Highlights from 2020

SUSTAINABLE BUILDINGS RESEARCH CENTRE

SBRC
SUSTAINABLE BUILDINGS RESEARCH CENTRE

UNIVERSITY OF WOLLONGONG AUSTRALIA

WHO ARE WE...

A multi-disciplinary facility addressing the challenge of transforming our buildings and built environment into sustainable, resilient and effective places where people live and work.

A message from the director

While it was by no means a normal year for all of us, the team at the Sustainable Buildings Research Centre continued our dedication to innovation in building technologies and sustainability through research and industry partnerships.

Research such as targeting the gaps in the scientific understanding of bushfires or The Innovation Hub for Affordable Heating and Cooling (i-Hub) project, reflects our commitment to driving positive outcomes for sustainability within business and industry, and shows the impact that our teaching and learning, research and operations has on society and the environment.

Despite all the disruptions and uncertainty, our researchers' commitment to helping governments and businesses better plan for a sustainable future is unwavering and it is this passion that drives SBRC.

Guided by our values and strategic plan, we continue to deliver projects that ensure our research culture is focused on excellence. Over the past 12 months we had success across a range of grants and SBRC was cited across 187 publications. SBRC academics are currently involved in the supervision of 26 HDR students.

Thank you to our industry partners and affiliated research partners for their ongoing commitment and support during a tumultuous year. We wish you have a very successful and productive year of 2021.

Acting Director
Associate Professor Zhenjun Ma

RESEARCH AND PROJECT HIGHLIGHTS

To eat or to heat?

HOW RETROFITTING AUSTRALIAN SOCIAL HOUSING FOR ENERGY EFFICIENCY CAN CHANGE LIVES

Most people in Australia take for granted switching the ceiling fan or air conditioning on to relieve the sticky summer heat or turning the heater up on chilly winter nights, and certainly think nothing of their right to a daily hot shower.

But for some people, these seemingly small acts represent anxiety, worry and a quality of life that's quite simply out of reach. For many people, including those who live in Australia's social housing system, concern about the affordability of their energy is a fact of life. The most basic decisions about heating or cooling their home can be a choice between eating and heating.

THE AUSTRALIAN SYSTEM OF SOCIAL HOUSING

Supporting the most vulnerable and in need, the Australian system of social housing consists of public housing, community housing and Aboriginal housing. Briefly, public and Aboriginal housing is owned and managed by state and territory governments while community housing is provided by not-for-profit community organisations. Of this, government-owned public housing provides nearly 80 per cent of the housing and the community sector supplies the balance.

It's not a perfect system. While approximately 4 per cent of Australians live in social housing, almost 150,000 households are on social housing waiting lists. Decades of inadequate investment have left Australia with a growing shortfall in social housing dwellings and construction isn't keeping up with the rising need or addressing the growing backlog. Critically, much of the public stock is ageing, with associated increased need for repairs and maintenance. As a result, around 1 in 5 homes fail to meet even the governments' own minimum acceptable standards.

ENERGY HARDSHIP, A WAY OF LIFE

Energy poverty, not being able to afford electricity and gas, is a huge problem for low income households in Australia, not just in social housing.

Social housing tenants are frequently reliant on income-support, but are responsible for their own gas, electricity and water bills. Residents often spend a high proportion of their income on fuel costs or find ways to manage their energy bills by restricting usage, often in ways that reduce comfort and wellbeing and many of these have significant health impacts.

Research at the University of Wollongong's Sustainable Buildings Research Centre (SBRC) and the CRC for Low Carbon Living, a national research and innovation hub of researchers and planning, engineering, property and policy organisations, has evaluated a number of possible ways to reduce the energy and carbon emissions from social housing stock and more importantly, improve the lives of those who live there.

LIVING LABORATORIES

The project, 'Mainstreaming Low Carbon Retrofits in Social Housing', explored the opportunity for social housing providers to cost-effectively upgrade their housing stock to improve energy efficiency and thermal comfort.

From a variety of locations across NSW, 42 social housing properties were recruited to participate in the study. The project had three main activities:

- To assemble an evidence base regarding the direct benefits, co-benefits (benefits beyond energy such as health and wellbeing) and risks of the relevant upgrades.
- Monitoring and evaluation of a range of energy efficiency upgrades implemented in real world situations.
- Collaborative activities with stakeholders to assemble the resulting evidence into user-friendly formats.

Home energy audits were undertaken on the 42 social housing properties and over the course of 24 months energy consumption, internal temperature and humidity were monitored.

During the study, each of the 42 properties received an energy efficiency upgrade from their Housing Provider. This allowed researchers to gather both pre and post-installation data for comparison.

One or more of the following upgrades was implemented across the 42 properties:

- Wall insulation;
- Double glazing;
- Hot water heat pump;
- Reverse cycle air conditioning;
- Solar photovoltaics;
- Roof insulation;
- Ceiling fan;
- Draught proofing;
- Internal shading.

The researchers also conducted in-depth ethnographic interviews with a subset of the participants exploring how social housing tenants balance energy bills, comfort and health on a tight income.

Because social housing properties are generally managed and maintained through a centralised process, this was a significant opportunity for the development of a major, aggregated approach to implement low carbon retrofits in large portfolios of residential building stock.

THE SIMPLEST SOLUTIONS ARE OFTEN THE BEST

On the most fundamental level, the research demonstrated that the impacts of improved energy efficiency are far greater than purely financial. In addition, it's not necessarily the most expensive options that deliver the greatest benefit to tenants.

Anecdotally, the tenants who took part in the research expressed genuine gratitude for the upgrades they received. From substantially reduced electricity bills to the joy of new double-glazing and ceiling fans, the upgrades vastly improved their quality of life.

The management and maintenance of these social housing properties represents a significant financial burden for their providers. But social housing represents a duty of care that extends beyond providing a roof. So while the biggest barrier to large-scale retrofits is funding, there is a growing realisation that something has to be done.

Addressing energy efficiency through a 'fabric first' upgrade system delivers long lasting rewards to energy efficiency and tenant wellbeing. This approach means the performance of the components and materials that make up the building's fabric are improved first, before considering the use of additional elements.

A ROADMAP FOR SOCIAL HOUSING MANAGERS

At the completion of the study each housing provider involved was given a detailed report on the energy efficiency of their property, both before and after the retrofit, and specifics on the benefits of the upgrades to each property.

A comprehensive handbook, Guide to Implementing Low Carbon Retrofits for Social Housing, was written and distributed widely across social housing sector management and specifically to sustainability managers.

Providing a clear pathway to achieving low carbon homes for social housing with simple visual guides, it details a roadmap broken down into three steps;

1. Simple, high impact retrofits that can benefit all homes;
2. Higher upfront cost upgrades that will benefit most homes, and;
3. Longer payback period upgrades that are appropriate for some homes or providers with more ambitious low carbon goals.

Ultimately, the dichotomy of improving energy efficiency in social housing is that tenants face a constant struggle to pay their energy bills while their housing provider faces a substantial financial outlay to upgrade properties without the ability to recoup financial benefits from the tenants.

However given the benefits, including improved wellbeing as well as the financial benefits, to residents of energy upgrades, there is an important consequential feedback loop between what it costs to implement energy upgrades and the savings made against other areas of the welfare system, which for most of social housing tenants is all borne by the public purse.

A growing necessity exists for further study to research the impacts of different upgrades and the cost benefit analysis across the whole system.

HUMANS FIRST

The smallest social housing apartment may represent an enormous achievement for an individual. Whether it's a safe place to raise a family or the first step up from homelessness or away from a damaging domestic situation, these are personal spaces that people take pride in.

Empowerment in energy efficiency within the social housing sector is for a parent to be able to switch on a ceiling fan to cool a sleeping child, or for a pensioner to securely close a window to block the southerly chill. Making this a reality in 21st century Australia is within reach.

Supply in the age of demand

HOW RESEARCH INTO SUPPLY CHAINS IS LEADING TO POSITIVE AND SUSTAINABLE SOLUTIONS

From toilet rolls to fruit pickers, supply chain has entered the consciousness of Australians in 2020 like never before.

In the 21st century we've become complacent that our consumer demands will always be met, whether that's being able to buy what we want when we want it in the supermarket, or have the construction materials delivered for our new house in full on time and to specifications. And yet by and large we're completely ignorant of how that happens.

But supply chain management is a complex and ever-evolving field of study. An effective and efficient supply chain is integral to every industry across the entire world, and yet it has frequently been a case of set-and-forget for many businesses, as well as the general public.

Supply chain transformation is increasingly critical to how we live, so delivering support to supply chain professionals, governments and industry will help improve and refine systems, drive sustainability, increase job opportunities and connect communities to markets.

BRIDGING THE GAP

The team at the Sustainable Buildings Research Centre (SBRC) at the University of Wollongong have been working across a variety of different industries to examine the specific pain points in their supply chains and what business process improvement programmes can be identified.

The research projects have a fixed focus on a sustainable future and social outcomes, rather than profit driven outcomes, and the analysis of supply chain forms part of a holistic project overview.

The researchers are able to inform the projects using a database of global field research and case studies of businesses with existing supply chain issues and consequently apply and contextualise those learnings to any market.

With the scope for seeding these methodologies to a wider audience, these test cases are proving to offer valuable understandings for supply chain methodology and how this can be applied across a vast array of industries.

The unique multi-disciplinary perspective of the SBRC team delivers comprehensive research, shining a lens on the supply chain process from a multitude of angles. Each research group comprises a team that's drawn from a variety of different disciplines, both complementary and contrasting, who augment the working party with their expertise.

The inherently collaborative nature of the team extends further out to their business sponsors, bridging the gap between academia and practice, industry and government. Because the research is unbiased and impartial, its value being underpinned by theory as well as practice, it delivers measurable outcomes and maximum impact.

COOPERATION THAT FUELS CHANGE

The appetite across industry for re-engineering supply chains varies, but to the most progressive and agile businesses, as well social change makers and those wanting to increase their impact, it's critical to their very existence.

Additionally, when governments are able to measure the impact of their own policies along the supply chain, this has a positive ripple effect of seeding change where it will have the most impact. The University has been able to help government, industry and private businesses examine elements of their processes and their impacts on wider supply chain.

Collaboration with government

The collaborative research project 'Understanding Decision Making Processes to Meet or Exceed BASIX requirements in Apartment Construction' was undertaken by the University of Wollongong as part of the Energy Efficiency Decision Making Node (EEDMN) and funded by the NSW Government.

BASIX, or Building Sustainability Index, is a NSW Government planning measure to reduce household electricity and water use by setting minimum sustainability targets for new and renovated homes. A BASIX certificate is required for the construction of all new dwellings such as houses, flats and apartments.

The complicated and multi-faceted nature of the design, construction, approvals and supply chain process of apartment blocks, means residents have little or no say in the factors that help reduce their apartments' energy use. Wall and ceiling insulation, window placement and shading and heating and water systems are just some of the factors influencing energy efficiency that are predetermined by the developers.

The research used a mixed method approach of literature review, semi-structured interviews with stakeholders across the apartment construction sector, and data from an online survey to a broader array of stakeholders.

Using applied systems thinking linking all the aspects from design, through to construction onto habitation, gave a broader view of where the most impact might be felt and opportunities and effective decision points for interventions.

The project identified four target areas for future policy action:

- Government policy to increase apartment sustainability through increasing minimum BSAIX targets and/or modifying apartment design guidelines
- Measures to increase compliance to ensure apartments as constructed meet modelled energy efficiency performance
- Increasing customer demand for more sustainable and energy efficient apartments
- Providing incentives for developers to exceed existing minimum BASIX targets.

Collaboration with industry

The EEDMN project 'Developing the CCF market baseline: Establishing a baseline against which to measure market transformation', looked to address energy efficiency and renewable energy beyond the traditional evaluations of cost and savings (eg. kW, kWh and pollution reduction).

Extending on previous work for the Department of Planning, Industry and Environment (DPIE) the project aimed to evaluate the extent of market transformation through two priority market areas:

- Household Batteries: primarily impacted by the Empowering Homes Program (EHP)
- Accredited Certificate Providers: primarily impacted by the Household and Small Business Upgrade Program (HASBUP).

With battery inverters and battery cell manufacturers headquarters located internationally, assembly situated within Australia and a range of distributors and retailers, household batteries have a complex supply chain.

Coupled with this, future demand is unpredictable in a market sensitive and responsive to government policy announcements, and information flow along the household battery supply chain is not coordinated or integrated.

Ultimately, there is very little coordination between states, territories and federal government. Additionally, federal government initiatives to undertake supply chain market transformation, such as supplying incentives to manufacture in Australia and DPIE to get batteries to households, needs definitive action.

The impact of addressing market transformation along this supply chain, such that it creates lasting change, would have a far-reaching effect on the domestic job market.

Collaboration with business

BuiltQuik, an entrepreneurial startup with a philosophy to support regional projects and regional jobs, developed a pre-certified and pre-fabricated structural housing product refined to meet the needs of Aboriginal residents in the Northern Territory.

In the past, there's been little or no consultation with the community, Elders or tenants in the supply of fit-for-purpose housing. Delivering a product for the community, into the community, BuiltQuik were conscious that the project therefore had to be community led. Examining the supply chain in detail, led to an understanding of how the company could engage local businesses to support local employment.

Recognising the benefits of working with an academic institution and partnering with world-class researchers, BuiltQuik connected with the research team at the SBRC via the ICR at UOW to develop and refine the business model as well as develop the supply chain solution.

The deliverable from the collaboration focused on having a turnkey housing solution for the community as well as meeting the Northern Territory Government and Federal Government requirements to fund the housing, making the business model for the community viable.

BuiltQuik's housing frame will become a vehicle for job creation as BuiltQuik is licensing the technology to the community, training people to deliver the product themselves and developing skills to create housing over a longer term.

Innovative supply chain solutions were enthusiastically adopted to enhance the community sustainability aspects; regionally available materials for the simple wall structures are used (rather than supplying walls from other parts of the country), fit out and design of the frame is left to the community, and the fabrication is done by Indigenous fabricators. This creates an end-to-end physical supply chain, which is owned by the Indigenous community.

A WORKING PUZZLE

Supply chain management is like putting the pieces of a puzzle together. With an understanding of working environments and the consequence of decisions, you can identify the weak links and fix them, creating a seamless and sustainable function.

Providing well-researched, well-specified and well-communicated solutions, practitioners are able to adopt a rigour and thoroughness to their supply chain solutions.

The outcomes of poor supply chain management are simple; reduced productivity and poor economic growth in the regions and ultimately the nation. And when combined with an approach that looks at our sustainable future, the effects are even longer term.

ALWAYS MOVING FORWARD

Seeking always to drive transparency, sharing information and adopting a distinctive multi-disciplinary approach, the researchers at UOW and SBRC are able to reach into the deep well of expertise and passion that exists there, and translate data into knowledge to serve all parties looking to create a more sustainable future.

Relentlessly tackling issues that defy categorisation but have far-reaching consequences has become the hallmark of research at the University.

> "We designed a supply chain in theory and now it was about implementing it to work in practice."

DR TILLMANN BÖHME
SUPPLY CHAIN RESEARCH LEAD, SBRC

Living on the bushfire frontier

HOW WE'RE BUILDING BUSHFIRE RESILIENCE IN COMMUNITIES AT RISK

A united effort

At the University of Wollongong a team of experts are participating in a unique project with the aim of targeting the gaps in the scientific understanding of bushfires.

Under the Global Challenges project a multi-disciplinary team is bringing together specialists from social science, engineering and business to capture the complexity of bushfire events and how communities prepare for, respond to and recover from these destructive events.

In areas ranging from the physical interaction between fires and buildings, through to the social and societal factors that can help us build more bushfire-resilient communities, this project, along with other bushfire related work at UOW, will address the substantial hazard faced in Australia from these seasonal events.

The deadly situation

While new houses in fire affected zones are subject to stringent building codes, the majority of properties in bushfire-prone areas predate these regulations. Upgrading or 'retrofitting' existing properties is left to the individual homeowners who often don't have the requisite understanding or resources, to bear the costs and responsibility.

Due to urban expansion, economics and lifestyle considerations, people and communities are increasingly choosing to live adjacent to or amongst fire prone areas. Inevitably this closer proximity poses an escalating risk to people, property and emergency services from seasonal bushfire, which are themselves breaking records for their duration and intensity due to climate change. Put simply, more people are at greater risk from bushfires every year.

To address the increasing bushfire hazard in Australia, we need to facilitate better community cooperation and encourage people to prepare themselves and their properties.

Understanding what it takes

Studies have shown that cost, time and understanding are the main barriers preventing residents from preparing for bushfires. In beginning to quantify what it costs in real terms to retrofit a property and recognising the best ways to do that, we can begin to discern whether modifying houses to an upgraded construction standard may provide a cost-effective and sustainable way to reduce the vulnerability of existing communities to bushfires.

A dialogue built on research

Our ongoing research aims to build a conversation with the whole spectrum of concerned parties; those implicated on a micro level because of the location of their homes, and those on a macro level of local and state government, as well as the various fire management authorities and emergency services charged with reacting to and fighting the fires.

The devastating summer of 19/20

Eastern Australia is one of the most fire-prone regions of the world and every year widespread fires ignite and burn with varying degrees of impact and devastation. But even the most seasoned of bushfire veterans was shocked at the extent and ferocity of the 2019-2020 bushfires.

The bushfire season started early due to the prolonged draught and hotter than average temperatures, and by March 2020 a geographic area of approximately 72,000 square miles across Victoria, New South Wales, South Australia and the Australian Capital Territory had been razed.

Multiple states of emergency were declared as cataclysmic fires destroyed over 5,900 buildings including 2,779 homes, and killed at least 34 people and billions of animals. For weeks fire fighters waged intense battles to save lives and properties as the nation choked through a summer of smoke.

Under the microscope

Two of our projects are examining some of the preventative measures people can take to mitigate the damage to property. In the shadow of the recent bushfire season a project in the Kangaroo Valley is examining the potential retrofitting of houses, while research around the efficacy of sprinkler systems has been ongoing for several years.

Retrofitting homes

Up to 50 homes were lost in the Currowan fire in the Kangaroo Valley where ferocious southerly winds propelled the fire to jump the Shoalhaven River. Residents had spent the preceding days preparing their homes and properties fearful for what was to come.

This study aims to build on the long-term bushfire resilience and recovery examining the real costs of retrofitting houses and what people are willing to pay to make their properties as safe as possible. In 2014 similar retrofitting research in Wyong Shire Council area on the New South Wales Central Coast, focused on ten homes, all built before 2002.

The ten homes were from two distinct groups; five homes in a predominantly forested area on larger plots with a smooth transition from property to forest (intermix) and five homes on the edge of a developed residential suburb bordering wetland native forest (interface).

We carried out visual inspections to identify actions needed to prepare a home and establish what modifications were needed to retrofit buildings up to the required standard (Australian Buildings Standard AS3959 – Construction of Buildings in Bushfire Prone Areas). In addition we conducted interviews with these residents to explore the extent of financial outlay they were willing to contribute to make their homes safer.

Following this process an approximate cost of actions required to rectify any areas of unmet preparedness was estimated, plus the costs to upgrade to cover the next ten years.

Our results

Our results threw into stark consideration three factors; the large financial outlay needed to both prepare for the forthcoming bushfire season and retrofit the property, the reluctance of residents to bear the whole cost of this themselves and importantly, the lack of personal preparedness across all households.

Financial assessment

Total cost to prepare a house for the upcoming bushfire season and the total cost to upgrade a building*

	Lowest cost	Highest cost	Average
Cost to prepare	$1,954	$12,905	$7,145
Cost to upgrade**	$8,527	$46,856	$24,596

* These results apply to a specific set of 10 buildings, and do not represent all buildings.

** To BAL 40 standard of construction

Social assessment

Perception of risk differed in each group with the intermix residents believing their properties to be at a greater risk. Most households had undertaken basic preparatory actions but there were a number of tasks that few or no households had completed, including completing a written Bushfire Survival Plan, which no resident had done.

Barriers to preparedness fell under uncertainty (for instance whether they had permission to clear trees), frustration (sourcing advice and purchasing equipment), time and perceived priorities (work commitments, approaching council).

Most residents had a limited understanding of preparedness activities but none had a comprehensive understanding of their options for improving their resilience or preparedness. Sadly, this is not uncommon as previous studies have shown residents have difficulty in applying generic information to their property.

Sprinkler Research

Sprinklers offer an alternative approach when retrofitting existing properties for bushfire resistance. Rather than looking at modifying the building itself, sprinklers can help to reduce the intensity of bushfire attack on vulnerable building components.

While the theory of reducing radiant heat and extinguishing embers with water sprays is sound, this research is taking some of the first steps needed to gain a scientific understanding of how bushfire sprinklers perform in the hot, windy conditions of a bushfire such as those of the Currowan fire.

The research involved testing sprays in the laboratory using high-speed cameras, measuring spray deposition in outdoor experiments and computational fluid dynamics simulations of twelve different sprinkler systems in a range of bushfire conditions.

Our detailed analysis will enable the design of sprinkler systems that are resilient to the strong wind and heat of a bushfire. And importantly, this continuing research will help residents determine which sprinklers are most suitable for their property, where they should be installed and how to use and maintain them.

Who pays?

The question around who should pay for the retrofitting of properties remains a vexed one, largely due to individual perceptions of responsibility.

In our previous study in Wyong, a shared expense scheme between local Council and homeowners was met with mixed response; those with the higher perception of risk seemed more willing to consider an equal cost scheme and those who thought their risk less, held the view the Council should manage the bushfire risk by clearing nearby fuels.

With the approximate average cost of $25,000 for the houses in that study, each resident would have to pay in the region of $12,500 to adequately modify their house in a shared expense scheme. Clearly, this is both a substantial personal outlay and a significant cost to local government.

As an indication of willingness to contribute, residents were asked if they would pay $5,000 in such a scheme and were considerably resistant to such a proposal.

Understanding is key

Ultimately, the choice to live in bushfire-prone areas will always involve the acceptance of some risk. The reduction of this risk is the ultimate goal.

A holistic approach of education, both in targeted communities and ideally on a case-specific basis, is crucial. Residents in at-risk communities need to be empowered with a range of information about potential mitigating actions to enable them to make informed decisions about their own risk.

A work in progress

Without doubt, more research is needed and with the Global Challenges project only just underway, this is happening right now. Running for a year alongside other projects, the University is engaging people from community, government and industry to shape strategies and policies for future bushfires.

Preventing the loss of life and property and reducing the enormous financial and personal costs that result from our Australian bushfires, is the goal.

“The work we’re doing will help shape strategies and policies for future bushfires, to minimise the damage they do and help communities recover more easily.”

DR ALAN GREEN, RESEARCH FELLOW SBRC

The Sustainable Homes Challenge 2020

TEAM LEADER DR LEELA KEMPTON

HOMES FROM WASTE

The Sustainable Homes Challenge aimed to bring together a diverse group of university students from around the world to design a home from waste-derived building products.

Academic and professional staff from the Sustainable Buildings Research Centre, Engineering and Information Sciences, Business, and Social Science worked together to write the outline of the challenge and develop the education resources.

Project Leader Dr Leela Kempton said the challenge’s aim to attract students from multi-disciplinary backgrounds was also reflected in the diversity of the project working group.

“It was a highly collaborative project with cross faculty representatives donating their time to the challenge,” she said.

“Unfortunately, the impact of the global COVID-19 pandemic resulted in the need to postpone the project, however, it is hoped that if circumstances allow, it will run in 2021, with changes to the format to accommodate any potential global travel restrictions in place at the time.”

Highlights from this year’s project included:

- A framework for the SHC was developed including a design process for teams to follow and a set of ten evaluation criteria built around the three pillars of sustainability, health and affordability and underpinned by innovation.
- Expected deliverables for the teams were specified to ensure high quality outcomes to be presented during the Finale Week. Teams were expected to present a short pitch of their design, as well as to demonstrate their design with an interactive digital display addressing the evaluation criteria.
- Recruitment for the 2020 challenge occurred over November and December 2019, and resulted in 40 applications from 10 targeted institutions across Australia, Europe, North America and the United Kingdom.
- Thirty scholars were chosen to participate, with 13 from UOW, 5 from other Australian universities and 12 from international universities. Scholars were from a mixture of engineering, architecture, science and social science backgrounds.
- Four companies agreed in principle to sponsor prizes for the teams, with a total prize value of $6750 committed and potential for additional sponsorship opportunities.
- A structure for the educational resources, covering teamwork, problem identification and housing design and remote delivery of UOW teaching in 2020 has led to the additional development of resources that may be drawn upon for the SHC and other UOW educational initiatives in the future.

“While it was not possible to proceed with the SHC as planned, the calibre of the students recruited and their exposure to UOW was encouraging,” Dr Leela Kempton said.

“In preparing for the challenge, members of the SHC Operations team developed new methodologies for teaching and preparing educational resources online, which had a direct impact given the change to remote learning requirements for 2020.

“The philosophy behind the challenge has also had a positive influence on the teaching of the first year engineering subject ENGG105 – Engineering Design for Sustainability.”

If the project proceeds in 2021, planning will account for the risk of ongoing international travel restrictions as a result of the COVID-19 pandemic.

Living laboratories testing renewable energy

THE INNOVATION HUB FOR AFFORDABLE HEATING AND COOLING (i-Hub)

A team of researchers from the Sustainable Buildings Research Centre have established living laboratories in an aged care facility and within Australian Capital Territory based schools, to test the heating, ventilation, air conditioning and refrigeration with the hope of demonstrating increased value for a switch to renewable energy.

Team member and Associate Research Fellow Clayton McDowell (pictured) said the "i-Hub Living Laboratories provide a unique opportunity for industry to evaluate new technologies and services in a real world scenario while still having the independent and thorough evaluation through a University".

The Warrigal Shell Cove aged care i-Hub Living Laboratory and ACT Schools Living Laboratory established research-quality measurement and verification systems within both facilities in order to observe and evaluate technology upgrades within the context of the daily life of the aged care and schooling ecosystem.

The technology upgrades trialled in the living labs will be selected from promising electric heating and cooling strategies that increase the energy flexibility of each facility and deliver increased value for renewable energy, at the site and grid level.

"There are thousands of schools across Australia that combine to make up a large energy consumer, the i-Hub ACT living laboratories enable us to understand potential opportunities to improve the energy efficiency and when partnered with the i-Hub Education Sector Wide project we are able to evaluate the impact these technologies may have when applied to state or Australian wide policy environment," he said

"This will help provide us understand if these facilities are introducing enough fresh air which is especially critical with the current Covid-19 pandemic."

Next year the team are hoping to include "solar and battery technologies" within the research "and demonstrate their implications in the ACT moving to a net zero energy trajectory"

The i-Hub project is an initiative led by the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) in conjunction with CSIRO, Queensland University of Technology (QUT), the University of Melbourne and the University of Wollongong and supported by Australian Renewable Energy Agency (ARENA) to facilitate the heating, ventilation, air conditioning and refrigeration (HVAC&R) industry's transition to a low emissions future, stimulate jobs growth, and showcase HVAC&R innovation in buildings.

The objective of i-Hub is to support the broader HVAC&R industry with knowledge dissemination, skills-development and capacity building. By facilitating a collaborative approach to innovation, i-Hub brings together leading universities, researchers, consultants, building owners and equipment manufacturers to create a connected research and development community in Australia.

Mr McDowell said the living laboratories are providing insights into energy consumption but also "provide us with a picture of the indoor environments including CO_2 concentrations within the classrooms and aged care rooms".

LIVING BUILDING STATUS FORMALLY AWARDED

The University of Wollongong's Sustainable Buildings Research Centre (SBRC) achieved full marks under the world's toughest sustainability standard for buildings, the Living Building Challenge (LBC).

The result was confirmed in a formal ceremony held in February with SBRC building setting a new benchmark as, arguably, the most sustainable building in Australia.

The LBC, administered by the International Living Future Institute (ILFI), certifies projects that meet ambitious green building performance standards through a framework of "Petals" around categories that include Energy, Materials, and Water.

"Living" Certified buildings have met the criteria for all seven petals. There are only 24 buildings in the world that have met all seven Petals and are considered Living Certified; an exclusive list that now includes the SBRC.

Former SBRC Director Senior Professor Paul Cooper said the research centre's design was based on the LBC regenerative design framework aimed at creating "living" buildings that make a positive impact on our society and our environment overall.

"The building has been carefully designed to generate positive health and wellbeing through a restorative and healthy coexistence with nature, including the use of green walls and native plants, creating a strong connection between the building occupants and the landscape," he said.

"From day one, I said to the design team that we wanted to create a building that went way beyond the current benchmark for sustainable buildings. We believe society as a whole needs to do much better than that."

DESERT ROSE WINS AGAIN

Team UOW won the Inspirational Engineering Project award for their project Desert Rose House at the recent Australian Engineering Excellence Awards.

The award recognises Australia's top engineering projects and the engineering teams behind them.

Civil Mining and Environmental Engineering Head of School and team leader, Professor Tim McCarthy, said "this award is special because we were judged against all the massive and impressive engineering projects across all engineering disciplines in the Sydney region".

"When you read through the list of finalists and consider that Desert Rose House was one of only six projects selected as a winner for the Sydney region, you can get an idea of the impact this Solar Decathlon inspired project has had," he said.

"All of us at Team UOW thank all of our supporters across the campus for your enthusiasm and constant goodwill towards this amazing project."

About Desert Rose

Throughout 2017 and 2018 more than 200 students volunteered from the University of Wollongong and TAFE NSW, to take part in the Desert Rose House project.

The collaboration between students, staff and industry was called Team UOW and they built a net-zero energy eco-friendly home that was architecturally inspiring, innovative and adaptive to a person's needs as they age.

The home's design takes into account the challenges people may encounter when suffering from dementia and other age-related disabilities. The unique features means the home will adapt to the occupant through the years, making it 'A House for Life'.

Desert Rose House came second at the Solar Decathlon 2018 – the world's largest sustainable architecture contest that challenges student teams to design and build highly efficient and innovative buildings powered by renewable energy.

Senior Professor Paul Cooper awarded prestigious James Harrison Medal

THREE AWARDS FOR THE SUSTAINABLE BUILDINGS RESEARCH CENTRE TEAM

UOW's Senior Professor Paul Cooper was awarded the prestigious James Harrison Medal at the 2019 Australian Institute of Refrigeration, Air conditioning and Heating Industry Awards in Sydney.

The former Sustainable Buildings Research Centre Director was awarded the institute's highest honour "for his focus on developing the most efficient and effective engineering solutions to improve the quality of living and working environments for all".

During his acceptance speech, Professor Cooper acknowledged the industry has "a major part to play in reducing... societal and environmental impacts, such as the current global heating crisis".

"In particular, we need people who have the creativity and drive to help our society meet some really significant global environmental challenges that are happening right now and will continue into the coming decades," said Professor Cooper.

"Buildings in fact account for approximately 40% of global energy use and greenhouse emissions (IEA) – and a large fraction of this is due to HVAC systems and other building services.

"We need to continue to develop ways to drastically reduce the energy consumption and greenhouse emissions resulting from these systems."

When asked how he was feeling about the award, Professor Cooper said AIRAH have only made this award 5 times in the previous 10 years, "and I am the only academic awarded the medal during that time – so I'm feeling pretty happy about that".

Along with Professor Cooper's award, Desert Rose won the Excellence in HVAC&R Research award and SBRC's Brendan Banfield won Student of the Year – Higher Education or Research.

Robyn Dawson, SBRC's Administrations Officer, was "ecstatic with the outcome".

"Three wins from three nominations is fantastic. I am so proud of the team and a well-deserved lifetime achievement award for Paul," she said.

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VIRTUAL TOUR
Sustainable Buildings Research Centre,
Illawarra Flame House and Desert Rose house
uow.edu.au/sbrc/virtual-tour

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