



LOW CARBON LIVING
CRC

ANNUAL REPORT
HIGHLIGHTS
2012-13



An Australian Government Initiative



CRC
AUSTRALIA

We are a national
research and
innovation hub.
We enable a
globally competitive
low carbon built
environment sector.





PARTNERS 2012/2013



PROJECT PARTNERS



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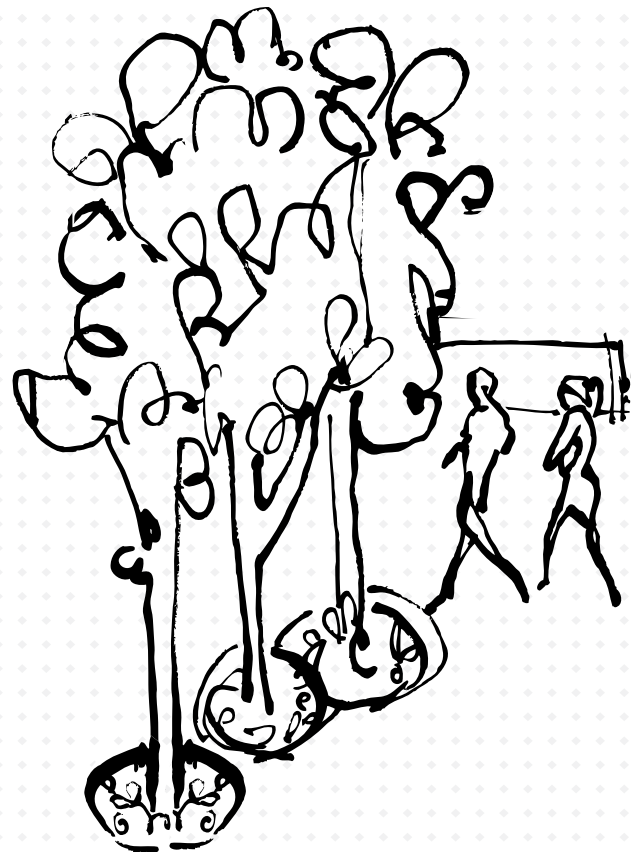


Tyree Energy Technology Building
constructed by CRCLCL partner
Brookfield Multiplex

The CRC for Low Carbon Living seeks to facilitate the development of low carbon products and services to increase government and industry uptake of social, technological and policy-based tools.

To do this, we will deliver:

- Opportunities for lower-carbon manufacturing
- A more efficient and productive built environment sector as a whole
- Engaged communities participating in low carbon living
- An evidence base for good planning and policy
- Large-scale national capability development
- Tools, technologies and techniques that will ensure the sector remains globally competitive



First year's highlights

1st July 2012 – 30th June 2013

27

NEW RESEARCH
PROJECTS APPROVED

2

LIVING LABORATORIES
APPROVED

45

CRC PARTNERS

24

PROJECTS WITH
MULTIPLE
PARTNERS

1

MODULAR HOME
(ECO-POD) CONCEPT
READY TO SHOWCASE

2

INNOVATIONS
NEARING
COMMERCIAL
READINESS

9

SCOPING DOCUMENTS
DEVELOPED TO
INFORM THE
RESEARCH STRATEGY

120

PARTICIPANTS
IN SEMINARS
& WORKSHOPS

\$9.12
MILLION

TOTAL CONTRIBUTIONS BY
PARTNERS & GOVERNMENT

BUILDING FOUNDATIONS

The CRCLCL is a national research and innovation hub within the built environment sector. Our mission is user driven research which captures opportunities for low carbon technologies, materials, design and planning innovations. This we do through a collaboration which includes leading universities and the CSIRO, service organisations including architects, engineers and planners, major building companies and product developers, and government regulators and urban planning authorities. This is Australia's most significant attempt to advance low carbon living through such a collaborative effort. We therefore feel a significant sense of responsibility and are all committed to seeing the CRC achieve the best possible results.

Governance of the CRC is principally in the hands of a Board of Directors. As the Chair of the Board, it is my pleasure to report on governance activities undertaken in the 2012/2013 financial year. I am pleased that we have a Board consisting of six elected sector representatives and three independent directors with extensive experience in a range of research, industry and government roles. The Board has met regularly through the year in order to meet its responsibilities.

The work of the Board has been assisted by a number of committees and working groups established by the Board. These include:

- an Audit and Risk Committee, tasked with reviewing the financial management of the CRCLCL and assisting the Board in carrying out its corporate governance responsibilities. The committee is chaired by the Deputy Chair, Sandy Hollway AO.
- a Research Advisory Committee, chaired by Board member Professor Dennis Else, which provides advice on the CRCLCL's science and research projects, ensures milestones are met, and formally reviews research project proposals prior to submission to the Board.
- a Nominations Committee, which I chair. This committee identifies and nominates individuals who may be suited to roles as independent or additional directors on the Board.
- an SME and Peak Body Network, chaired by Board member Professor Ken Maher of HASSELL which identifies the research needs of SME partners and ensures that their ideas, interests and concerns receive the attention they deserve.
- a Task Group led by Board member Tim Horton which has advised the Board on how we can develop the best communication strategy to ensure effective communication with our participants, the built-environment sector and the broader community.

At an operations level we have appointed a Headquarters Management team, comprising a CEO, Business Manager and Office Manager. The team is ably led by our CEO, Scientia Professor Deo Prasad AO. Professor Prasad oversees

the activities of a Program Leadership Group. Our three main research program areas are in turn headed by a program leader and a research leader. Through this structure we have many of Australia's finest built environment researchers leading our work.

The Board is pleased with the outcomes of the first operational Year. Professor Prasad will in this report provide some detail of progress within our research programs. This progress is a credit to the efforts of our staff, the cooperation of our participants and the many researchers who want to work with us to make a difference. We thank them all.

We also want to thank the Commonwealth Government and the officials who have worked closely with us in the start-up phase of the CRC. We have appreciated their support and wise counsel.

Finally I want to thank my fellow Board members for their cooperation and support. The next six years will tell the story, but we are confident that the CRC will prove to be an important asset for Australia in meeting its climate change responsibilities.

THE HON. ROBERT HILL AC
CHAIR, BOARD OF DIRECTORS

“ The built environment provides the most cost-effective way of reducing carbon emissions in Australia as well as an opportunity to improve the performance and health of building occupants. We are committed to constructing high performance spaces that maximise value whilst minimising the impact on our environment. The CRC for Low Carbon Living is building the evidence base around this to enable us to positively impact future generations. ”

JOHN FLECKER, CEO,
BROOKFIELD MULTIPLEX



“ AECOM has a proud history of working with clients to design living, breathing cities that are resilient economically, structurally and ecologically. CRC research provides us with the insight necessary to initiate and contribute to debate and discussion about how tomorrow’s cities can benefit from low carbon outcomes. ”

MICHAEL BATCHELOR, AECOM
CHIEF EXECUTIVE, AUSTRALIA NEW ZEALAND

**University of Wollongong’s
Innovation Campus, a project
by CRCLCL partner AECOM**

Photographer:
Dee Kramer Photography

INNOVATION THROUGH COLLABORATION

It is my great pleasure to report on the CRCLCL and the exciting successes we achieved in 2012/2013, our first year of business. Established under the Commonwealth Government's Cooperative Research Centres Program, the CRC was launched with the aim of increasing government and industry uptake of social, technological and policy-based tools that facilitate the development of low carbon products and services. I am delighted to say that we have already made great strides towards this goal.

Our first year of business

The 2012/2013 year was focused on embedding the key structures, people and strategic directions that will ultimately guide the CRC through its first seven years of operation. Key among the outcomes from this period was the creation of a comprehensive research strategy, which was heavily informed by a series of scoping studies carried out earlier in the year. This research strategy articulates the three key research program streams into which our day-to-day and year-to-year research activities are divided:

- Program 1: Integrated Building Systems
- Program 2: Low Carbon Precincts
- Program 3: Engaged Communities

The programs acknowledge the need for specific building scale innovations, up-scaled to precinct/urban scale innovations as well as the important role of engaging people in the transition to lower carbon outcomes. These programs will continue to inform the CRCLCL's research agenda into the future.

Key milestones

The administrative complexities of setting up a new organisation led to a delay in meeting some of our early objectives, as well as under spending against our budget. The CRCLCL wishes to remain a lean and resourceful organisation. Despite our challenges the CRCLCL has made major strides in engaging end-users to identify research needs which can deliver industry wide benefits.

Research

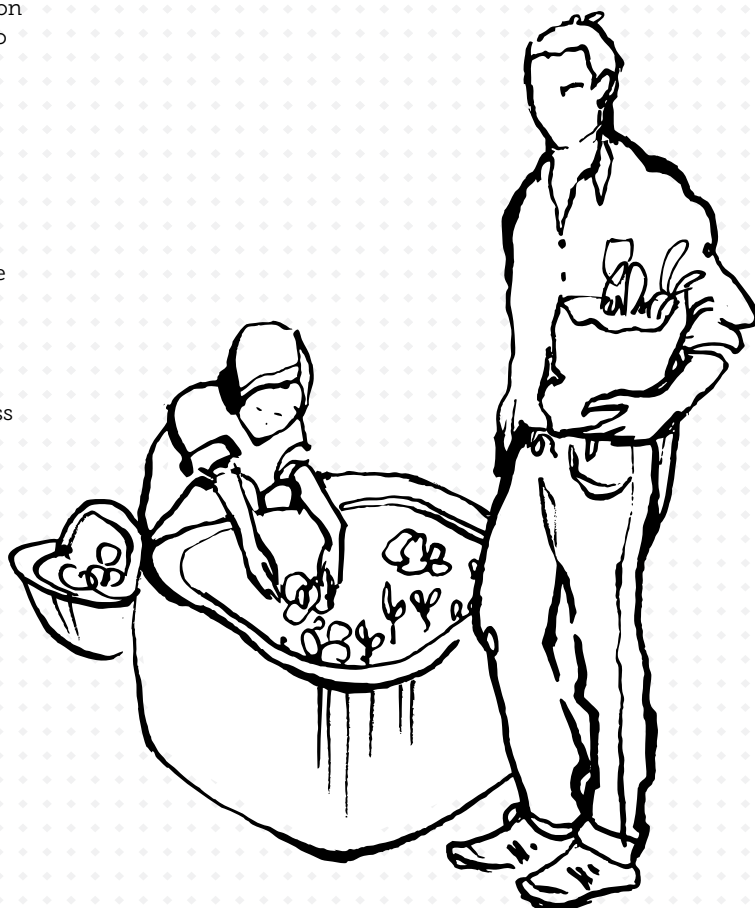
- Board approval granted for 27 new research projects across our project streams.
- Commitment to establishing 88 PhD scholarships over the next seven years.
- Board approval for 29 PhD scholarships in the 2012/2013 year. Nine PhD positions filled and others rolled into year 2.
- Two Living Laboratories were implemented in Fremantle – Josh's House and FreZED (Fremantle Zero Energy Development).
- Two projects nearing commercial readiness – the Solar Analytics tool and Photovoltaic Thermal (PVT) Air Roofing System.
- Recruitment of 47 CRC partners and three third-party partners for research engagement and collaboration.

How to engage with us?

We are very keen to work with all our partners in identifying projects with well identified IP and utilisation plans, underpinned by good science to deliver outcomes for industry, professions and governments. Our Program Leadership Team is very keen to hear from you. We can either develop collaborative projects initiated by end-users or developed together with research leaders. Current and pipeline projects are listed on our website together with contacts of all research leaders. Feel free to contact me directly to discuss any ideas that may grow into projects within the CRCLCL. Intending new partners should contact me to discuss opportunities for collaboration.

I would like to thank the Board of Directors, our staff, our industry partners and the wealth of CRC partners who have aligned themselves with the CRCLCL for a very successful first year. I look forward to continuing our work together into the future.

SCIENTIA PROFESSOR DEO PRASAD AO
CHIEF EXECUTIVE OFFICER



PROGRAM 1 INTEGRATED BUILDING SYSTEMS



The widespread uptake of energy efficient systems in Australian homes, offices and factories is the next frontier for low carbon research. The CRCLCL's Integrated Building Systems research program is set to transform traditional approaches to building materials, construction practices and appliance technologies via the innovative use of building materials and design. This program has been divided into three key research streams with 10 projects operating in year 1:

Activity 1: Integrated solar technologies for buildings

Technology integration is key to the delivery of energy efficient building systems. This research stream is focused on the progression and integration of solar-photovoltaic and solar thermal products that will deliver improved performance, multiple outputs and improved aesthetics over existing products on the market.

Activity 2: Low carbon materials

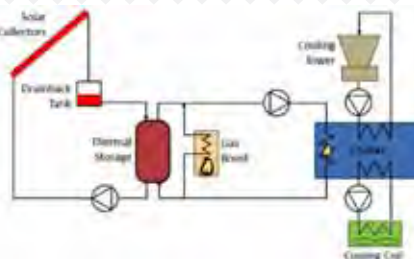
Geo polymer concrete and composite products are prime examples of the low carbon, high performance construction materials being developed at the CRCLCL. Widespread usage of these materials will have significant implications in lowering the carbon emissions associated with traditional construction products.

Activity 3: Integrated design, showcase, ratings and standards

Evaluating the technical and economic potential of high performance, low carbon design is a crucial step in the development of low carbon buildings. Research in this stream provides a showcase for low carbon technologies, materials and designs for industry and consumers, delivering a unique opportunity for CRCLCL researchers to monitor and model the performance of these products in order to inform revisions to Australian building codes and standards.

SOLAR ABSORPTION COOLING SYSTEMS IN LARGE-SCALE BUILDINGS RP 1002

Air conditioning accounts for 40% of energy consumption in buildings. The heat from the sun can be used to drive this process instead of electricity. The project will develop tools to aid the design of buildings by incorporating a solar thermal system to reduce the energy consumption.



RESEARCH TEAM

Ali Shirazi (PhD student, UNSW)
Robert Taylor (UNSW)
Stephen White (CSIRO)
Graham Morrison (UNSW)

PARTNERS

CSIRO
UNSW

PHOTOVOLTAIC THERMAL (PVT) AIR ROOFING RP 1001

Buildings in Australia need considerable energy to keep people comfortable. By integrating the solar panel system, air heating and ventilation the cost of comfort can be reduced. The project enables better building design and when the system is implemented into residential and commercial buildings, saving energy and money, and producing more comfortable and healthy buildings.

RESEARCH UTILISATION

This PVT roofing system enables rooftop photovoltaic panels to generate electricity, and contains inbuilt functionality to heat and shade buildings. The system captures the electrical and thermal outputs generated by solar radiation, generating heating and cooling energy for residential buildings and providing a significant

carbon offset opportunity. This project focuses on the 'back end' integration of this technology into buildings, tapping into the engineering and built environment research competencies.

RESEARCH TEAM

Mehrdad Farshchimonfared (PhD student, UNSW)
Alistair Sproul (Supervisor, UNSW)
Rob Scott (BlueScope)
Wasim Saman (UniSA)

PARTNERS

BlueScope Steel
UNSW
University of South Australia

"The CRC provides the ideal mechanism for addressing some of the critical gaps in delivery of novel technology to drive down the carbon footprint of the Australian built environment. This project is an important piece in the jigsaw of work needed to change how we design the building envelope, utilising the solar energy that hits the roofs of our buildings."

DR ROB SCOTT,
BUILDING & CONSTRUCTION
APPLICATIONS MANAGER,
BLUESCOPE STEEL

INTEGRATING PHOTOVOLTAICS (PV) WITH BUILDING PRODUCTS (BIPV) REPORT RP 1003



Photovoltaics (solar cells) can be integrated with building materials like glass, steel or concrete, to produce truly Building Integrated Photovoltaic (BIPV) products. This research was carried out to enable the industry to better identify novel and cost effective BIPV materials for use in residential, commercial, office and public buildings, for both new construction or refurbishments.

RESEARCH TEAM

Stuart Wenham (UNSW)
Francoise Burgun (UNSW)
Alistair Sproul (UNSW)
Mark Snow

PARTNERS

All CRCLCL partners

DELIVERED

Final report

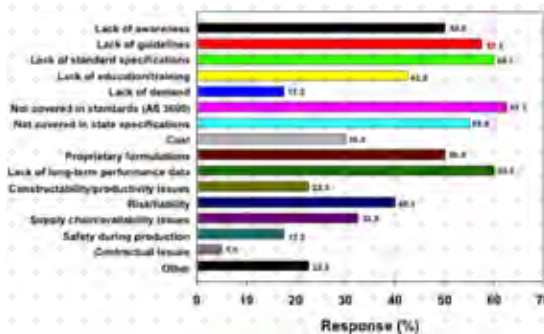
"To start building a technology roadmap, we need to know what technology is available and this project helps the CRCLCL better inform its priorities for Industry." STUART WENHAM, SCIENTIA PROFESSOR, UNSW

PATHWAYS FOR LOW CARBON CONCRETE MANUFACTURE RP 1004

Geopolymer concrete has enormous potential as a low carbon recycled building material of the future. A lack of adoption has inspired research to identify the barriers and pathways for wide spread adoption. e.g. Development of new engineering standard specifications.

DELIVERED

Two final reports



Industry survey responses to identify the major barriers to wide spread acceptance to geopolymer concrete.

RESEARCH TEAM

Stephen J Foster (UNSW)
Arnaud Castel (UNSW)
Jay Sanjayan (Swinburne)
Marita Berndt (Swinburne)

PARTNERS

Australasian (iron & steel) Slag Association
Ash Development Association of Australia
UNSW
Swinburne University of Technology

"By identifying the key barriers to uptake of new green materials, means that we know how to focus our efforts in the industry and for our members."

CRAIG HYDRICH, CEO, AUSTRALASIAN SLAG ASSOCIATION

SUSTAINABLE AND AFFORDABLE LIVING THROUGH MODULAR, NET ZERO ENERGY, TRANSPORTABLE, AND SELF-RELIANT HOMES AND COMMUNITIES RP 1011

This project aims to deliver cost effective, energy efficient prefabricated modular home units (Pods). The Pods



will be designed to suit a variety of climates and will be able to be connected to existing urban services or to be used in applications where services such as electricity and water are not available or not required. The Pods will enable the development of urban and rural communities that are not reliant on the grid as they are energy efficient and produce their own power.

DELIVERED

Early concepts and design ideas for the first green Pod.

“Our ultimate goal is to produce an affordable, completely sustainable home, with no utility services required such as power, water and sewerage. We have our first concept being showcased in mid 2014.”

JIM DICKSON, MANAGING DIRECTOR, NOVA DEKO

RESEARCH TEAM

Bruce Watson (UNSW)
Alistair Sproul (UNSW)
Jose Bilbao (UNSW)
Malay Dave (UNSW)

PARTNERS

Nova Deko
UNSW

INTELLIGENT AUTOMATED MONITORING OF PHOTOVOLTAIC (PV) SYSTEMS RP 1007

This project refines the Solar Analytics tool that uses algorithms and weather data to provide a prediction, monitoring and fault detection system for photovoltaic systems. The tool allows users to identify and correct problems with energy production levels from their PV system so that they can ensure that their system is making as much power as it should. A feasibility study using a similar system for monitoring energy consumption in small buildings will also be conducted.

RESEARCH UTILISATION

With more than 1,000,000 rooftop solar systems in Australia, of which almost 50% are estimated to underperform, the Solar Analytics Tool offers exciting potential for industry and

the community. The tool allows for an online assessment of rooftop solar system performance, leading to prompt detection and management of poorly performing systems. Unlike existing systems, the Solar Analytics Tool monitors the power output of rooftop solar systems, compares actual with expected performance relative to the weather conditions, and automatically reports system underperformance. A Beta version of the tool was launched during Clean Energy Week in July 2013.

“At Suntech, we have always put technology-led, value-added services at the heart of what we do. With the launch of Solar Analytics, we can fill an important gap in the residential and commercial markets for full service solar solutions, in addition to our high quality solar panels.”

RENATE EGAN, MANAGING DIRECTOR, SUNTECH R&D AUSTRALIA

RESEARCH TEAM

Stefan Jarnason (Suntech R&D)
Avantika Basu (Suntech R&D)
John Laird (Suntech R&D)
Thomas Bell (Suntech R&D)
Alistair Sproul (UNSW)
Jessie Copper (UNSW)
Lester Partridge (AECOM)
Angela Rozali (AECOM)

PARTNERS

Suntech R&D
UNSW
AECOM

MONITORING AND MODELLING THE CSR LOW ENERGY HOUSE RP 1010

This is a monitoring project of an existing residence with an 8 star NatHERS rating. The research will provide detailed information about the energy usage of various elements of the building, how air tight the building is and condensation levels. The project will also investigate which elements of the building provide the best energy saving results for their cost. The results will provide a residential model and help to develop more widespread, cost effective, energy efficient residential design.

RESEARCH TEAM

Wasim Saman (UniSA)
Zichao Meng (PhD Student, UNSW)
Alistair Sproul (UNSW)
Jesse Clarke (CSR Limited)
Ray Thompson (CSR Limited)

PARTNERS

CSR Limited
University of South Australia
UNSW

“As energy prices continue to rise, energy efficiency has never been a higher priority for homeowners and builders alike. What is perhaps less well understood is that a single-minded focus on build quality can deliver this and a myriad of other advantages, such as excellent acoustics, comfort, air quality, and of course lower power bills. We’re proud to be spearheading such an initiative in the construction industry, sharing the many lessons we learnt during this process.”

RAY THOMPSON, GM INNOVATION & MARKET DEVELOPMENT, CSR

CLOSING THE LOOP ON EVIDENCE BASED LOW CARBON DESIGN OF NON-RESIDENTIAL BUILDINGS RP 1009

The Closing the Loop project will connect the wealth of evidence that exists for high-performance buildings with front-end decision makers. It will inform decision makers on how best to capture better occupant health and productivity, as well as low carbon outcomes, through outputs including improved business case analysis, professional education and training resources and guidelines. There is a huge opportunity for our industry to apply 25 years of research and thinking to our processes and products. 'Closing the Loop' is helping to facilitate that transition.

"The Closing the Loop project presents a unique opportunity to not just further drive down the carbon emissions and environmental impacts of the built environment but also to have a substantial, positive impact on the health and wellbeing of the people who inhabit our buildings, towns and cities."

BRETT POLLARD,
HEAD OF KNOWLEDGE AND SUSTAINABILITY, HASSELL

RESEARCH TEAM

Deo Prasad AO (CRCLCL)
Lu Aye (UoM)
Peter Newman (Curtin)
Brett Pollard (HASSELL)
Ken Maher (HASSELL)
Lauren Haas (BM)
Dennis Else (BM)
Lester Partridge (AECOM)

PARTNERS

UNSW, University of Melbourne, Curtin University of Technology, University of South Australia, Brookfield Multiplex Constructions Pty Limited, AECOM, HASSELL

INTEGRATED SYSTEMS FOR ZERO CARBON HOUSING RP 1006

Zero carbon housing can be made possible by developing software and design tools for designers, suppliers and builders, regulators and households. Researchers will develop and validate building energy modelling tools to create a regulatory pathway towards zero emission housing in Australia and make them available for use to designers, material and appliance suppliers, households and regulators.



RESEARCH TEAM

Wasim Saman (UniSA), Dong Chen (CSIRO), Lu Aye (UoM), Paul Nagle (Department of the Environment), Phil Donaldson (SA Government), Kevin Yee (NSW Government), Jesse Clarke (CSR Limited)

PARTNERS

University of South Australia, CSIRO, University of Melbourne, Department of the Environment, SA & NSW governments, CSR Limited

NEXT GENERATION LOW EMISSION PLIABLE MEMBRANES FOR MOISTURE MANAGEMENT IN BUILDING CONSTRUCTION RP 1012

Research into the role of moisture membranes in managing condensation and water vapour transmission in low carbon buildings, where air tightness and large temperature differences between inside and outside tend to create dampness issues. The research will lead to the creation of a new generation of membranes that do not readily let heat pass through them and that effectively manage liquid and vapour moisture and reduce energy required to heat or cool the building.

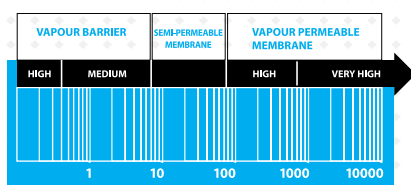
"As a team of concerned professionals, we reject the concept of energy efficient building, where one seeks to minimise the energy consumption in a building that is designed to require high carbon-emitting refrigerative air conditioning in order to maintain comfort. We aim to achieve year-round thermal comfort primarily through controlled ventilation, thermal storage and radiant heat. This is achievable in most Australian climate zones with traditional vernacular design. We aim to do even better with modern materials and design. At the same time, we seek to address the issues of moisture

RESEARCH TEAM

Steve King (UNSW)
Richard Aynsley (UNSW)
Michel Bostrom (Ametalin)
Craig Lumsden (Ametalin)

PARTNERS

Ametalin
Amalgamated Metal Industries
UNSW



Water Vapour Transmission $g/m^2 \cdot 24hr$

management and air quality. The CRCLCL has a critical role to play in this effort by developing manuals and standards of practice."

MICHEL BOSTROM, MANAGING DIRECTOR, AMETALIN

PROGRAM 2 LOW CARBON PRECINCTS

Low carbon precincts present a viable opportunity for future development in urban areas. As such, they are a key research priority for the CRCLCL.

The Low Carbon Precincts program has a strong emphasis on:

- creating tools that support the design of low carbon precincts, infrastructure development, redevelopment and retrofitting
- stimulating the market in order to expand the commercial potential of these tools
- evaluating and assessing the carbon performance of existing precincts using modelling and analysis
- developing novel and interactive Performance Information Models (PIM) to facilitate objective, quantitative and information assessment of existing and prospective precincts
- interacting with professional societies, organisations and professionals in the built environment sector to facilitate collaborative projects.

This program comprises of two key research streams with five projects operating in year 1:

Activity 1: Digital information platform

Using recent advances in cloud computing and open standards, researchers in this stream are developing an



integrated PIM platform to extend the capability of building information modelling technology to precinct scale.

Activity 2: Precinct planning and design

In this stream, multi-criteria performance assessment tools are using PIM to facilitate precinct design, including the integration of embedded carbon and alternative energy and water options that are not currently addressed by existing assessment tools.

INTEGRATED ENERGY, TRANSPORT, WASTE AND WATER (ETWW) DEMAND FORECASTING AND SCENARIO PLANNING FOR PRECINCTS RP 2002

Research and development of a tool for predicting energy, transport, waste and water demand on a precinct level. Planners, developers and consultants will be able to use the tool to set up scenarios and calculate demand estimates for the four Energy, Transport, Waste, Water (ETWW) domains for large projects.

DELIVERED:

Workshops and summary reports

“Sustainable and optimal use of infrastructure resources contribute to good land use planning and development outcomes. This project offers a potential tool to guide planning policies for a new generation of compact, mixed use and healthy urban precincts designed to provide more choices for households and businesses.”

JASON TING, GENERAL MANAGER,
SOUTH AUSTRALIAN DEPARTMENT
OF PLANNING, TRANSPORT AND
INFRASTRUCTURE

RESEARCH TEAM

Michael Taylor (UniSA)
Rocco Zito (UniSA)
Steffen Lehmann (UniSA)
Adam Berry (CSIRO)
Tommy Wiedmann (UNSW)

PARTNERS

University of South Australia
CSIRO
UNSW
Sydney Water
SA Water
Renewal SA
DPTI
DEWNR
AECOM

URBAN MICRO CLIMATES RP 2005

By collecting and analysing a body of evidence from Australian cities on climates, local government can be better informed about policies for mitigations in an environment of increasing temperatures. The project aims for sharing of information about urban micro climates between cities. The project outlines characteristics of urban micro climates, and aims to produce an effective way to monitor and record information about micro climates for use by planning agencies, service providers and developers.

DELIVERED: Workshop

RESEARCH TEAM

Steffen Lehmann (UniSA)
John Boland (UniSA)
Conrad Philipp (UniSA)
Paul Osmond (UNSW)
Susan Thompson (UNSW)
Lu Aye (UoM)
Dominique Hes (UoM)

PARTNERS

City of Sydney

City of Adelaide
NSW Office of Environment and Heritage
SA Government: DEWNR
Renewal SA
Zero Waste SA
HASSELL
BlueScope Steel Limited
Nursery & Garden Industry Australia

LOW COST AND LOW CARBON HOUSING RP 2006

This project follows the design of two medium and high density developments in Perth as case studies to encourage the mainstreaming of low cost, low carbon housing in Perth. The developments will be used to inform and inspire the building industry,

policy makers and buyers about the benefits and ability to achieve large scale low cost, low carbon housing.

DELIVERED:

Awareness of Sustainability Strategies for the Bentley Regeneration Project.

RESEARCH TEAM

Peter Newman (Curtin)
Jemma Green (Curtin)

PARTNERS

WA Department of Housing
City of Canning

“By working with the WA Housing department, we hope that our work starts to realise the possibility of low cost and low carbon housing to be attainable for all Australians, starting with the Bentley Regeneration Project.”

JEMMA GREEN, SENIOR RESEARCH FELLOW AND PHD CANDIDATE, CURTIN UNIVERSITY OF TECHNOLOGY

A REVIEW OF NATIONAL AND INTERNATIONAL LOW CARBON PRECINCTS RP 2003



Recent low carbon precincts will be used as case studies to identify and demonstrate design considerations, building elements, policy, social and financial considerations that have played a role in the development of successful precincts. The case studies may be used to encourage the mainstreaming of sustainable urbanism.

DELIVERED:

Scoping study

RESEARCH TEAM

Giles Thomson
Peter Newman
Annie Matan (Curtin)
Peter Newton (Swinburne)

PARTNERS

All CRCLCL partners

PERFORMANCE ASSESSMENT OF URBAN PRECINCT DESIGN: A SCOPING STUDY RP 2001

This project is an evaluation of urban precinct assessment tools to identify what level of collaboration, standardisation of information, data and processes are required to develop a 21st century design tool to evaluate the carbon imprint and sustainability of current and future built environments and to provide a common environmental rating system for urban precincts. A standardised system will improve the present fragmented approach to precinct assessment.

DELIVERED:

Final report

RESEARCH TEAM

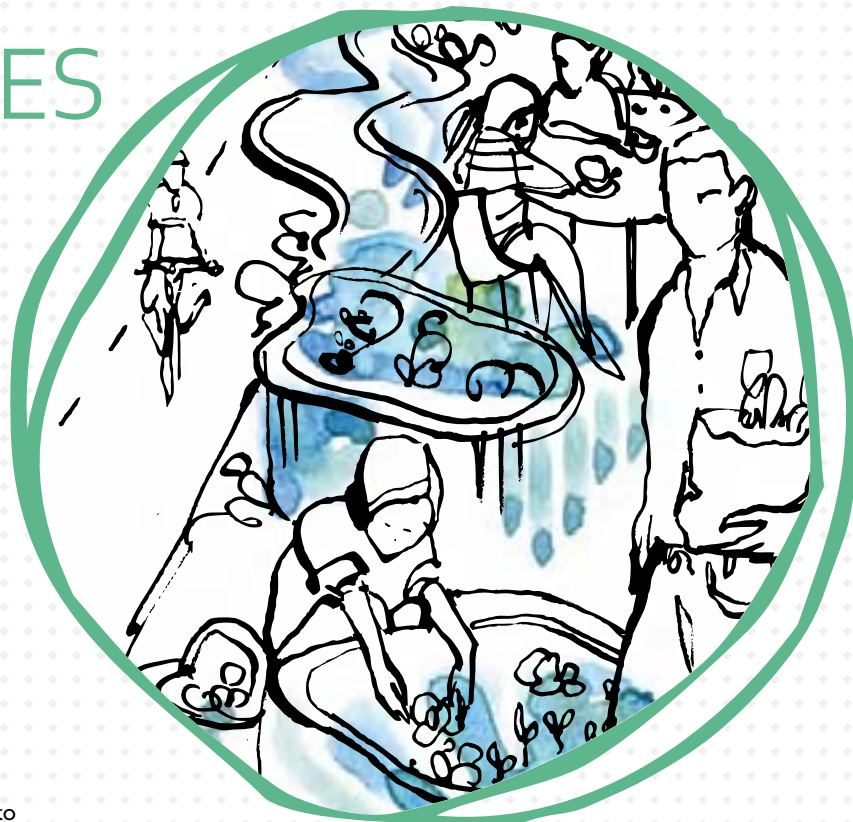
Peter Newton (Swinburne)
Jim Plume (UNSW)
David Marchant (UNSW)
John Mitchell (buildingSMART)
Seongwon Seo (CSIRO)
Rob Roggema (Swinburne)

PARTNERS

AECOM
Victorian Building Authority
Curtin University of Technology

Green Building Council of Australia
HASSELL
Housing Industry Association Ltd
NSW Urban Growth
Renewal SA
Sydney Water
University of Melbourne
University of South Australia
Swinburne University of Technology
CSIRO
UNSW
BuildingSMART Australasia Inc.

PROGRAM 3 ENGAGED COMMUNITIES



Empowering communities and decision makers to make low carbon choices lies at the heart of the Engaged Communities program. Research in this area seeks to understand the barriers that prevent individuals and groups from adopting low carbon living, to actively inform and influence their lifestyles and business choices, and to develop an evidence base from which to model how such factors impact on federal, state and local government policies and programs.

This program is both a key research focus area and a unique education and training opportunity that will shape the research careers of approximately 30 higher degree research students over the next seven years.

This program has been divided into four key research streams with 10 projects operating in year 1:

Activity 1: Transition scenarios and affordability

Detailed models of future energy end use in the built environment are being developed in this stream. They will assist researchers to understand the timing and geographical use of alternative energy products and services, as well as the affordability of low carbon solutions, under a range of policy scenarios.

Activity 2: Drivers and barriers to community engagement

Psychological and cultural barriers and consumer preferences will be the foundation of a series of economic and behavioural models developed in this stream, assisting researchers to develop a comprehensive picture of community attitudes to low carbon living. These modelling activities will inform the development of strategies for low carbon living that will transform the way that communities engage with the built environment.

Activity 3: Living Laboratories

The Living Laboratories are collaborative projects that engage councils, developers, residents, businesses and researchers to integrate, test and evaluate low carbon living solutions through the design of 'learn-by-doing' community developments, drawing on research expertise from across the CRCLCL. Four other proposals for Living Laboratories (one in Victoria, one in South Australia and two in NSW) are being considered for 2014.

Josh Byrne of ABC's Gardening Australia is a showcase example of the CRCLCL's Living Laboratories initiatives, in which 'live' occupied buildings are used to study the technological impacts and sociological/behavioural interventions the built environment. A public showcase building in Fremantle, which is occupied by Byrne and boasts a 10-star energy efficiency rating, was one of two Living Laboratories launched this year. It was followed by a second facility based on the Fremantle Zero Energy Development program, in collaboration with Fremantle City and the WA Department of Housing.

Activity 4: Education and capacity building for low carbon living

The ongoing success of low carbon research in Australia is dependent on the successful mentoring and development of the next generation of low carbon researchers, building tradespeople, built environment professionals and communities. This research stream will concentrate on education, training, skills development and professional development opportunities to inspire these professionals to continue producing world leading research now and into the future.

A FRAMEWORK FOR LOW CARBON LIVING POLICY AND PROGRAM DEVELOPMENT: MODELLING THE UPTAKE OF ENERGY EFFICIENT RETROFITS IN COMMERCIAL BUILDINGS RP 3002

This project aims to develop software tools to identify the impact of alternative policy decisions on the take-up of energy efficient retrofits of commercial buildings and about how effective government interventions and programs are at increasing the energy efficiency of retrofits.

RESEARCH TEAM

James McGregor (CSIRO)
 Leorey Marquez (CSIRO)
 Andrew Higgins (CSIRO)
 Seongwon Seo (CSIRO)
 Luis Laredo (CSIRO)
 Alexander Volodin (PhD student)

PARTNERS

Australian Government:
 Department of the Environment
 NSW Office of Environment
 and Heritage

HIGH PERFORMANCE HOUSING: MONITORING, EVALUATING AND COMMUNICATING THE JOURNEY OF JOSH'S HOUSE, LOCHIEL PARK & CSIRO ZEH LIVING RP 3009

Three living laboratories (energy efficient homes) across Australia have been designed to be economically mass produced by the construction industry. Information is being gathered on how the inhabitants behave in an energy efficient house and what energy and water savings can be made. The results of this project are broadcast via



multiple channels and are being used by regulators, construction industry, property developers, government and the general public to assess the benefits, accessibility and cost savings of sustainable housing.

RESEARCH TEAM

Peter Newman (Curtin)
 Josh Byrne
 Michael Ambrose (CSIRO)
 Wasim Saman (UniSA)

PARTNERS

Curtin University
 CSIRO
 University of South Australia
 Josh Byrne & Associates

“The CRCLCL has been instrumental in setting the framework for our sustainable house as a living laboratory. It has provided a test bed for demonstrating an affordable low carbon lifestyle, as well as being a catalyst for community engagement. The project uses a variety of promotional media, exemplified with an open house event in September 2013 that became a street party for over 4000 people.”
 JOSH BYRNE, CUSP RESEARCH FELLOW & ABC TV PRESENTER.

CRC LIVING LABORATORY FRAMEWORK RP 3005

A study that defines what Living Laboratories are, their benefits and what they need to be successful. Living Laboratories allow collaborative research with researchers, industry, government and end-users sharing resources and information and allowing users to help test and shape innovations so that the end product is well suited to its users. The study recommends how CRC can support Living Laboratories and has generated an application form for project proposals and a poster about Living Laboratories.

RESEARCH TEAM

Stephen White (CSIRO)
 Robert Salter (Curtin)

PARTNERS

All CRCLCL partners



Lochiel Park

“Our CRC participants are at the forefront of carbon saving initiatives in the Australian built environment. We already have a number of world leading examples of low carbon development at both Precinct (e.g. Lochiel Park) and individual building (e.g. Josh’s House) scale. The CRC can bring its monitoring and analysis capability to help capture and disseminate these success stories. And we’re not stopping there. This project has helped scope out an ongoing framework of research, focussing on engaging with Living Laboratory Communities to co-create new cutting edge developments that exemplify our shared low carbon living future.”
 STEPHEN WHITE, CSIRO

RESOURCE CONSUMPTION AND HOUSEHOLD AFFORDABILITY: THE CHANGING NATURE OF UTILITY COSTS AND THE DISTRIBUTIONAL IMPLICATIONS AMONG AUSTRALIAN HOUSEHOLDS RP 3001

This study uses ABS Household Expenditure Surveys to examine the changing nature of household energy use over the last two decades. By assessing the impact of the costs of these services on the household budget (by housing tenure and type, income group, household type and spatially),

we can see how energy use is changing and to what degree it is impacting on financial stress across different households and demographics.

RESEARCH TEAM

Terry Burke & Liss Ralston
(Swinburne)

PARTNERS

All CRCLCL partners

A LOW CARBON LIVING SPATIAL DATA HUB: ESTABLISHING THE CASE FOR THE DEVELOPMENT OF AN INTEGRATED SPATIAL DATA SERVER AND ANALYSIS RP 3003

Research into the opportunity to develop a mapping based database to store and link all information needed to operate the Living Laboratory concept and to act as a hub for storing and processing data from other CRC projects.



RESEARCH TEAM

Araz Taeihagh (UNSW)
Bill Randolph (UNSW)
Peter Newton (Swinburne)
Stephen White (CSIRO)

PARTNERS

All CRCLCL partners

EDUCATION SCOPING STUDY: EDUCATION FOR LOW CARBON LIVING RP 3006

This study surveyed CRC members' experience of low carbon education and found that more widespread, collaborative communication of information about low carbon built environments and their costs and savings is necessary for informed decisions to be made. The report identifies the key areas that could be improved so that various stakeholders have a common understanding of issues involved with creating a low carbon built environment.

RESEARCH TEAM

Tomi Winfree
Aneta Podkalicka (Swinburne)
Charlie Hargroves (Curtin)

PARTNERS

University of Melbourne
Australian Urban Research
Infrastructure Network (AURIN)
Sydney Coastal Councils Group
Victorian Building Authority
Swinburne University of Technology
Master Builders Australia Limited

"There is a huge unmet demand for housing in Australia, and the challenge is on to deliver dwellings that are affordable, liveable and environmentally sustainable. By better informing our members and the industry about low carbon building solutions, we can positively contribute to lowering Australia's carbon emissions. At the same time, we will be improving the bottom line of building businesses, through enabling them to meet increasing consumer expectations in the area of sustainability."

DR. ALEX MAROYA, MASTER
BUILDERS AUSTRALIA

CO-CREATION FOR LOW CARBON SCOPING STUDY RP 3004

Defines and gives examples of deliberate democratic initiatives with regards to Low Carbon Living. The report recommends the importance of establishing ways for members of the community to use their skills, knowledge and viewpoints to resolve issues and develop options which may then influence decisions to be made in their community by policy makers.



RESEARCH TEAM

Janette Hartz-Karp
(Curtin University)
Margaret Gollagher
(Curtin University)

PARTNERS

All CRCLCL partners

LOW CARBON TOURISM: BUILDING SUSTAINABLE COMMUNITIES RP 3010

The tourism industry accounts for 5% of Australia's greenhouse gas emissions. As one of Australia's top tourism destinations, the Upper Blue Mountains has been chosen for a pilot project focused on helping tourism businesses reduce their carbon footprint. Environmental auditors will work with tourism owners to identify how they can change their practices to reduce their emissions from energy, water, waste and purchasing. Education programs will be rolled out at TAFE to skill up tradespeople to implement the review recommendations.

"This is a project with benefits all round. Small and large businesses can reduce their carbon footprint and save money on their energy, waste and water bills while promoting the Mountains as a tourism destination in keeping with its World Heritage values."

**DR ROSALIE CHAPPLE,
EXECUTIVE DIRECTOR,
BLUE MOUNTAINS WORLD
HERITAGE INSTITUTE**

RESEARCH TEAM

John Merson (BMWHI)
Tom Hore (TAFE Sydney)
Nick Rigby (BMCC)
Geoff Luscombe (OEH)
Chris Ryan (UoM)
Peter Newman (Curtin)
John Merson (UNSW)
Paul Osmond (UNSW)
Lembit Pikkat (Gridstone)
James Shearer (BMLOT)

PARTNERS

Blue Mountains World Heritage Institute
University of Melbourne
Curtin University of Technology
UNSW
TAFE Sydney
BMCC
OEH
Gridstone
BMLOT

VISIONS AND PATHWAYS 2050: LOW CARBON RESILIENT URBAN ENVIRONMENTS AND CITIES RP 3008



To build low carbon cities and communities of the future wide stakeholder engagement and foresight encompassing what technologies, policies and investment will provide the pathway to achieve is required. These well-formed strategies with clear action plans for new buildings and precincts then need to be communicated to the broader community for successful uptake. The benefits obtained would be through lower carbon, energy costs, and water usage.

RESEARCH TEAM

Chris Ryan, Idil Gaziulusoy (UoM)
Paul Twomey, Deo Prasad AO,
Stephen McGrail (Swinburne)
Peter Newton (Swinburne)

PARTNERS

University of Melbourne
UNSW
Swinburne University of Technology
Aurecon
AECOM
HASSELL
BM
City of Melbourne
City of Sydney
Sydney Water
International Council for Local Environmental Initiatives (ICLEI)

OPPORTUNITIES AND CHALLENGES FOR THE DEVELOPMENT AND IMPLEMENTATION OF COMMUNITY-SCALE RENEWABLE ENERGY PROJECTS RP 3007

RESEARCH TEAM

Mark Diesendorf (UNSW)
Iain MacGill (UNSW)
Franziska Mey (PhD Student, UNSW)

PARTNER

BCI Media Group

Community scale renewable energy (wind farms) in Australia, Germany and other countries will be studied to understand what conditions help or hinder their expansion. Results of the study will be used to educate the public to increase the number of community renewable generated energy projects.



"BCI Media Group is committed to a sustainable development in Australia. We think that the transition to a renewable and decentralised energy system will be paramount for this development."

MATTHIAS KRUPS, CEO & FOUNDER, BCI MEDIA GROUP

**Global Change Institute,
The University of Queensland,
a project by CRCLCL partner
HASSELL**

Photographer: Peter Bennetts



INDUSTRY COLLABORATION

These organisations make up a large proportion of the low carbon industry, and the CRC is dedicated to ensuring that their ideas, interests and concerns are firmly embedded within our research agenda.

The formation of an SME and Peak Body Network within the CRCLCL was a key milestone of the 2012/2013 year. Peak body, industry, and SME sub-groups have been established within the network to represent the interests of key stakeholders.

The purpose of these sub-groups is to:

- increase the reach of the CRC within these sectors
- give SMEs, industry organisations and peak bodies an ongoing opportunity to participate in CRC research projects
- ensure that the CRCLCL's research outputs are reflective of contemporary SME, industry and peak body needs

The network meets quarterly. Current initiatives include:

- developing joint communications strategies across the network for engagement and promulgating CRCLCL activities
- enhancing the CRCLCL digital presence to specifically involve network members
- network members identifying specific projects for participation

“ The continuing success of the CRC will be dependent on effective engagement with a wide range of parties within the professions and the industry. Our network aims to reach this audience and create a forum for those interested to exchange ideas, co-ordinate activities, identify opportunities, and importantly ensure a channel for direct input to research projects. ”

KEN MAHER, LEADER OF SME AND PEAK BODY NETWORK AND FELLOW OF HASSELL

SME AND PEAK BODY NETWORK

ASH DEVELOPMENT ASSOCIATION OF AUSTRALIA

AURECON

AUSTRALIAN INSTITUTE OF ARCHITECTS

AUSTRALIAN SLAG ASSOCIATION

AUSTRALIAN WINDOW ASSOCIATION

AUSTRALIAN SUSTAINABLE BUILT ENVIRONMENT COUNCIL/
GREEN BUILDING COUNCIL

BCI MEDIA

BUILDING SMART AUSTRALASIA

CONSULT AUSTRALIA

HASSELL

HOUSING INDUSTRY ASSOCIATION

MASTER BUILDERS ASSOCIATION

STANDARDS AUSTRALIA

WOODHEAD

RESEARCH UTILISATION

A solar analytics tool and a photovoltaic thermal roofing system developed at the CRCLCL over the last 12 months are already on the brink of commercial success. See pages 13 and 14 for the highlights. The rapid development of these technologies is testament to the strength of the CRC's commercialisation strategy, which is focused on the dissemination of low carbon research outputs across industry, government and the wider community. These projects are the first in a long line of CRCLCL innovations that are expected to impact the global market over the next seven years.

EDUCATION & TRAINING

The growth of new research talent in the low carbon living sector will be supported at the CRCLCL, with a suite 88 PhD scholarships set to be offered over the next seven years. In 2012/2013, 29 scholarships associated with one of our 27 research projects were approved by the Board. Nine PhD positions were filled; recruitment for the remaining 20 places will be ongoing in 2013/2014.

Within the community, the CRCLCL is already focused on the creation and delivery of a comprehensive suite of education and training programs, including vocational training, tertiary education (Massive Open Online Courses and PhDs), professional development and regional capacity building. These programs provide a platform through which our research findings can be disseminated to a vast audience, with the aim of embedding low carbon practices into everyday community activities.

A scoping study to determine the gaps in education and training at vocational, tertiary and post-professional levels was undertaken in consultation with end-users and other stakeholders. This study will inform future projects.

IN THE PIPELINE: PROJECTS TO COME

We have over 20 projects in the pipeline for year 2. These projects are listed on our website (www.lowcarbonlivingcrc.com.au) for our partners to review and take the opportunity to participate.

One of these key project integral to professional development is where the CRCLCL has committed to establishing a series of Massive Online Open Courses (MOOCs) to provide access to contemporary low-carbon research and education to a broader audience. A project to trial the effectiveness of these MOOCs within the building sector's vocational and professional committees is scheduled to commence in our second year of operations.



OUR PEOPLE

BOARD



The Hon Robert Hill AC
Independent Chairman of CRC; Chair of Nominations Committee; member of Research Advisory Committee.



Sandy Hollway AO
Independent Deputy Chairman; Chair of CRC's Audit & Risk Committee.



Professor Ken Maher
Additional Director, leads SME and Peak Body Network



Professor George Collins
Research Sector Director; member of the Audit & Risk Committee.



Dr Kevin Cullen
Research Sector Director; member of Nominations Committee.



Professor Dennis Else
Industry Sector Director; Chair of Research Advisory Committee.



Lester Partridge
Industry Sector Director; member of Nominations Committee.



Timothy Horton
Government Sector Director; assisting CRC to develop its communications strategy.



Dr Kate Wilson
Government Sector Director; member of the Nominations Committee & Research Advisory Committee.



Professor Sue Holliday
Interim Board member until Oct 2012.

SME & PEAK BODY NETWORK

RESEARCH ADVISORY COMMITTEE

AUDIT & RISK COMMITTEE

NOMINATIONS COMMITTEE



Scientia Professor Deo Prasad AO
CEO



Paul Hopkins
Business Manager and Company Secretary



Liz Lockley
Research Project Manager*



Athena Prib
Communications Manager*



Maria Schwensen
Office Manager

* Commenced in year 2

PROGRAM LEADERSHIP

INTEGRATED BUILDING SYSTEMS



Associate Professor Alistair Sproul
Program Leader



Professor Wasim Saman
Research Leader

LOW CARBON PRECINCTS



Professor Michael Taylor
Program Leader

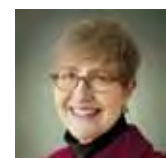


Professor Peter Newton
Research Leader

ENGAGED COMMUNITIES



Dr Stephen White
Program Leader



Associate Professor Susan Thompson
Research Leader



CRCLC partner **HASELL**,
Sydney studio
Photographer: Nicole England

COLLABORATION, INNOVATION, CHANGE

DELIVERING IMPACT-DRIVEN RESEARCH WITH A FOCUS ON END-USER NEEDS RELIES HEAVILY ON SUCCESSFUL COLLABORATION BETWEEN THE CRCLCL AND OUR INDUSTRY PARTNERS.

Strategic collaboration occurs at every stage of our projects, from defining a project's scope and purpose to conducting the research and delivering the final results. We have identified **four key channels** through which our collaborations are conducted:



1

COLLABORATION BETWEEN RESEARCHERS

Researchers at the CRCLCL are sourced from five universities, CSIRO, TAFE and our Third Party Agreements. Our research leaders explore potential collaborations with and between external organisations, providing the CRC with access to a strong network of expertise and to high quality academic and student supervision recruitment opportunities.

2

COLLABORATION BETWEEN RESEARCHERS AND END-USERS

Interaction between researchers and end-users is a key requirement of all our research projects. Our end-user-driven approach to research is comprised of three steps: mapping of end-user needs; mapping pathways to utilisation, commercialisation and impact; and ensuring good science and methodology. This approach results in research that is responsive to contemporary industry issues.

3

COLLABORATION BETWEEN END-USERS

CRC engagement with end-user forums assists us to understand the needs of our key stakeholders. In 2012/2013, these forums included the CRCLCL's SME and Peak Body Network, as well as the Australian Sustainable Built Environment Council and its wide range of industry partners, such as the Green Building Council of Australia, the Property Council of Australia and the Housing Industry Association.

4

COLLABORATION WITH LOCAL AND INTERNATIONAL EXTERNAL GROUPS

This year's signing of an MoU with the United Nations Environment Program and the hosting of a series of workshops and seminars with international partners, including KTH Royal University of Technology in Sweden and Tongji University in China, are prime examples of the CRCLCL's commitment to collaboration with international and external groups. These collaborations have a focus on sharing knowledge and enhancing industry engagement in low carbon research, and will continue to expand the CRC's reach within academia, government and industry across the globe.

ANNUAL PARTICIPANT FORUM

The Annual Participant Forum brings all CRCLCL partners together to workshop new research, innovations and directions in low carbon research. The first forum took place in October 2013. Over two days, we showcased our vision for the future, introduced our research programs and projects, and demonstrated the CRC's commitment to collaboration through a series of workshops led by industry affiliates. The forum will be run on an annual basis to assist us in measuring the success of our collaborations.



1 Shelley St, Sydney
constructed by CRCLCL partner
Brookfield Multiplex

Financial overview

In its first financial year, 1 July 2012–30 June 2013, the CRC for Low Carbon Living Ltd was granted a not for profit status, and maintains a healthy financial position carrying forward unspent funds to use in its research in year two.

The financial statements for the CRC for Low Carbon Living Ltd have been independently audited by HLB Mann Judd (NSW) Pty Ltd and submitted to ASIC and the Commonwealth CRC Program. The Auditor's report contained no adverse, qualified or other matters of emphasis. Copies of the Annual Financial Report for the period ended 30 June 2013, are available on request.

RESOURCES RECEIVED

TOTAL CASH AND IN-KIND CONTRIBUTIONS BY PARTNERS & GOVERNMENT

\$9.12
MILLION

CASH

FROM TWO SOURCES:

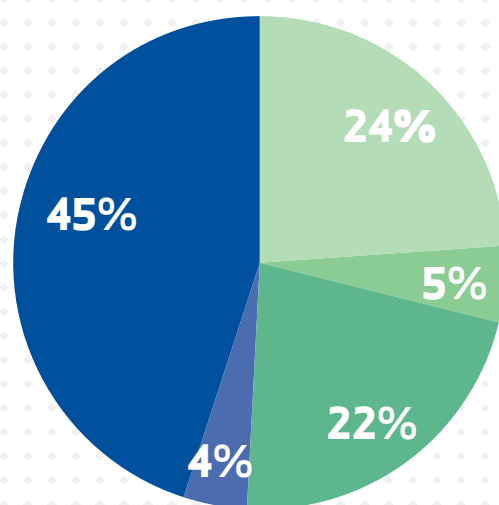
1. CRC PARTNERS (ESSENTIAL AND OTHER PARTNERS)
2. COMMONWEALTH GOVERNMENT

TOTAL: \$4.682 MILLION

IN-KIND

INCLUDES TIME PROVIDED BY EMPLOYEES OF THE PARTNERS AS WELL AS FACILITIES AND OTHER NON-STAFF CONTRIBUTIONS

TOTAL: \$4.438 MILLION



- PARTICIPANTS – ESSENTIAL
- PARTICIPANTS – OTHER
- CRC PROGRAM FUNDING
- NON-STAFF IN-KIND
- IN-KIND STAFF

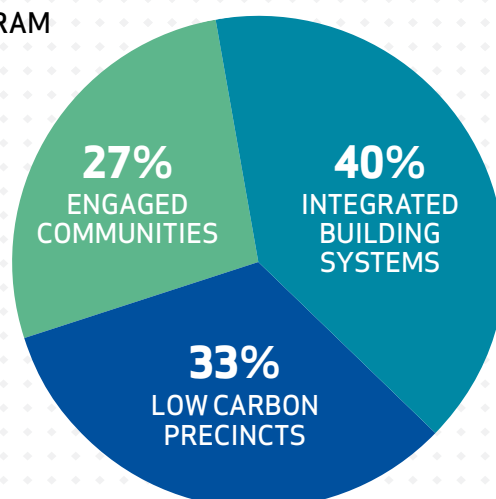
During this year, two partners from the CRCLCL retired, it does not impact the CRCLCL to meetings its goals and objectives.

RESOURCES APPLIED

RESOURCES APPLIED ACROSS THE THREE RESEARCH PROGRAM AREAS IN THE FIRST YEAR

\$7.12
MILLION

This includes proportions of expenditure on administration and education, but no capital purchases were made.



COLLABORATING PARTNERS' PROJECT INDEX

	PROGRAM			SME & PEAK BODY NETWORK ↓	PROJECTS
	1	2	3		
AECOM Australia Pty Ltd (AECOM)	█	█	█		RP1007 RP1009 RP2001 RP2002 RP3008
Ash Development Association of Australia (ADAA)	█				RP1004
Aurecon Australia Pty Ltd (Aurecon)	█	█	█		RP3008
Australasian Slag Association (ASA)	█				RP1004
Australian Window Association Inc (AWA)	█	█	█		
BCI Media Group Pty Ltd (BCI Media Group)			█		RP3007
BlueScope Steel Limited (BlueScope)	█	█	█		RP1001 RP2005
Brookfield Multiplex Constructions Pty Limited (BM)	█	█	█		RP1009
BuildingSMART Australasia Incorporated (BuildingSMART)	█	█	█		RP2001
City of Fremantle	█	█	█		RP3009
City of Greater Geraldton	█	█	█		
Commonwealth Department of Infrastructure and Regional Development (DIRD)	█	█	█		RP2002
Commonwealth Department of the Environment	█	█	█		RP1006
Concordia University, Canada, representing Smart Net-zero Energy Buildings Research Network (NSERC)	█	█	█		
Consult Australia	█	█	█		
CSIRO	█	█	█		RP1002 RP1006 RP2001 RP2002 RP3002 RP3003 RP3005 RP3009
CSR Limited (CSR)	█	█	█		RP1006 RP1010
Curtin University of Technology (Curtin)	█	█	█		RP1009 RP2003 RP2006 RP3004 RP3005 RP3006 RP3009 RP3010
HASSELL	█	█	█		RP1009 RP2001 RP2005 RP2008 RP3008
Housing Industry Association Limited (HIA)	█	█	█		RP2001
Master Builders Australia Limited (MBA)	█	█	█		RP3006
Nova Deko Pty Ltd (Nova Deko)	█	█	█		RP1011
NSW Department of Planning and Infrastructure (DEPI)	█	█	█		RP1006
NSW Office of Environment and Heritage (OEH)	█	█	█		RP2005 RP3002 RP3010
NSW Urban Growth	█	█	█		RP2001
Renewal SA	█	█	█		RP1006 RP2001 RP2002 RP2005
SA Department of Environment Water and Natural Resources (DEWNR)	█	█	█		RP2002 RP2005
South Australia Water Corporation (SA Water)	█	█	█		RP2002
Standards Australia Limited	█	█	█		
Suntech R&D Australia Pty Ltd (Suntech R&D)	█	█	█		RP1007
Swinburne University of Technology (Swinburne)	█	█	█		RP1004 RP2001 RP2003 RP3001 RP3003 RP3006 RP3008
Sydney Coastal Councils Group Inc. (SCCG)	█	█	█		RP3006
Sydney Water Corporation (Sydney Water)	█	█	█		RP2001 RP2002 RP3008
TAFE NSW Sydney Institute (TAFE Sydney)	█	█	█		RP3010
City of Sydney	█	█	█		RP2005 RP3008
The Royal Australian Institute of Architects (AIA)	█	█	█		
Tongji University, China	█	█	█		
University of Melbourne (UoM)	█	█	█		RP1006 RP1009 RP2005 RP3006 RP3008 RP3010
University of New South Wales (UNSW)	█	█	█		RP1001 RP1002 RP1003 RP1004 RP1006 RP1007 RP1009 RP1010 RP1011 RP1012 RP2001 RP2002 RP2005 RP3003 RP3007 RP3008 RP3010
University of South Australia (UniSA)	█	█	█		RP1001 RP1006 RP1009 RP1010 RP2002 RP2005 RP3009
Victorian Building Authority (VBA)	█	█	█		RP2002 RP3006
Woodhead Pty Ltd	█	█	█		
Project Partners					
Australian Sustainable Built Environment Council (ASBEC)				█	
Nursery & Garden Industry Australia (NGIA)		█			RP2005
The Corporation of the City of Adelaide (City of Adelaide)		█			RP2005
MoU					
United Nations Environment Program (UNEP)	█	█	█		
KTH, Royal Institute of Technology, Sweden (MoU)	█	█	█		



CRC for Low Carbon Living Ltd

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