to assist community reintegration for those members of society with a disability; and exploring green policies for developing economies.

Over the last few years Kym has spent a considerable amount of time in Indonesia working with a number of international non-governmental organisations (NGOs), the Indonesian Government and research institutions on a range projects designed to build a better and sustainable future for Indonesia.

Research areas of interest
- Sustainable management in operations and manufacturing
- Sustainable business and educational development in Indonesia
- Sustainable academic research with an emphasis on practical outcomes

Barbara Hardy Institute
Research endeavours have been greatly enhanced by being a member of the Barbara Hardy Institute. The Institute has provided a strong support framework for Adjunct researchers to undertake research activities and provides opportunities to interact with researchers from a broad range of research disciplines. Being part of a Research Institute with a primary focus on sustainability is something to be proud of.

Keywords to describe Kym’s research
- Management
- Operations management
- International business management

Statement
Effective management outcomes will improve teamwork, labour flexibility and develop policies for a greener economy.

Gunnar Keppel

Research area specialisation
Biogeography, climate change, community ecology, conservation, islands, evolution, plant biology, population genetics and the interfaces of these disciplines.

Research abstract
Gunnar’s research focus is concentrated in the fields of biodiversity conservation, climate change refugia and island biogeography. He is collaborating with Professor Hugh Possingham and Professor Thomas W. Gillespie to develop a new approach for the Theory of Island Biogeography.

His research on identifying and quantifying the quality of refugia under anthropogenic climate change was initiated during a postdoctoral fellowship with Dr Grant Wardell-Johnson in Western Australia that examined granite outcrops as climate change refugia. This project has now expanded into developing theoretical frameworks for the identification and effective conservation of potential climate change refugia.

In the South Pacific, Gunnar is leading a research project on the conservation of rare and iconic Fijian tree species, working with local non-governmental organisation ‘NatureFiji-MareqetiViti’ and Dr Peter Prentis and Professor Bob Pressey. He is also collaborating with Professor Gillespie on a project concerning the conservation of Pacific tropical dry forest and with Professor Janet Franklin and Dr Ted Webb.
he is investigating the ecology and biogeography of lowland tropical rainforests in Western Polynesia.

In South Australia, Gunnar is leading a project that investigates the inter-seasonal variation in the diet of the southern hairy-nosed wombat. This project involves honours student Joshua Allen, Dr Hugh Cross and Dr Noel Riessen, in collaboration with the Australian Wildlife Conservancy.

**Contributing to a better and sustainable environment**

Climate change is one of the major challenges to the persistence of biodiversity. Research on climate change refugia will identify locations that have the greatest potential for facilitating in-situ survival of biodiversity under climate change. Gunnar’s research is contributing toward the identification and protection of such refugia.

Three of the 25 global biodiversity hotspots are located in the South Pacific, indicating a unique biota under high threat of extinction. Gunnar’s research in the South Pacific contributes essential environmental information about the conservation, ecology and taxonomy of the biota in this region and in Mediterranean-style climate Australia. Gunnar was recently appointed the principal co-ordinator of the Pacific-Asia Biodiversity (PABITRA) program, which focuses on improving our understanding of the ecology and conservation of Pacific Island ecosystems through local capacity building and high-quality research.

**Research areas of interest**

- Climate change refugia
- Island biogeography
- Biodiversity conservation

**Barbara Hardy Institute**

The Barbara Hardy Institute provides the opportunity to meet researchers from a broad range of disciplines interested in sustainability, which opens the doors for collaboration and partnerships in new projects.

**Keywords to describe Gunnar’s research**

- Climate change refugia
- Island biogeography
- Biodiversity conservation
- Community ecology

**Statement**

Research on climate change refugia will identify locations that have the greatest potential of facilitating in-situ survival of biodiversity under climate change.

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**Kathy Paige**

**Research area specialisation**

Science and mathematics pre-service education in the primary/middle year levels with a focus on Educating for Sustainability (EFS).

**Research abstract**

Kathy is working on several research projects to provide an interdisciplinary approach to science and mathematics education with a focus on ecological sustainability.

Her first project focuses on working with teachers in the North of Adelaide, South Australia using citizen science to provide authentic learning experiences in the middle years of schooling (Years 6-9). Her second project explores how transdisciplinary approaches of planning for learning with pre-service teachers improves their confidence to teach science and mathematics as early career teachers and her third project focuses on new pedagogies and social justice with teacher educators.

**Contributing to a better and sustainable environment**

Kathy contributes to a sustainable environment by providing professional learning opportunities for teachers and pre-service teachers to engage students in inquiry based, meaningful, context rich and rigorous science experiences. Pedagogical practices include place-based education, undertaking voluntary experiences in an urban ecological setting, participation in an ‘Act of Green’, planning transdisciplinary units of work to teach in their fourth placement and guerrilla gardening. By using socio-scientific issues as the driver, teachers can involve students in social action to reduce their ecological footprint and connect to the natural world.

In the near future, Kathy will be expanding upon her 2014 ARC Discovery Project grant application ‘Educating the scientific citizen in Australia: citizen science’. This project involves colleagues from Education and Sustainable Urban Ecology establishing a model to develop scientific citizenship in low socio-economic areas in the space between schools and communities.

**Research areas of interest**

- Educating for Sustainability (EFS) and action based pedagogies
- Using citizen science as a vehicle to engage middle school students in science and developing a connection to the natural world
- Science and mathematics teacher education in primary/ middle years
Barbara Hardy Institute
Advantages include working with colleagues with similar interest and values and being able to access and contribute to cutting edge world leading research.

Keywords to describe Kathy’s research:
■ Educating for Sustainability (EfS)
■ Citizen science
■ Science education

Statement
By using socio scientific issues as the driver, teachers can involve students in social action to reduce their ecological footprint and connect to the natural world.

Peter Pudney

Research area specialisation
Peter’s research is in the area of applied optimisation theory, with a particular focus on efficient transportation.

His initial research was on optimal train control, where he worked with colleagues and industry over many years to develop a system that is now being used by train drivers around the world to keep trains on time with minimum energy use.

Following on from the completion of a PhD in optimal energy management for solar racing cars, Peter has helped design, build and race solar and low-mass electric cars. Peter has led projects investigating the impact that electric cars will have in Australia on CO₂ emissions and our use of electricity, as well as designing algorithms that will enable the coordinated charging of electric vehicles to control peak electricity demand. Work also continues with the rail industry to develop systems for coordinating the efficient flow of trains through rail networks and progress is being made on developing a low-energy vehicle to be used as a taxi service for transporting pregnant women to hospital in rural Zimbabwe.

Research abstract
Peter is currently working on the following projects:

Saving Energy on Trains. After developing the driving advice systems that are being used by railways around the world, Peter and his team are now developing new methods and tools that will help the users of driver advice systems to analyse the performance of their train networks and to integrate driver advice with central control systems to ensure better flow of trains through rail networks.

African Solar Taxi. Peter leads a research project that is developing low-energy vehicles that will be used in Zimbabwe transporting pregnant women to hospital to give birth. Lack of transport to health facilities is a key contributor to Zimbabwe’s high maternal death rate and the propagation of AIDS. Traditional fuels are not available, hence he is developing simple electric vehicles that can be recharged from solar-powered charging stations.

Electricity without fossil fuels. Peter is working with research students on projects that will develop methods for finding the optimal mix of renewable energy generation, demand management and energy storage to enable much greater use of renewable energy.

Contributing to a better and sustainable environment
Energy is largely invisible. We fill our cars with petrol and turn on appliances with little appreciation of how much energy is being used, where it comes from and the impact of its use. For this reason, Peter’s research will now focus on the development of techniques that allow us to meet our energy consumption needs using less energy and developing systems and devices that will allow greater use of renewable energy.

With much of Peter’s past research focusing on single users, there will now be a focus on how to operate more efficiently using a systems approach to providing clean, safe, quiet mobility using a wide variety of vehicle types, each appropriate to its different task and electricity systems that enable cooperative demand management.

Research areas of interest
■ Application of optimisation and optimal control to efficient operation of transport and electrical systems
■ Low-energy mobility

Barbara Hardy Institute
The Barbara Hardy Institute is a collection of researchers with a focus on sustainability but with a wide range of interests, expertise and skills. A key advantage of being part of the Institute is the ability to form teams that can add both depth and breadth to a project.

Keywords to describe Peter’s research
■ Energy efficiency
■ Renewable energy systems
■ Transport

Statement
The development of new electric systems will allow us to reduce our energy consumption and to explode the use of renewable energy.
David Slaney

Research area specialisation
With a focus on biology and ecology in the field of Environmental Health, David’s main area of research is focused upon the health effects of anthropogenic ecosystem disruption.

Research abstract
David is leading a $3M funded project from the New Zealand Foundation for Research, Science & Technology. The Health Analysis and Information for Action (HAIFA) project, ‘HAIFA – Enhancing Human Health Resilience to Climate Variation and Change’ aims to reduce New Zealand’s vulnerability to the human health impacts from climate variation and change. This project has delivered several reports and associated tool development, international peer reviewed scientific publications, conference presentations, postgraduate scholarships and supervision, as well as a GIS web-based interface.

The interface can carry out ‘what if’ scenarios for 2015, 2040 and 2090 to within 25 square kilometres for six diseases under different climate change projections – campylobacteriosis, cryptosporidiosis, meningococcal disease, influenza, Ross River and dengue fevers. HAIFA is the first international project of its kind and will help central, regional and local authorities to respond to potential infectious disease risks associated with climate variation and change.

David also collaboratively supervises PhD and Masters students whose research currently encompasses: the ecology of zoonotic arboviruses in urban and peri-urban South Australia; the development of a risk assessment tool for antimalarial resistance; and the development of environmental health indicators for the human health impacts from climate change.

Contributing to a better and sustainable environment
Through his research, David works to determine the underlying drivers involved in the emergence and spread of human and wildlife diseases, many being of anthropogenic origin e.g. changing land use and climate. A better understanding of these drivers and their impacts will support actions to mitigate them through the use of local community responses or government policy that contribute to a sustainable environment.

Research areas of interest
- Vector and vector-borne disease ecology
- Climate change and human health
- Environmental health indicators
- Anthropogenic ecosystem disruption and human health/conservation/biosecurity

Barbara Hardy Institute
The Institute allows us to be in the presence of, and work with, like minds that have a passion for environmental research for better sustainable environment outcomes.

Keywords to describe David’s research
- Mosquitoes
- Climate
- Disease
- Biosecurity

Statement
The HAIFA project will deliver important information to authorities to respond to potential infectious disease risks associated with climate variation and change.

Jian Zuo

Research area specialisation
Sustainable built environments via stakeholder engagement through education, training, regulations, legislation and planning.

Research abstract
Jian is working on the research project, ‘Re-considering sustainable building and design: a cultural change approach’, an Australian Research Council (ARC) funded Linkage Project.

This project aims to explore the factors leading to the minimisation of waste in construction via a holistic approach with Industry being actively engaged for their professional views on effective ways of managing construction and demolition waste.

Jian is also one of the Chief Investigators in a research project recently approved by the National Natural Science Foundation of China (NFSC) that aims to investigate how construction firms can be more competitive in the international market. An international benchmarking exercise will be undertaken to develop a best practice framework which will serve as a useful reference for both governments and international contractors.

Contributing to a better and sustainable environment
Construction activities have significant impacts on environment, society and economy. The incorporation of sustainable development principles into construction activities
helps to minimise the negative impacts. Jian works closely with stakeholders, engaging them with sustainability measures as one of the effective approaches to achieving sustainable development. Other ways to achieve sustainable development include: effective use of resources, utilising clean energy sources and waste management via reuse, recycle and reduce.

In the future, Jian expects to see the outcomes of his sustainable built environments research practically applied within regulations, policies and social awareness. Jian is currently expanding his network of international partnerships to collaborate in publications and joint competitive grants such as the National Natural Science Foundation of China.

**Research areas of interest**
- Sustainable built environment
- Stakeholder engagement
- Corporate strategy and competitiveness

**Barbara Hardy Institute**
Being a member of the Barbara Hardy Institute enables access to resources necessary for conducting research, including seed funding and potential collaborators.

**Keywords to describe Jian’s research**
- Green building
- Competitiveness
- Stakeholder management
- Cultural and behaviour in construction

**Statement**
Awareness among construction stakeholders into sustainability issues is paramount to ensuring the use of clean energy sources and correct waste management via reuse, recycling and reduction.

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**Leanne Haller**

**Position description**
Leanne is the Institute Manager for the Barbara Hardy Institute and has been a key member of the administration team since October 2012. Leanne has worked for UniSA for a number of years making it easier to step into the Institute Manager role and is responsible for providing strategic management and support to the Director and Research Leaders across the Institute.

This position provides a critical interface between the Institute and its stakeholders. As the Institute Manager, Leanne provides advice and support to the Institute’s researchers to enable them to deliver quality research outputs. This is a leadership role which involves managing and coordinating the Institute’s administration hub in the provision of recruitment, financial management and reporting, marketing, work health safety, space allocation and research infrastructure requirements for researchers and their projects. Leanne also oversees the delivery of critical analysis, development of business proposals and interpretation of UniSA policies, procedures and government legislation for the Institute.

**About sustainability**
Leanne is particularly interested in the social and educational aspects of environmental sustainability. Institute researchers have a direct link to improving both the environmental impacts of sustainability which also lead to positive social and socio-economic impacts, both of which improve the quality of life for our community. The Institute’s research capabilities include improved agricultural technology to minimise the workload of our farmers, reducing energy bills for low socio-economic families, or developing solar transportation for pregnant women to get to hospital in Zimbabwe.

**Contributing to a sustainable way of living**
Working in the Barbara Hardy Institute is a constant reminder of some of the simple ways we can individually contribute to a sustainable way of living. Considering the purchasing decisions you make in the office and home, remembering to turn off lights and air-conditioning, investing in solar power technology and minimising unnecessary waste are all opportunities to enhance a sustainable work and lifestyle.

**Working at the Barbara Hardy Institute**
The research undertaken in the Barbara Hardy institute is complex and diverse in nature and the opportunity to develop strong stakeholder relationships with Barbara Hardy Institute researchers whilst learning about ‘great research into sustainability’ is one of the rewards of working in this Research Institute. Overall, being an informed community and environmental citizen allows an opportunity to teach others about the interesting work being undertaken and the impact this has on the global community.
5.4 Scholarship Recipients

**Barbara Hardy Honours Scholarship**

**Bianca Hollow**

The Barbara Hardy Honours Scholarship is awarded to an outstanding Bachelor of Sustainable Environments (Honours) student undertaking sustainability research under the supervision of a member of the Barbara Hardy Institute.

In 2013, Ms Bianca Hollow was awarded the Barbara Hardy Honours Scholarship.

Bianca’s research investigated the impact of a citizen science project, the Great Koala Count, on participants compared to non-participants. Citizen science involves the engagement of non-scientists in scientific research and this participation can have an impact on the knowledge, attitudes and behaviours of participants. The citizen science project, the Great Koala Count (GKC) asked participants, to look for and submit sightings of koalas (*Phascolarctos cinereus*) in South Australia using a smart-phone application (app) and to complete a follow-up survey about their opinions towards koala management.

Based on the results of the follow-up survey, Bianca conducted as part of her honours project, an online survey detailing the three groups of Greater Adelaide residents: direct participants of the GKC, indirect participants (those who read information or heard radio broadcasts) of the GKC (onlookers) and non-participants. This survey asked respondents about their opinions towards possible management options for koalas in South Australia and in addition, GKC participants were asked about changes in their knowledge and opinions as a result of the project. Responses to six koala management related questions identified some significant differences between participants and non-participants. Bianca also found that the GKC had some impact on participants in terms of learning and change of opinions. Citizen science is a valuable tool to engage the community in scientific research and to impact the knowledge, opinions and behaviours of participants. Future studies will investigate the impact citizen science has on participants’ opinions and behaviours.

The Barbara Hardy Institute Honours Scholarship supported Bianca’s honours project through the availability of funds that allowed her to increase the sample size for the non-participant group which were sourced from a survey respondent company. Without this scholarship Bianca would not have been able to produce reliable statistical analyses and expressed her gratitude to the Barbara Hardy Institute for the support and guidance offered through the scholarship.

**Barbara Hardy Institute PhD Scholarship**

**Bjørn Dueholm**

The Barbara Hardy Institute PhD Scholarship is awarded to a high achieving PhD student undertaking sustainability research under the supervision of a member of the Barbara Hardy Institute.

In 2013 the Barbara Hardy Institute PhD Scholarship was awarded to Bjørn Dueholm (Principal Supervisor: Prof Phil Weinstein). Bjørn was also the University of South Australia’s first dual PhD recipient and he will be awarded a jointly badged PhD parchment from the University of Copenhagen (KU) and University of South Australia upon successful completion of his studies.

His PhD thesis is entitled, “The *Santalum spicatum* – *Acacia ligulata* relationship: A chemical ecology study”. Australia is home to a great number of parasitic plants as a parasitic lifestyle is advantageous in nutrient-limited environments. There are more than 90 species of mistletoes and 6 endemic species in the genus *Santalum*. One of these species is Australian sandalwood (*Santalum spicatum*) that has played an important role in the history of South Australia and Westerns Australia, where this tree grows naturally. Its fragrant heartwood has highly valued compounds (sesquiterpenoids called santalols) that are in great demand on many different markets. The demand for Sandalwood and the associated extreme “harvesting” in the wild has resulted in a severe reduction in its natural populations.

The two primary fields of research in Bjørn’s PhD project are chemical ecology and spatial ecology. Both fields seek to uncover the processes leading to the observations we see in ecological systems. The chemical ecology field seeking to discover what natural compounds are involved between the organisms (e.g. toxic compounds produced by plant to wade off herbivores), and the spatial ecology field seeking to link spatial patterns to the processes creating these patterns (e.g. plant-plant interactions).

Gaining a good understanding of the processes that shape successful sandalwood populations will greatly assist with the conservation and natural resource management (NRM) of Australian sandalwood. To gain insight into the processes Bjørn uses natural communities with Australian sandalwood
Being a member of the Barbara Hardy Institute has provided Bjørn the opportunity to establish positive connections with experts and ensure the multidisciplinarity of his PhD.
for his project. The project will also contribute to general knowledge on parasitic plants that seem to be important players in many ecological systems worldwide – especially here in Australia. Over the last year Bjørn has collected chemical and spatial data and undertaken some interesting observations in the field. He has also created contact with Australian sandalwood researchers in Western Australia for a broader perspective of his research project.

Being a member of the Barbara Hardy Institute has provided Bjørn the opportunity to establish positive connections with experts and ensure the multidisciplinary research of his PhD project.

Bjørn is delighted to see that the network of people involved in conservation and natural product management here in South Australia seems to have grown in strength and hopes to contribute with applicable knowledge from his research.

NRM Scholarships

The Barbara Hardy Institute in collaboration with the Department of Environment and Natural Resources (NRM Research) offered four Honours Scholarships in 2013 to the total value of $10,000 as part of a new initiative to improve the promotion and integration of practical NRM outcomes into academic research programs.

In 2013, the NRM scholarship assisted Honours students from the School of Natural and Built Environments who had completed a Bachelor of Sustainable Environments to develop the necessary skills that are in demand across the SA Government Environment Portfolio and each project provided close links with the Department of Environment and Natural Resources NRM.

The Institute and our Honours Scholarship recipients are grateful for the financial support and positive feedback received from the NRM Research team regarding their final Honours thesis. These funds were used to cover costs such as specialised equipment, survey development, remote travel and accommodation to support successful research outputs.

Details regarding the Honours projects for each student are listed below:

Bianca Hollow
Supervisors: Dr Philip Roetman and Professor Chris Daniels
Project Title: Changing attitudes to community response from the Great Koala Count.

Sanchita Mandal
Supervisors: Professor Nanthi Bolan and Dr Sharolyn Anderson
Project Title: Potential value of biochar for mitigating greenhouse gas emission from the soil.

Christopher Carr
Supervisor: Dr Gunnar Keppel
Project Title: Abundance, quality and occupancy of tree hollows in old-growth mallee at Brookfield Conservation Park, SA.

Joshua Allen
Supervisor: Dr Gunnar Keppel
Project Title: Inter-seasonal variation in diet of the southern hairy-nosed wombat at Yookamurra Wildlife Sanctuary.
5.5 Research Students

Research students (or HDR students – completing a higher degree by research) are often described as the ‘engine room’ of research in tertiary institutions. Research students:

- Support the research activities of academic and research-only staff
- Generate research outputs
- Undertake contract research and improve connections with government and industry

In addition, postgraduate education is a vital component of the tertiary education process as many graduating students continue on in academic positions around the world, and their training in research methodology is handed down to future students who contribute to the social and technological development of the world community.

In 2013, the Barbara Hardy Institute connected to 121 research students supervised by its members. Figure 8 shows that these research students were based in four schools with students primarily based in the School of Natural and Built Environments (63) and School of Engineering (52).

In addition, 20 research students completed their degrees in 2013. This comprised 17 PhDs and three Professional Doctorates. (Appendix 1 contains a full list of students, their thesis titles and listed supervisors).

By using socio scientific issues as the driver, teachers can involve students in social action to reduce their ecological footprint and connect to the natural world.
6.1 Foundation Programs

The Barbara Hardy Institute uses its Foundation Programs to provide researcher support and research development activities to assist members to enhance career development, secure grants, disseminate their research and provide research student supervision. In 2013, the Barbara Hardy Institute organised a series of activities to support its membership.

Foundation Program Events

Having set internal benchmarks and identified areas of development for our membership, the Barbara Hardy Institute staged the inaugural Director’s Hot Topics series with attendees learning various aspects of media training, legalities of research and University processes and research management.

Foundation Programs

<table>
<thead>
<tr>
<th>Category 1 and 4 funding development</th>
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<tr>
<td>Early career and associate researcher development</td>
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<td>Fellowships and internationalisation</td>
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<td>Teaching-Research nexus and attracting research students</td>
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<td>Public profile</td>
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<td>Facilities and infrastructure</td>
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Table 3: Foundation programs

Director’s Hot Topic 1: Developing media expertise
5 September

This interactive workshop was led by media expert Alison Rogers whose expansive career history includes roles as journalist, ABC broadcaster, chief political media advisor, PR manager and Director of leading Adelaide communications and marketing agency, 'communikate et al'.

Fourteen Barbara Hardy Institute members had the exceptional opportunity to learn how to promote and communicate their research to the media. As part of the workshop, Alison critically examined the attendees' media skills, including videotaping and analysing their interviews. Her feedback to each researcher included invaluable advice on how they could improve their communication skills and address some of the more delicate issues of being thrown into the media spotlight.

Foundation Programs: Early and Associate Researcher Development, Public Profile.

Director’s Hot Topic 2: Contracts, copyright and commercial communication
27 September

Former barrister and solicitor Penny McCann provided insights about researcher rights, commercial negotiation and communication skills to Barbara Hardy Institute members who engaged in an interactive discussion about how to protect their research work while dealing with other partners within the academic, industry or government sectors.

Nineteen members engaged in a number of topics that covered the basics of contract and intellectual property law (contract formation, content, performance and termination), contract types (IP ownership, publication and commercialisation), University processes including utilisation of the Business Development team, and communication and negotiation skills.

Foundation Programs: Early and Associate Researcher Development, Category 1 and 4 Funding Development.
Director’s Hot Topic 3: There IS a better way! Tips and tricks to manage your working week
30 October

Dianne van Eck from DVE Business Solutions led this workshop designed to provide information, tips and tricks to assist researchers in better managing their research and administration commitments during the working week.

Seventeen participants learned how to best use their time in work planning and time management. Dianne shared with them effective ways to improve email management, planning processes and information management, as well as communication and collaboration techniques.

Foundation Program: Early and Associate Researcher Development.

Foundation Program Funding Schemes

Barbara Hardy Institute 2013
PhD → Research Fellowship position

To assist an outstanding PhD student transition from graduate to Research Fellow, the Barbara Hardy Institute provided a salary and office for up to one year whilst the development of future research funding was secured.

As the recipient of the inaugural position, Dr Philip Roetman has set up the Citizen Science Unit ‘Creating Biophilic Cities through Citizen Science’ and has secured $1.5million over five years. Strong links and a signed MOU with the Victoria University of Wellington and strategic partnerships with local government and industry stakeholders will ensure engagement with the public and PhD students in specific citizen science projects.

Foundation Program: Early and Associate Researcher Development

ARC Grants, Fellowships & Awards Assistance Scheme

A total of 15 grants, fellowships and awards were submitted by members of the Institute to Australian Research Council between November 2012 and April 2013. Of the 18 full members who were eligible, 16 members were offered $4,000 in funding assistance with the post-ARC application process at a total of $64,000. These funds were provided to assist in further development of projects through the writing of rebuttals, preliminary data collection and other activities in the preparation of an improved re-submission for the subsequent ARC funding round.

Foundation Programs: Category 1 and 4 Funding Development; Fellowships and Internationalisation

Barbara Hardy Institute Adjunct Support Funds

The Adjunct Support Funds initiative was designed to be utilised to assist Adjunct members in the course of their sustainability research. It was aimed at increasing and improving the quality of research outputs, with a preference given to activities that attracted measurable HERDC outputs. Adjuncts applied for the funds for a range of activities including: journal, book and conference publication costs, conference registration, data analysis, and travel costs.

Six applications were approved at a total of $11,276 for 2013 with an additional $6,000 approved for utilisation in 2014. Funds will be applied to a range of activities including testing and data analysis, publication costs, research travel (flights, accommodation) and conference registration.

Foundation Program: Early Career and Associate Researcher Development
6.2 Distinguished Lecture Program

As part of the Public Profile Foundation Program, the Barbara Hardy Institute’s Distinguished Lecture Program continued into its second year, achieving the aim of extending networks of collaboration and partnership opportunities with other researchers and institutions.

Two highly respected researchers in their fields, Professor Robert Costanza from the Australian National University and Professor Stuart White, from the University of Technology Sydney, accepted invitations from the Barbara Hardy Institute to share their knowledge with our members and general audience in their areas of expertise.

Distinguished Lecture Program 1: Professor Robert Costanza

Professor Robert Costanza is currently the Chair of Public Policy at the Crawford School of Economics and Government at the Australian National University. Professor Costanza’s transdisciplinary research integrates the study of humans and the rest of nature to address research, policy, and management issues. His work has focused on the interface between ecological and economic systems, particularly at larger temporal and spatial scales, from small watersheds to the global system. This includes landscape-level spatial simulation modelling; analysis of energy and material flows through economic and ecological systems; valuation of ecosystem services, biodiversity, carrying capacity and natural capital; and analysis and correction of dysfunctional incentive systems.

This Distinguished Lecture Program had a number of positive research outputs including an Australian Research Council (ARC) funding submission and publication outputs.

HDR Master Class – 10 April
Value of natural capital relative to the global economy

There were 20 Higher Degree by Research students (PhD and Masters by Research) engaged in an interactive Master Class led by Professor Robert Costanza about the challenges of the ecosystems, their value and benefits in our society.

Professor Costanza focused his discussion on how a recent economic valuation of the ecosystem services provided by natural capital suggests that the value of ecosystem services in monetary units is significantly larger than global GDP. He noted however, that ecosystems cannot provide any benefits to society without the presence of people (human capital), their communities (social capital) and their built environment (built capital).

Professor Costanza advised that ecosystem services do not flow directly from natural capital to human well-being – and it is only through interaction with the other three forms of capital that natural capital can provide benefits. The challenge in ecosystem services valuation is to assess the relative contribution of natural capital in this interaction and to balance our assets to enhance sustainable human well-being.
Distinguished Lecture – 11 April
Solutions for a sustainable and desirable future

Over 200 people attended this public lecture, by Professor Costanza who provided abundant evidence to show that, beyond a certain threshold, further material growth only marginally contributes to improvement in quality of life and creates significant roadblocks to sustainability.

Subsequently, overcoming these roadblocks and creating a sustainable and desirable future will require an integrated systems redesign of our socio-ecological regime and economic paradigm focused explicitly and directly on the goal of sustainable quality of life and well-being rather than the proxy of unlimited material growth.

Professor Costanza explained that not only does further material growth not meet humanity’s central goal, but there is also mounting evidence that it creates significant roadblocks to sustainability through increasing resource constraints (i.e., peak oil, water limitations), sink constraints (i.e., climate disruption, biodiversity loss, pollution) and the inequitable distribution of wealth.

Visions and models of integrated sets of worldviews, institutions and technologies are needed to stimulate and seed this evolutionary redesign and for Professor Costanza, the process of creating a shared vision of the future is also a key missing element of real democracy in the modern world.

Workshop – 12 April
Leveraging the economic valuation of ecosystem services

This workshop attracted 50 attendees from Barbara Hardy Institute membership, government and industry representatives. During the session attendees explored different ways in which the economic valuation of ecosystem services can serve to cogently inform the decision making and policy development processes of local and state government.

Professor Costanza demonstrated that the dollar value of non-market ecosystem services exceeds the dollar value of the entire market economy. However, Government decisions and policies often do not recognize or account for these non-market benefits in policy formulation or decision making.

Participants at the workshop discussed how green open spaces (often not a priority for City Councils) in an urban environment can reduce public expenses on health care, street maintenance, energy expenditure and storm water mitigation. The debate focused on how parks are often considered an expensive luxury that make the top of the list for budget cuts in times of austerity measures. At the end of this workshop, a plan to reinforce collaborations between the University and local government and industry partners was created to provide useful and actionable information that will improve human well-being and sustainability.

Distinguished Lecture Program 2:
Professor Stuart White

Director of the Institute for Sustainable Futures at the University of Technology Sydney, Professor Stuart White leads a team of researchers who create change towards sustainable futures through independent, project-based research. With more than thirty years' experience in sustainability research, his work focuses on achieving sustainability outcomes for a range of government, industry and community clients in Australia and internationally. This includes both the design and evaluation of programs for improving resource use efficiency and an assessment of their impact.

This Distinguished Lecture Program was co-hosted with the SA Zero Waste Centre for Sustainable Design and Behaviour (sd+b) and helped to further collaborative research between the two UniSA research concentrations.

PhD Colloquium – 20 September
Collaborating for sustainability

This Colloquium brought together early career researchers and PhD students to discuss the work of their peers. Professor White was a panel member in this PhD Colloquium, considering and evaluating the research of ten PhD students from the Barbara Hardy Institute and the sd+b Centre.

Li Meng and Sheryn Pitman from the School of Natural and Built Environments and Christian Reynolds from the School of Information Technology and Mathematical Science had the opportunity to talk about the research that they have developed as part of their PhD work and received positive feedback and invaluable advice from Professor White.

The research topics included climate change, urban planning and sustainability.
Distinguished Lecture – 20 September
Sustainable cities: from possible futures to preferred futures

More than half the world’s population live in cities. They are the source of most of the world’s greenhouse gas emissions, resource use and waste and yet also a major source of innovation and transformation. They are the key to the future of the societies and the planet.

Over 100 people attended this Distinguished Lecture, which focused on the potential for cities to be the source of sustainability. Professor White posed the question of what would need to happen or how would our decision-making systems need to change in order for this to happen.

Using examples from the work of the Institute for Sustainable Futures, his presentation described solutions that can take us from possible futures to preferred futures.

Sabbatical Lecture:
Dr Paul Sutton
13 December

Adjunct Senior Research Fellow Paul Sutton, Professor and Director of Graduate Studies at the University of Denver, Colorado, US was a sabbatical visitor of the Barbara Hardy Institute from mid-2012 to late 2013, with some time spent teaching in the School of Natural and Building Environments. Dr Sutton delivered a lecture entitled, ‘Alone in the Void: Getting Real about the Tenuous and Fragile Nature of Modern Civilisation’.

In this lecture Dr Paul Sutton explained why he sides with ecological economics theorists, regarding what collective choices will result in a better future for humanity. In a world of seven billion people, the dominant neo-classical economic paradigm is optimistic and growth oriented with faith in technological solutions to pressing social and environmental problems; whereas, the minority paradigm of ecological economics posits a need to move toward a steady state economy governed by the laws of thermodynamics as the preferred path for human progress.

The paradigm of ecological economics posits a need to move toward a steady state economy governed by the laws of thermodynamics as the preferred path for human progress.
### 6.3 Fields of Research

Using an external appraisal that was conducted as part of the Excellence in Research in Australia (ERA) initiative allows us to understand the various fields of research by members.

Our research is strongly aligned with the University’s recognised areas of research strength. In 2012, the Australian Research Council (ARC) conducted its second major review of research in Australian higher education institutions, called ERA. As part of that process all research activity was divided into 22 ‘divisions’, each given a two-digit Field of Research (FoR) code. These codes and divisions are based on the classification system that the Australian Bureau of Statistic uses for classifying research – the Australian and New Zealand Standard Research Classification (ANZSRC) 2008. Australian higher education institutions were required to categorise their research according to this system, with each researcher classified in up to 3 ERA divisions. The ARC then evaluated the research, based on the four indicators of quality, quantity, application and recognition with research at each institution then ranked by ERA discipline as:

**ERA ranking 5**  Research that is **well above world standard**

**ERA ranking 4**  Research that is **above world standard**

**ERA ranking 3**  Research that is **at world standard**

**ERA ranking 2**  Research that is **below world standard**

**ERA ranking 1**  Research that is **well below world standard**

UniSA submitted its research in 15 of the 22 divisions and was ranked at world standard or above in 13 of these divisions. At the Barbara Hardy Institute, 92.7% of our ERA division classifications were ranked at or above world standard (refer Figure 9) and the research of our members contributed to nine of the 13 ERA divisions where the university is considered at or above world standard. Table 4 presents our research foci classified by ERA divisions and how they ranked in 2012.

The ERA results confirm that Barbara Hardy researchers contribute to a large number of general fields of research that provide outstanding opportunities to:

1. Develop more fields of research to reach **world standard**
2. Progress fields of research that are already **world standard** to **above world standard**
3. Progress the field of research that is already **above world standard** to **well above world standard**
4. Conduct truly multidisciplinary research given our broad range of research expertise and a common focus: **great research into sustainability**.

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**Table 4:** Research by ERA division

<table>
<thead>
<tr>
<th>ERA Code</th>
<th>ERA Field of Research</th>
<th>Research fields of full and associate members</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>Engineering</td>
<td>31</td>
</tr>
<tr>
<td>05</td>
<td>Environmental Sciences</td>
<td>9</td>
</tr>
<tr>
<td>01</td>
<td>Mathematical Sciences</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Built Environment and Design</td>
<td>24</td>
</tr>
<tr>
<td>11</td>
<td>Medical and Health Sciences</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Language, Communication and Culture</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>Commerce, Management, Tourism and Services</td>
<td>1</td>
</tr>
<tr>
<td>08</td>
<td>Information and Computing Sciences</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Studies in Human Society</td>
<td>1</td>
</tr>
<tr>
<td>04</td>
<td>Earth Sciences</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Education</td>
<td>2</td>
</tr>
<tr>
<td>02</td>
<td>Physical Sciences</td>
<td>1</td>
</tr>
</tbody>
</table>

**Figure 9:** ERA standards of research conducted by members (2-digit FoR)
6.4 Research Strength and Capability

The Barbara Hardy Institute has a range of large scale research activities focussing on aspects of physical, mathematical, engineering, educational or environmental areas of sustainability. Showcased below are three of our research topics in sustainable energy, engineering for sustainable agriculture and citizen science.

Sustainable Energy

Research in the area of sustainable energy included the completion and release of a final report: A framework for adaptation of Australian households to heat waves by the National Climate Change Adaptation Research Facility. This was a national multidisciplinary project that provided vital information on the likely impact of climate change on households and infrastructure due to the anticipated discomfort, changes in heating and cooling requirements and associated impact on electricity infrastructure in Australia. The final report also provided potential design solutions for new and existing housing to reduce the negative impact of heat waves.

The first projects commenced in the two major national research initiatives which were announced in 2012; The CRC for Low Carbon Living (LCL CRC) and the Australian Solar Thermal Research Initiative (ASTRI), now ARENA. These initiatives focused on solar thermal energy generation and storage and sustainable energy use in buildings. The focus in the solar thermal area involved developing materials and systems for thermal energy storage using phase change materials. This will be critical for future reliance on solar energy to provide more and more of the world’s energy demands as it enables the generation and provision of electricity at any time, not just when the sun is shining.

Other research in sustainable energy focused on evaluating the methods for reducing conventional energy use in housing. In 2013 the Institute saw the completion of a prototype integrated solar system for the provision of hot water heating, dehumidification and cooling. This system was installed in a Housing SA home in Adelaide where system performance is continually monitored.

Monitoring activities continued in Lochiel Park and these findings have been presented in a number of international journals and conferences with the results of this project demonstrating that we can maintain our Australian lifestyle with improved comfort while relying mainly on solar energy. This work will continue in a new LCL CRC project focused on developing viable systems to enable the transition to zero carbon housing. In this context we have completed projects on monitoring the performance of domestic hot water systems in typical Adelaide homes with the project aims of assisting households in obtaining advice on suitable hot water heaters and the anticipated costs of using alternative systems.

Engineering for Sustainable Agriculture

Engineering for sustainable agriculture research is directly related to the ever increasing world population and continuing growth in demand for food. A range of projects were undertaken during 2013 involving research students and staff in Australia and abroad.

A number of Higher Degree Research students completed and/or submitted their PhD in 2013 and their research has contributed significantly to agricultural machinery sector projects:

- Soil movement during tillage which will aid soil opener selection to improve the performance of soil applied herbicides at higher than current tillage speeds
- Adapting a walk behind rotary tiller to a strip till conservation framing machine to use modern farming techniques to small scale farmers
- Disc seeding with the view to developing strategies to reduce the detrimental effects of soil adhering to disc seeder components and development of a theory for soil tool interaction for a rotating disc cutting soil

Directly linked to Nick Berry’s PhD submission has been the resultant patent for an Integrated Seed Destructor. This machine impacts seeds exiting a grain harvester in the chaff stream in a manner that devitalises them and is an aid to farmers to help control their problem of herbicide resistant seeds. In the next few years this attachment may be factory fitted to grain harvesters.

Nick is now working as a Research Fellow with the Barbara Hardy Institute to commercially develop the technology. Prototype of the machines have been run for the past two harvests with one farmer in Western Australia using it throughout his recent harvest. This development was awarded recognition from Engineers Australia’s 2013 Society for Engineering in Agriculture awards.

Associate Professor John Fielke continues to work in the Advanced Processing of Almonds funded by Horticulture Australia Limited which includes the dehydration and aeration of almonds in storage to allow earlier harvest and reduce losses due to rain and insects and developing improved methods to hull and shell almonds with less damage to the kernels.

Dr Chris Saunders was involved in a range of projects, including adoption of mouldboard plough technologies to combat non-wetting soils, an autonomous field vehicle that can be used for weed mapping and soil sampling and machine vision for weed detection.

Dr Jack Desbiolles has been involved in a range of international aid projects in agriculture to address food security and sustainability issues in world farming. Agricultural projects in areas such as Syria, Iraq and Cambodia are using Australian conservation agriculture equipment and techniques in...
these developing countries. This research assists the local manufacture and extension of these technologies to small scale farmers to take them from subsistence farming to feeding more of the local population including improving rice crop practices in Cambodian wetlands and dry land farming projects in the Middle East. The projects are designed to lift crop productivity and enhance soil conservation and water-use efficiency, improving drought management and overcoming land degradation.

Citizen Science

Creating Biophilic Cities through Citizen Science was launched in 2013 and is a new $1.5 million Barbara Hardy Institute research program over five years aimed at connecting communities to their natural environments. The research unit will undertake research, education and community engagement projects aimed at cultivating public awareness of environmental assets and issues while promoting environmental stewardship.

Led by Dr Philip Roetman, the program will expand on the successes of previous Citizen Science projects such as the 2012 Great Koala Count and Operation Magpie. New large-scale citizen science projects and community events are now being progressed with extensive community and stakeholder consultation anticipated in 2014.

Public participation in research activities will increase community understanding and interaction with local species and natural environments around South Australia and further afield which will stimulate community engagement, enabling people to connect to their natural environment in purposeful ways.

Projects will be designed to inform government planning and policy and results will be delivered back to the community for further education. A partnership with New Zealand’s leading research University, Victoria University of Wellington has culminated with the signing of a Memorandum of Understanding (MOU) and will further underpin research into the way people engage with nature.

A partnership approach is key to the success of this initiative and as such, there are a range of collaborators. Institutions involved include the Adelaide and Mt Lofty Ranges Natural Resource Management Board, the Department of Environment, Water and Natural Resources, City of Marion and City of Salisbury Councils. Project partners consist of ABC local radio (South Australia), Wellington City Council, and the South Australian Museum. Together with additional organisation engagement such as CSIRO, Creating Biophilic Cities through Citizen Science is able to create significant impact in this field of research and beyond.

6.5 Hawke-Hardy Research Grant

The Barbara Hardy Institute was excited to announce a new jointly funded collaborative grant scheme with the Hawke Research Institute in 2013 which was announced at the launch of the Hawke Research Institute’s ‘Identity Transformations’ theme on 17 May where the Honourable Bob Hawke and Dr Barbara Hardy, AO attended the launch.

The Hawke-Hardy Research Grant provided an opportunity for a maximum of two collaborative projects to be funded up to a total value of $50,000. Project teams must consist of at least one member from each Institute focusing on ‘Disasters’ as a research node to examine how planetary risks and catastrophes impact upon people and cultures, bringing questions of identity into sharp focus. Identity emergencies, disasters and catastrophes stemming from high-scale environmental risks such as climate change, global warming and associated threats to the future of the planet would be a key focus.

The inaugural Hawke-Hardy Research Grant recipients were Dr Delene Weber (Barbara Hardy Institute) and Dr Kiera Lindsey (Hawke Research Institute) who have successfully received a grant of $38,655 for their project titled: “Charismatic disasters: a South Australian case study” which will commence in 2014.
6.6 A Three-Tiered Approach to Multidisciplinary Research Projects

Our aim as an Institute is to establish a reputation for high-quality research into sustainability to produce multidisciplinary research. Multidisciplinary research allows researchers from different disciplines to work together while still retaining their individual disciplinary approaches. This type of research has the advantage of creating a research output that is greater than the sum of the component parts. Transdisciplinary research, creating new fields by merging two or more disciplines produces new and exciting areas of research and is illustrated through our Icon Projects. Multidisciplinary research has the advantage of retaining the core disciplines allowing research growth in these specialities to be recognised and measured (e.g. by the ERA initiative).

A three-tiered hierarchical model is used to develop the research profile of the Institute (refer Figure 10). Projects are allocated to tier one, two or three with consideration of scale and focus in addition to traditional measures of research such as quality and quantity. Research projects and topics are linked closely with our stakeholders for opportunities to collaborate on methodology and approach and the Institute actively encourages projects to grow from tier three to tier one.

6.7 Icon Projects (Tier One)

The Institute continued to support two Icon Projects in 2013 with a dollar value of $50,000. Icon projects are inclusive, large-scale and have significant impact. Each research project is merit selected by the Executive group and led by the best researchers in the Institute with performance indicators against the following criteria:

1. Multi-disciplinarity or trans-disciplinarity
2. Building partnerships
3. External funding
4. Engaging many Barbara Hardy Institute researchers
5. Multiple research outputs
6. Industry and community engagement
7. Industry and community profile
8. Scale, focus and impact
9. Quality and quantity of research

Icon projects reflect the ethos of the Institute which is to work together on complex issues around sustainability and are led by full members who are project champions in the Institute.

Figure 10: A three-tiered approach to research projects
Icon Project 1

**Sustainable living in the low carbon Lochiel Park development**

**Project Champions**  
Dr Frank Bruno and Professor Wasim Saman

Residential buildings emit 13% of Australia’s greenhouse gas emissions. They are also responsible for a growing differential between average and climate-related peak electricity demand with associated impacts on investment in electricity transmission and generation infrastructure.

Lochiel Park, located approximately eight kilometres north-east of the Adelaide CBD, has been transformed into an area of natural parklands with a new small housing development and is considered the nation’s leading green village model that incorporates Ecologically Sustainable Development (ESD) practices.

Icon Project leaders Dr Frank Bruno and Professor Wasim Saman continued to lead this project with over 100 dwelling that include social housing and a zero carbon house establishing a benchmark for a low carbon community.

This project considers the social sustainability development of the green village, its integration with local community and the impact on the building and construction industry, transport and waste. Interaction with other projects within the CRC for Low Carbon Living, and the CRC for Water Sensitive Cities will also develop the knowledge needed by industry, government and the community to provide economic, environmental and socially optimised low carbon urban development appropriate to local conditions.

Monitoring activities continued in Lochiel Park and these findings have been presented in an number of international journals and conferences with the results of this project demonstrating that we can maintain our Australian lifestyle with improved comfort while relying predominantly upon solar energy. This work will continue via a new LCL CRC project focused on developing viable systems to enable the transition to zero carbon housing.
Australia’s use of fossil fuels is unsustainable. The need to transition to a future where electricity is generated primarily from renewable energy sources is a priority. The research for this Icon Project develops the knowledge and tools required to design and optimise a system composed of a mix of generation technologies, including solar thermal, solar photovoltaic and wind.

This project continues to progress the issue of a sustainable energy supply into the future from a technological and social perspective providing Australians with affordable, reliable, clean electricity in a context of environmental sustainability.

Icon Project leaders Professor John Boland and Professor Philip Weinstein and their team continued their research in this field with a further seven publications attributed to the project.

During 2013, significant advances were made and substantial work undertaken with the Australian Solar Energy Forecasting System (ASEFS). The coupled autoaggressive and dynamical system (CARDS) forecasting model was selected to be integrated into the ASEFS system that is being developed by Overspeed for the Australian Energy Market Operator.

An ARC Discovery Grant on renewables and storage was unsuccessful in 2013 but has been substantially amended for submission in the following year. Two ARENA (Australian Renewable Energy Agency) expressions of interest have been submitted and invitations to present as a key note speaker as a result of this work at the World Renewable Energy Congress, IEA Task 46, Solar Forecasting and other major conferences/institutions have been confirmed.
6.8 Key Researchers leading Focused Research Projects (Tier Two)

Tier two research projects are the mainstay of University research. In 2013 the Barbara Hardy Institute conducted 34 tier-two projects with a total value of over $15,088,000. A list of projects is provided in Appendix 2 and is regularly updated on the Barbara Hardy Institute website. Tier-two research projects have the following characteristics:

1. Primarily research of senior members (Associate Professor/Professor)
2. Project is well funded e.g. Category 1 grant funded research (nationally competitive grants), or a significant component of a Cooperative Research Centre (CRC)
3. Focused on a specific topic or area
4. Undertaken by a small group or an individual with external partners
5. Produces many quality research outputs (e.g. research papers/products/symposia)
6. Produces quality research students and supports junior research fellows
7. May be part of an ongoing research program that lasts for many years

6.9 Small-Scale, Pilot or Student Research (Tier Three)

Tier three research is small-scale research, including contract research, consultancies and testing or evaluation services. Tier-three projects have the following characteristics:

1. Small-scale
2. Produces a limited number of publications
3. Predominantly funded by category 2 (public sector grants) and 3 (industry and international research income)
4. Includes pilot and non-core research
5. Can have significant impact as individual pieces of research
6. Often only lasts for a short period e.g. one year
7. May lead to tier-two projects
6.10 Research Publications

Research publications are sorted into a range of categories against the HERDC (Higher Education Research Data Collection) guidelines. Funding comes to the University and subsequently to the Barbara Hardy Institute on the basis of the recognised quality of the research publications. The University submits the final list to the Department of Innovation, Industry, Science and Research (DIISR) where it is used as part of the calculation for University funding.

In addition to the four categories collected via HERDC, the University also collects information on other research outputs that may not meet the requirements for the HERDC but are eligible outputs for inclusion in Excellence in Research for Australia (ERA) submissions. In 2012, it was determined that a number of these internal categories would no longer be included however, in order to fully showcase the research of our membership, they have been included in this 2013 Research Report.

In 2013, Institute members produced 347 research publications, a 34.3% increase from the 228 published in 2012. A full list of publications is provided in Appendix 4. Figure 11 shows a breakdown of these publications by the following categories of which those underlined are particularly important for research funding calculations:

- Authored Research Books (category A1)
- Authored Other Scholarly Books (category A2)
- Edited Scholarly Books (category A3A)*
- Book Chapters (category B)
- Refereed Journal Articles (category C1)
- Non-refereed Journal Articles (category C2)
- Refereed Conference Papers (category E1)
- Non-refereed Conference Papers (category E2)
- Edited Refereed Conference Proceedings (category E4A)
- Patents (category I)*
- Reports (category K)*

Note: Categories noted with an asterisk ‘*’ are not included within the Internal publication collection process.

Publication Highlights

A highlight of the Institute’s publication outputs includes an increase of categories B (book chapters) by 42.3%, C1 (refereed journal articles) and E1 (refereed conference papers) categories by more than 60% combined from 2012 to 2013. Both categories play a significant role in research funding calculations.
6.10 Other Research Activity

Presentations

During 2013, members of the Institute delivered 138 presentations at local, national and international events (Figure 12) covering conference presentations, seminars, forums, workshops, public talks and symposia contributions (refer Figure 13). This represented a 42.5% increase in international presentations from 2012. Seminar and workshop presentations experienced significant growth of 50% from the previous year. Overall, our members have increased the number of presentations that deliver our message of great research into sustainability by 23.2% since 2012.

Please refer to Appendix 3 for a full list of presentations and Appendix 4 for those published in conference proceedings.

Figure 12: Locations of presentations

Figure 13: Types of presentations
Honours and Awards

Special mention goes to our patron Dr Barbara Hardy AO, who in late 2013 was awarded Senior South Australian of the Year for 2014 in recognition of her tireless environmental and scientific work.

Barbara Hardy Institute members received 24 honours and awards in 2013. The awards are:

**Saiful Bari**  
Oral Evaluation Award. Society of Automobile Engineers (SAE) 2013 World Congress and Exhibition.  
Best Academic Researcher 2013. School of Engineering, University of South Australia.

**Jacqueline Balston**  
Climate Champions Award for the State and Local Government categories. National Climate Change Adaptation Research Facility (NCCARF).  
Climate Change Adaptation Good Practice Projects. National Climate Change Adaptation Research Facility (NCCARF).  
State Disaster Resilience Award 2013. Central Region of South Australia.

**Martin Belusko**  
Postdoctoral Fellowship. Australian Renewable Energy Agency (ARENA).

**Frank Bruno**  
Scientific Committee Member of the Australian Solar Cooling 2013 Conference.

**Chris Daniels**  
Appointed Chair of the Presiding Members forum for the South Australian NRM boards for 2013.  

**John Fielke**  
Learning and Teaching 2013 Citation for Outstanding Contributions to Student Learning.

**Mohammed Haque**  
Established an IEEE Power and Energy Society Chapter in South Australia and served the Chapter as Chair.

**Phil Howlett**  
Appointed chair of the CSIRO/ANZIAM, Australia and New Zealand Applied Mathematics division of the Australian Mathematics Society.

**Bin Huang**  
Outstanding Self-Financed Students Abroad. China Scholarship Council.

**Gunnar Keppel**  
UniSA Early Career Researcher Development Program – High Quality Research.

**Ming Liu**  
UniSA Early Career Researcher Development Program – High Quality Research.

**Huajian Liu**  
Grains Research and Development Corporation (GRDC) Travel Award to support research.

**Vahid Poorjafarizavazm**  
Golden Key Asia Pacific Postgraduate Study Award 2013.

**Peter Pudney**  
Unsung Hero of South Australian Science Communication. Australian Science Communicators (SA) and National Science Week (SA).

**Tom Raimondo**  
UniSA Early Career Researcher Development Program – High Quality Research.

**Mark Shelbourn**  
International Design and Build Competition. Associated Schools of Construction.

**Sekhar Somenahalli**  
Fellowship Scholarship. School of Natural and Built Environments, University of South Australia.

**Steven Tay**  
Early Career Researcher International Travel Award for a six weeks research exchange in Spain.

**Mohammad Uddin**  
Office for Learning and Teaching Grant 2013. Department of Education.  
Teaching grant under Workforce Innovation Program: Enhancing Industry Engagement in Engineering Degrees. ITEE Teaching and Learning office, University of South Australia.
6.12 News and Media

The Barbara Hardy Institute continues to be a focus across various forms of news and media covering print and electronic form such as newspapers, website and facebook. A review of ‘Top Stories’ reported by the University of South Australia on domestic media content shows that members of the Barbara Hardy Institute were in the media on more than 65 occasions in 2013, a substantial increase from 2012.

The top five media sources in South Australia included ABC Radio, The Advertiser, Seven News: Today Tonight, Channel 10: Scope and the Sunday Mail. Nationally, the Institute was represented on Radio National Canberra, 2BG Sydney and ABC Hobart, South Western Victoria and Newcastle. Articles covered a range of issues such as:

- Cooling systems affected by heat wave
- Healthy environments equal healthy people
- Urban ecology and the bee population
- Mosquitoes and public health
- Electric cars scoring top marks for environmental impact
- African solar taxis
- Dr Peter Pudney bestowed Unsung Science Hero Award

Website and Social Media

The Barbara Hardy Institute website continues to promote current and past key research areas undertaken within the Barbara Hardy Institute.

The website is designed to communicate to Barbara Hardy Institute’s key research elements, its fellow researchers and the community, with sections on collaboration and resources for the public to engage with science.

Audience and online visitation to the website averaged 2,750 page views per month. The Barbara Hardy Institute also featured a spike in activity surrounding the announcement of our patron Dr Barbara Hardy AO as Senior South Australian of the Year 2014.

Steady traffic to other pages featuring community resources also positively reflects the Institute’s commitment to community engagement (Figure 14).

In June 2013, the Division: ITEE launched a new blog, Innovator that addressed the latest trends and developments in research, technology and innovation. Several members of the Barbara Hardy Institute contributed articles, which were promoted on social media and across the UniSA and Division: ITEE websites. The top three hits in online media were:

- John Boland
  Balancing electricity demand and supply (205 views)

- Philip Roetman
  Creating Biophilic Cities through citizen science (229 views)

- Peter Pudney
  Don’t wait for electric vehicle infrastructure, you (probably) don’t need it (94 views)
  From Trev to taxis (119 views)
The Barbara Hardy Institute received more than $3,623,000 in revenue in 2013 as follows:

**Category 1** Australian Competitive Grants
**Category 2** Other public sector grants
**Category 3** Industry and international research income
**Category 4** CRC income

The ongoing delivery of extensive technical and consultancy services is also an important revenue stream along with support from internal University revenue as a result of the Institute’s research outputs. The CRC for Low Carbon Living and the Automotive Australia 2020 CRC have a combined worth of $54 million of research income over the life of the 2 CRCs.

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Figure 15: Revenue breakdown
## Appendix 1

### Members

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<td>Mr</td>
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</tbody>
</table>
Research students: 2013 graduates

Mr Reazul Ahsan  Supervisors: AsPr Jon Kellett; Dr Sadasivam Karuppanan  Climate migration and urban changes: a study of adaptation in Bangladesh

Mr Alemu Alemu  Supervisors: Prof Wasim Saman; Dr Martin Belusko  Integration of passive elements into ventilation and air-conditioning of buildings

Mr Salim Al Mamary  Supervisors: AsPr George Zillante; Dr Nicholas Chileshe  Water management in the Aflaj system under a changing climate: strategy for sustainability

Mr Atiya Al-Zuheri  Supervisors: Prof Lee Luong; Dr Ke Xing  Modelling and optimisation of walking worker assembly line for productivity and ergonomics improvement

Mr Zainul Baharuddin  Supervisors: Prof Chris Daniels; Dr Alpana Sivam; Dr Sadasivam Karuppanan  Environmental attitude of the people and stakeholders towards urban biodiversity in Kuala Lumpur, Malaysia

Mr Justin Beck  Supervisors: Dr Peter Pudney; Prof Jerzy Filar  Incompetence, training and changing capabilities in game theory

Ms Jantanee Dumrak  Supervisors: Dr Sam Baroudi; Dr Stephen Pullen  Evaluating collaborative reproductive health programs in Thailand

Mr Bin Huang  Supervisors: Dr Ke Xing; AsPr Kazem Abhary; Dr Sead Spuzic  Parameterised hybrid modelling for optimal roll pass design in hot rolling of light-round profiles

Mr Jing Huang  Supervisors: AsPr John Boland; Dr Malgorzata Korkiewicz  Forecasting wind and solar energy on short time scales

Mr Swee Kuik  Supervisors: Dr Sev Nagalingam; Dr Hung-Yao Hsu; Dr Yousef Amer  Development of an integrated performance evaluation framework for product returns and recovery operations

Mr Maqsood Memon  Supervisors: AsPr Bruce Gurd; Dr Sev Nagalingam  A framework of supply chain management practices for organisational performance

Ms Li Meng  Supervisors: EmPr Michael Taylor; EmPr Stephen Hamnett; Dr Nicholas Holyoak  Investigating travel choices in a suburban rail corridor: an Adelaide case study

Mrs Indu Wadhawan  Supervisors: Dr Julia Piantadosi; EmPr Phil Howlett; Dr Peter Pudney  Pickup and delivery with queuing

Ms Juan Yang  Supervisors: Prof Linda Zou; Prof Chris Daniels  High performance and cost effective nano structured carbon electrode materials for capacitive deionisation technology

Mr Izzuddin Zaman  Supervisors: Dr Jun Ma; Prof Lee Luong  From clay to graphene for polymer nanocomposites

Mr Philip Roetman  Supervisors: Prof Chris Daniels  The ‘citizen’ in citizen science: the research, education and engagement of a program based on local wildlife species in South Australia

Mr Ali Solhjou  Supervisors: AsPr John Fielke; Dr Jack Desbiolles  Study into the mechanics of soil translocation with narrow point openers

Mr Nguan Hwee (Steven) Tay  Supervisors: Dr Frank Bruno; Dr Martin Belusko  Optimisation of heat transfer in a tube-in-tank phase change thermal energy storage system

Mr Hari Prasetyo  Supervisors: AsPr George Zillante; Dr Jian Zuo  The future of project procurement (PP) in the Hong Kong consumer electronics industry

Mr Philip Roetman  Supervisors: Prof Chris Daniels  The ‘citizen’ in citizen science: the research, education and engagement of a program based on local wildlife species in South Australia

Mr Ali Solhjou  Supervisors: AsPr John Fielke; Dr Jack Desbiolles  Study into the mechanics of soil translocation with narrow point openers

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Ms Juan Yang  Supervisors: Prof Linda Zou; Prof Chris Daniels  High performance and cost effective nano structured carbon electrode materials for capacitive deionisation technology

Mr Izzuddin Zaman  Supervisors: Dr Jun Ma; Prof Lee Luong  From clay to graphene for polymer nanocomposites
## Appendix 2

**Tier Two Projects**  
These are multi-year, externally funded projects in excess of $40,000.

<table>
<thead>
<tr>
<th>Funding Body</th>
<th>Investigators</th>
<th>Project Title</th>
<th>Project Years</th>
<th>Project Funding</th>
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<tr>
<td><strong>Australian Centre for International Agricultural Research (ACIAR)</strong></td>
<td>Geoff Beecher, Rajinder Pal Singh, David Johnson, Joel Janiya, <strong>Jack Desbiolles</strong>, Seng Vang, Som Bunna, Chuong Sophal, Ngin Chhay, Chea Sovandina</td>
<td>Improved rice establishment and productivity in Cambodia and Australia (administered via Industry and Investment NSW)</td>
<td>2009–2014</td>
<td>$247,257</td>
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<tr>
<td><strong>Australian Centre for International Agricultural Research (ACIAR)</strong></td>
<td>Mohammed El Mourid, Omar Zhagouane, Oussama ElGharras, Cheikh Md Hatem, <strong>Jack Desbiolles</strong>, Jim Fortune</td>
<td>Adapting Conservation Agriculture (CA) for rapid adoption by smallholder farmers in North Africa</td>
<td>2012–2016</td>
<td>$153,013</td>
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<td><strong>Australian Renewable Energy Agency (ARENA)</strong></td>
<td>John Boland, Manju Agrawal</td>
<td>Forecasting and characterising grid connected solar energy (administered via University of New South Wales)</td>
<td>2011–2014</td>
<td>$120,000</td>
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<td><strong>Australian Renewable Energy Agency (ARENA)</strong></td>
<td>Ming Liu</td>
<td>Postdoctoral Fellowship: High performance thermal energy storage systems with high temperature phase change material</td>
<td>2011–2014</td>
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<td><strong>Australian Renewable Energy Agency (ARENA)</strong></td>
<td>Shane Sheoran</td>
<td>PhD Scholarship: A direct contact heat exchanger for high temperature thermal storage in solar power plants</td>
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<td><strong>Australian Renewable Energy Agency (ARENA)</strong></td>
<td>Steven Tay</td>
<td>Postdoctoral Fellowship: Dynamic phase change material (PCM) systems for high temperature thermal storage</td>
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<tr>
<td>Australian Renewable Energy Agency (ARENA)</td>
<td>Wasim Saman, Frank Bruno, Farid Christo, Ming Liu</td>
<td>Development of high temperature phase change storage systems and test facility</td>
<td>2012–2015</td>
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<td>Australian Renewable Energy Agency (ARENA)</td>
<td>John Boland, Jing Huang</td>
<td>Australian Solar Energy Forecasting Systems (ASEFS) – Phase 1</td>
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<td>Australian Renewable Energy Agency (ARENA)</td>
<td>Wasim Saman, Frank Bruno, Ming Liu, Martin Belusko, Steven Tay</td>
<td>Australian Solar Thermal Research Initiative</td>
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<td>George Zillante, Lou Wilson, Jian Zuo, Stephen Pullen, Jasmine Palmer, Frank Schultmann, Keri Chiveralls, Jiayuan Wang</td>
<td>Re-considering sustainable building and design: A cultural change approach</td>
<td>2011–2013</td>
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<td>Australian Research Council (ARC) Linkage Project</td>
<td>Amie Albrecht, Phil Howlett, Andrew Metcalfe, Peter Pudney, Roderick Smith</td>
<td>Saving energy on trains -demonstration, evaluation, integration</td>
<td>2011–2014</td>
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<td>Cooperative Research Centre (CRC) – Automotive Australia 2020 CRC</td>
<td>Rocco Zito, Peter Pudney</td>
<td>Developing a new framework for environmental evaluation of vehicles</td>
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<td>Cooperative Research Centre (CRC) – CRC for Low Carbon Living</td>
<td>Wasim Saman, David Whaley, Pei Chao, Frank Bruno</td>
<td>Viable integrated systems for Zero Carbon Housing</td>
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<td>Rocco Zito, Michael Taylor</td>
<td>Integrated energy, transport waste and water (ETWW) demand forecasting and scenario planning for precincts</td>
<td>2012–2016</td>
<td>$613,000</td>
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<td>Cooperative Research Centre (CRC) – CRC for Low Carbon Living</td>
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<td>Planning a research agenda for low carbon transport</td>
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<td>Department of Climate Change and Energy Efficiency</td>
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<td>Panel of Experts: Energy in built environments</td>
<td>2013–2016</td>
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<td>Department of Environment Water and Natural Resources, Adelaide Mt Lofty Ranges NRM Board, City of Marion, City of Salisbury</td>
<td>Philip Roetman</td>
<td>Creating biophilic cities through citizen science</td>
<td>2013–2015</td>
<td>$480,000</td>
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<td>Grains, Research and Development Corporation (GRDC)</td>
<td>Alan McKay, Paul Bogacki, Jack Desbiolles, Dean Thiele, Andrew Burge, Daniel überli, Bill McLeod</td>
<td>Fungicide control of Rhizoctonia (administered via SARDI)</td>
<td>2011–2013</td>
<td>$175,000</td>
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<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>John Fielke, Chris Saunders, Graeme Quick</td>
<td>Mechanical weed seed termination at harvest</td>
<td>2011–2013</td>
<td>$719,706</td>
</tr>
<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>Gurjeet Gill, Sam Kleeman, Chris Preston, Jack Desbiolles, Dean Thiele</td>
<td>Improving Integrated Weed Management (IWM) practice in the Southern Region: Emerging weed issues (administered via University of Adelaide)</td>
<td>2011–2014</td>
<td>$120,000</td>
</tr>
<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>Chris Saunders</td>
<td>Development of a prototype soil sensor using the UniSA Micro Electronic and Mechanical (MEMS) IR chip</td>
<td>2013–2014</td>
<td>$238,546</td>
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<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>Steven Barnett, Chris Franco, Jack Desbiolles, Dean Thiele</td>
<td>Beneficial Microbes Program 2: Progressing new microbial products for Australian grain production to commercialisation (Collaboration on Stream 2: Control of Rhizoctonia root rot on wheat) (administered via SARDI)</td>
<td>2013–2015</td>
<td>$50,000</td>
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<td>Funding Body</td>
<td>Investigators</td>
<td>Project Title</td>
<td>Project Years</td>
<td>Project Funding</td>
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<tr>
<td>--------------------------------------------------</td>
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<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>John Fielke, Chris Saunders, Nick Berry</td>
<td>Extension to mechanical weed seed termination method at harvest</td>
<td>2013–2015</td>
<td>$700,000</td>
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<tr>
<td>Grains, Research and Development Corporation (GRDC)</td>
<td>Alan McKay, Margaret Evans, Jack Desbiolles, Dean Thiele</td>
<td>New fungicide technologies for crown rot management (administered via SARDI)</td>
<td>2013–2015</td>
<td>$42,000</td>
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<tr>
<td>Horticulture Australia Limited (HAL)</td>
<td>John Fielke, Chris Saunders</td>
<td>Advanced processing of almonds</td>
<td>2012–2017</td>
<td>$960,000</td>
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<td>National Climate Change Adaptation Research Facility (NCCARF)</td>
<td>Wasim Saman, Stephen Pullen, George Zillante, John Boland, Martin Belusko</td>
<td>A framework for adaptation of Australian households to heat waves</td>
<td>2011–2013</td>
<td>$468,000</td>
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<td>National Health and Medical Research Council (NHMRC) Project Grant</td>
<td>Philip Weinstein, Nicholas Fisk, Angus Cook, Mark Nieuwenhuijsen, Natasha Nassar, Annette Dobson, John Newnham, Carol Bower, Emily Fearnley</td>
<td>Study of birth defects from fetotoxic agents</td>
<td>2011–2014</td>
<td>$703,124</td>
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<tr>
<td>Quickcool Cooling Technologies Pty Ltd</td>
<td>Frank Bruno</td>
<td>Assessment of the Phase Change Materials thermal storage system at Parilla</td>
<td>2013–2015</td>
<td>$75,000</td>
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<tr>
<td>Uniting Communities</td>
<td>Frank Bruno</td>
<td>Low Income Energy Efficiency Program (LIEEP)</td>
<td>2013–2016</td>
<td>$240,600</td>
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<tr>
<td>Urban Renewal Authority (URA)</td>
<td>Frank Bruno, David Whaley, Pei-Ru Chao, Nicholas Holyoak, Stephen Berry, Ralph McLaughlin</td>
<td>Lochiel Park Evaluation</td>
<td>2013–2015</td>
<td>$140,000</td>
</tr>
</tbody>
</table>
This appendix includes conference presentations, seminars, forums, workshops, public talks and symposia. Note: Members of the Barbara Hardy Institute are shown in bold type.

**Kazem Abhary**

2nd International Conference on Manufacturing and Industrial Engineering ICME, 8-9 March, Kinabalu, Malaysia.

International Conference of Advance Engineering Optimisation through Intelligent Techniques, 1-3 July, Surat, India.

**Andrew Allan**

Transit-oriented development – Exploring techniques to increase urban densities around TODs. South Australia Transport Infrastructure Summit 2013, 18-19 September, Adelaide, Australia.

**Sharolyn Anderson**


**Jacqueline Balston**

Integrating climate change into the state zone emergency risk assessment process Workshop. State Government Department of Environment, Water and Natural Resources (DEWNR), the State Emergency Service (SES) and the South Australian Fire and Emergency Services Commission (SAFECOM), 22 January, Adelaide, Australia. (Co-organiser and presenter)

Impacts of climate change on Local Government infrastructure.

Climate Change and Human Dimensions Symposium, 11 April, Adelaide, Australia.

Department of Industry, Innovation, Climate Change Science Research and Tertiary Education (DIICCSRTE) Coastal Adaptation Pathways Good Adaptation Workshop, 15 April, Melbourne, Australia.

Impacts of climate change on Local Government infrastructure.

Rural Solutions Journal Club Luncheon, 16 April, Adelaide, Australia.

**Saiful Bari**

An Investigation on the Use of EGR in a Natural Gas SI Engine. FORD Car Company, 19 April, Detroit, United States.

Additional Power Generation from the Exhaust Gas of Diesel Engine by Bottoming Rankine Cycle. Purdue School of Engineering and Technology, Purdue University Indianapolis (IUPUI), 20 November, Indianapolis, United States.

**Sam Baroudi**

Network Restorers Conference, Network Restorers, 1 June, Queensland, Australia.
Stephen Berry


Sustainable House Day: Is it worth the effort? AuSES/ATA workshop, 16 September, Adelaide, Australia.

John Boland


Multisite forecasting of solar radiation. Solar World Congress, 3-7 November, Cancun, Mexico. (Theme Chair)

Probabilistic forecasting of wind farm output. Solar World Congress, 3-7 November, Cancun, Mexico.

Post-processing of WRF forecasting of solar radiation using a Kalman Filter. Solar World Congress, 3-7 November, Cancun, Mexico.

The interplay between rainfall and vegetation. 20th International Conference on Modelling and Simulation MODSIM2013, 1-6 December, Adelaide, Australia.

Multivariate forecasting of solar energy. 20th International Conference on Modelling and Simulation MODSIM2013, 1-6 December, Adelaide, Australia.

Rainfall affects vegetation, but does the opposite also occur? 2013 Indigenous Knowledge Symposium, Protecting Country and Connecting the Expertise, 30 September, Adelaide Australia.

David Bruce

Finding Your ‘Old’ Place in the ‘New’ World. Surveying and Spatial Sciences Institute Biennial Conference, 15-19 April, Canberra, Australia.

Trans Basin Water Transfer to the MDB: GIS modelling and engineering solutions. Surveying and Spatial Sciences Institute Biennial Conference, 15-19 April, Canberra, Australia.

The Evolution of the Australian Surveyor from Goyder to Present Day. 2013 Australian Institute for Mining Surveyors Conference, 14-16 August, Adelaide, Australia.

Frank Bruno

Australian Solar Cooling Conference, 12 April, Sydney, Australia. (Chair)


Don Cameron

The use of recycled aggregates in unbound road pavements. Thailand Research Fund Congress, 6 April, Pattaya, Thailand.

The use of recycled aggregates in unbound road pavements. 18th International Conference on Soil Mechanics and Geotechnical Engineering, 2-6 September, Paris, France.

John Cann

The Coorong Lagoon, South Australia: it’s origin and a record of Holocene sedimentation. Sustainable Solutions Seminars, 24 May, Adelaide, Australia.

Farid Christo and Pegah Haseli

Integrated Solar Supercritical Water Gasification Process for Power and Hydrogen Production. First Australian Workshop on Solar Thermal Chemical and Industrial Processes, 7-8 February, Adelaide, Australia. (Poster)

Australian Solar Thermal Research Initiative (ASTRI) Workshop, ASTRI, 19-20 February, Canberra, Australia.

Barry Cooper

The ‘Global Heritage Stone Resource’: Past, present and future. First Heritage Stone Conference, European Geosciences Union General Assembly, 7-12 April, Vienna, Austria. (Opening address)

A ‘sense of place’ in geology: the case history of four locations from South Australia. 24th International Congress on the History of Science, Technology and Medicine, 21-28 July, Manchester, United Kingdom.

Paul Corcoran


Chris Daniels

Session ‘Research Agendas’: Launch of the China-Australia Centre for Sustainable Urban Development, 21 February, Adelaide, Australia. (Chair)


Backyards: the most important room in the house. Strathalbyn Gardening Club, 26 July, Adelaide, Australia.

Citizen Science: Bringing Science into your Backyard. Biological Society of South Australia – Nature Conservation Society of South Australia, 1 August, Adelaide, Australia.

Man and Raptors: the future of birds of prey in Australian cities. Australasian Raptor Conference, 10 August, Adelaide, Australia. (Keynote speaker)

Official opening of the Oaklands Park Wetlands in City of Marion, 11 August, Adelaide, Australia.


City of Mitcham Environmental Groups Forum, City of Mitcham, 14 August, Adelaide, Australia. (Keynote speaker)

Grubs up. South Australian Museum, 13 September, Adelaide, Australia. (Master of Ceremonies)

Why children need nature. 30th Anniversary Junior Field Naturalists, 26 September, Adelaide, Australia. (Keynote speaker)

Positive participation. Coastal Environment Conference, 30 September, Adelaide, Australia. (Keynote speaker)

Citizen Science connecting people with nature through spider research. Australasian Entomological Society, 2 October, Adelaide, Australia. (Keynote speaker)

Building resilience to climate change in Adelaide: and NRM perspective. Royal Society Climate Change Symposium, 4 October, Adelaide, Australia. (Keynote speaker)

Sustainable development: oxymoron or opportunity? Talking History series History SA, 9 October, Adelaide, Australia. (Keynote speaker)

Jack Desbiolles

Disc seeder incentives and limitations: a research overview. Vic-No-Till Disc Seeding Demo Day, 8 March, Horsham, Australia. (Keynote speaker)

Zero-tillage seeder technologies and field operation. Workshop in training presentations and practicals with Iraqi and Kurdish Agricultural extension specialists and researchers, 31 March – 4 April, Erbil, Iraq.

Zero-Tillage seeder technologies and field operation. Workshop in training presentations and practicals with agricultural engineers and mechanisation specialists from the Maghreb, 8-11 April, Ain Draham and Bousalem, Western Tunisia.

Fungicide application technologies for Rhizoctonia control. Lameroo field research trials, GRDC farmers update, 15 August, Lameroo, Australia.

Seeding machinery set-ups for sowing into heavy residue. GRDC stubble initiative – Southern region project planning forum, 19-20 November, Glenelg, Australia.

Conservation agriculture in Australia and seeding system research. Setif University Ferhat-Abbas Seminar, 12 December, Setif, Algeria.

Jack Desbiolles and Dean Thiele

Zero-till disc seeding systems. Glencore Grain 15th Annual SANTFA Conference, 2 February, Tanunda, Australia. (Research display)

John Fielke

Planting ideas and growing knowledge: 30 years of agricultural machinery research. Knowledge Works Public Lecture, 18 June, Adelaide, Australia.

Almond Orchard Productivity. R&D Project Development Workshop, 29 October, Glenelg, Australia.

John Fielke and Michael Coates

Aeration, cooling and dehydration – On farm storage options. 15th Australian Almond Conference, 30-31 October, Glenelg, Australia.

Mohammed Haque


IEEE Region 10 PES Chapter Chairs Meeting, IEEE Region 10 PES Chapter, 8-9 November, Bangalore, India. (Chapter Chair)


Jim Jago

Emu Bay Shale Lagerstätte, Kangaroo Island. Tasmanian Division of the Geological Society of Australia, 21 February, Hobart, Australia

Emu Bay Shale Lagerstätte. Waterhouse Club, 7 March, Adelaide, Australia.

Gunnar Keppel

A framework for assessing the IUCN status of plant species in developing island countries. 12th Pacific Science Inter-Congress, 8-11 July, Suva, Fiji.

Local knowledge facilitates rapid assessment of the conservation status of iconic tree species. 12th Pacific Science Inter-Congress, 8-11 July, Suva, Fiji.


Plant diversity in Insular environments. Department of Geography UCLA, 26 November, Los Angeles, United States.

Huajian Liu

Development of a green plant image segmentation method of machine vision system for no-tillage fallow weed detection. 2013 Society for Engineering in Agriculture Conference, 21-26 September, Mandura, Australia.

David Lloyd

Futures thinking, Well-being & Sustainability: Making the connections. 9th International Conference on Environmental, Cultural, Economic and Social Sustainability, 23-25 January, Hiroshima, Japan.

David Ness

ICT-enabled Rural Community Development. Australia and Malaysia Experiences Workshop, 19 August, Adelaide, Australia. (Chair)
Ecological Education. Asia Education Forum, 24-26 October, Chengdu, China. (Moderator)

Core values of a green economy. International Conference on Corporate Social Responsibility and Sustainable Development, 27 October, Shenzhen, China. (Keynote speaker)

Kathy Paige

Educating the Scientific Citizen in Australia: Implications for teacher education. Australian Association of Research Education Conference, 1-4 December, Adelaide, Australia. (Chair)

Sheryn Pitman

Green infrastructure: Life support for human habitats. Treenet Symposium, 5-6 September, Adelaide, Australia.

How much do we need to know about nature – and who knows? Collaborating for Sustainability UniSA Colloquium, 20 September, Adelaide, Australia.


John Pockett

Stephen Pullen
Design options for houses in heat waves. SA Climante Change Adaptation Showcase, 14 March, Adelaide, Australia.

Facets of sustainable housing research to the Adelaide sustainable buildings network. Spotlight Series Australian Institute of Architects Seminar, 31 July, Adelaide, Australia.

Aspagoon Sustainable Housing Research. Meeting of the Sustainability Community of Practice (SCoPe) – Building and Construction, 7 November, Adelaide, Australia.

Peter Pudney
Using timing windows to allow energy-efficient driving. World Congress on Railway Research, 25-27 November, Sydney, Australia.

Christian Reynolds


Christian Reynolds and John Boland
The challenges and opportunities of constructing Input-Output frameworks in a Virtual Laboratory – the new NeCTAR industrial ecology lab. 20th International Congress on Modelling and Simulation (MODSIM2013), 1-6 December, Adelaide, Australia.

Philip Roetman
Citizen Science. Friends of Marino Conservation Park, 8 May, Adelaide, Australia.


John Rolls
Political Psychology of Climate Change. Australian Political Studies Association Annual Conference, 30 September – 2 October, Perth, Australia.

Wasim Saman
Scientific Committee for the First Australian Workshop on Solar Thermal for High Temperature Processes, 7-8 February 2013, Adelaide, Australia. (Panel Member)

Australian Solar Thermal Research Initiative (ASTRI) Workshop, 18-21 February, Canberra, Australia. (Committee Member)

CRC for Low Carbon Living Program Leadership Group Workshop, 28 February, Sydney, Australia.

SA Climate Change Adaptation Showcase, 14 March, Adelaide, Australia.

Heatwave planning research project 2: A framework for adaptation of Australian households to heat waves. NCCARF Workshop Heatwave management under climate change, 8 April, Adelaide, Australia.

Solar-thermal energy generation/storage. Solar Power and Chemical Energy Systems Meeting, 15-19 April, Newcastle, Australia. (Invited speaker)


Viable Integrated Systems for Zero Carbon Housing. CRC Project Workshop, 24 May, Adelaide, Australia. (Committee Member, Moderator)


The impact of climate change on external and internal design conditions for air conditioning load estimation. Future of Heating Ventilation and Air Conditioning Conference, 13-14 August, Melbourne, Australia.

Integrated solar thermal system for water and space heating, dehumidification and cooling. International Solar Energy Society Congress, 3-7 November, Cancun, Mexico.

Jonathan Sobels
Evaluating the Basin plan: Socio-economic impacts. Murray Darling Basin Authority Workshop, 22 October, Canberra, Australia.

Sead Spuzic
A contribution to rolling mill technology – Roll pass design strategy for symmetrical sections. 83rd Association International Roll Pass Designers and Rolling Mills Engineers AIKW Conference, 9-11 October, Ostrava, Czech Republic.


Mohammad Uddin
Predicting the contact of dual mobility hip implant: Effect of bearing geometry. 15th International Conference on Biomedical Engineering, 4-7 December, Singapore.

On the Optimization of Cutting Parameters for the Manufacture of Metallic Femoral Heads. 15th International Conference on Biomedical Engineering, 4-7 December, Singapore.

Brian Webby
Sensitivity analysis for concentrating solar power technologies. 20th International Congress on Modelling and Simulation, 2-6 December, Adelaide, Australia.

David Whaley
Remote power systems for Tanna island, Vanuatu. UniSA City West campus, 21 March, Adelaide, Australia.


Solar thermal air conditioner prototype. What on Earth are we doing?, 9 May, Adelaide, Australia.


The impact of home energy feedback displays and load management devices in a low energy housing development. 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting, September, Coimbra, Portugal.

Denise Wood
Emerging service models facilitated by mobile and tablet devices as assertive technologies for adult with disabilities. M-Enabling Australasia Conference, 14-15 August, Sydney, Australia. (Invited paper).

A framework for guiding the design, development and implementation of work integrated learning through authentic activities embedded across the undergraduate curriculum. WACE 18 World Conference on Cooperative and Work Integrated Education, 24-27 June, Durban, South Africa.

Yvonne Zeegers
Higher Education Academy Conference, 18-19 April, London, United Kingdom.
Appendix 4 Publications

This appendix includes publications by members of the Barbara Hardy Institute in 2013. In order to recognise affiliation with the Institute, author names are formatted as follows:

- **Full members:** bold and underlined
- **Associate members:** bold and grey
- **Adjunct members:** bold
- **Research students:** bold, underlined and italicised
- **Not affiliated:** regular formatting

In order to fully showcase the research of our membership, the excluded internal publication categories (marked with an asterisk) have been included in this 2013 Research Report so as to capture all of our members’ outputs.

### Authored Research Books
**Category A1**

<table>
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<th>Author(s)</th>
<th>Title</th>
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<tr>
<td>Avrachenkov, K.; Filar, J. and Howlett, P.</td>
<td>Analytic Perturbation Theory and Its Applications</td>
<td>SIAM Publisher</td>
<td>1611973139, 9781611973136, 369 pages</td>
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### Authored Other Scholarly Books
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### Edited Scholarly Books
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### Book Chapters
**Category B**

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Refereed Journal Articles

Category C1

A


Abd-Elaal, E.S.; Mills, J. and Ma, X. 2012. A coupled parametric-CFD study for determining ages of downbursts through investigation of different field parameters, Journal of Wind Engineering and Industrial Aerodynamics, 123:30-42.


Al-Zuheri, A. Management and Economics. 2013. A road map by Joanna Williams, Allan, A.


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Z


Zuo, J.; Ye, K. and Shen, L. 2013. Utilising the linkage between domestic demand and the ability to export to achieve sustainable growth of construction industry in developing countries, Habitat International, 38: 135-142.


Article in a Professional Journal
Category C2

Kleemann, S., and Desbiolles, J. 2013. Ground zero changes the parameters. The Kondinin Group Farming Ahead, March 2013, 254:30-34.


Refereed Conference Papers
Category E1


**Agrawal, M.; Huang, J. and Boland, J.** 2013. ‘Probabilistic Forecasting of Wind Farm Output’, *20th International Conference on Modelling and Simulation MODSIM2013*, 1-6 December, Adelaide, Australia, 1461-1467.


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**Benn, T.; Baweja, D. and Mills, J.** 2013. ‘Chloride ion Ingress of Concrete – the Influence of Increased Levels of Limestone Mineral Additon’, *Concrete 2013*, 16-18 October, Gold Coast, Australia, 1-10.


**Berry, S. and Sharp, A.** 2013. ‘The role of open house events to improve energy efficiency: reaching the new or preaching to the converted?’, *Conference European Council for an Energy Efficient Economy – Summer Study*, 3-7 June, Presquille de Giens, France.


**Boland, J.** 2013. ‘The interplay between rainfall and vegetation’, *20th International Conference on Modelling and Simulation MODSIM2013*, 1-6 December, Adelaide, Australia.


Fraser, K. and Gunawan, J. 2013. ‘Reliability, maintenance and its management: The current state of play’, Proceedings of the 22nd International Conference on Production Research (ICPR 22), 28 July-1 August, Iguassu Falls, Brazil.


Gunawan, J. and Fraser, K. 2013. ‘International firm performance: Strategic choice or operational pressure?’, Proceedings of the 22nd International Conference on Production Research (ICPR 22), July 28-August 1, Iguassu Falls, Brazil.

Gunawan, J. and Fraser, K. 2013. ‘Determining the influence and role of MNEs in industrial cluster performance: A case study of Indonesia’s electronics industry’, Proceedings of the 22nd International Conference on Production Research (ICPR 22), July 28-August 1, Iguassu Falls, Brazil.

Hamilton, J. and Berry, S. 2013. ‘Rethinking energy efficiency delivery – what can we learn from sport?’, Conference European Council for an Energy Efficient Economy Summer Study, 3-7 June, Presquile de Giens, France.


Simpson, A., 2013. ‘From ‘outside’ to ‘inside’: The transformation of activism over energy projects in Myanmar’, Myanmar in Reform Conference, June, Hong Kong.


T


U


Reports
Category K

B


N


S


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