



WESTERN SYDNEY
UNIVERSITY

ZERO CARBON

A PRIORITY AREA OF THE WESTERN SYDNEY UNIVERSITY
RESEARCH THEME PROGRAM

The planetary life support systems of future generations are being compromised by climate change. Transitioning to a zero-carbon economy and society will help protect the ecological systems that people, plants, animals and cultures depend upon. We need bold actions to ensure this transition. Responding to this need, the four Research Themes have bundled their energy and resources to progress work that falls inside the broad Priority Area of Zero Carbon.

This document represents a unique resource for academics, industry and government organisations that want to progress towards Zero Carbon. It captures the first of a series of three symposia organised by the Western Sydney University Research Theme Champions, held at 1 Parramatta Square in 2023.

The events align with our Decadal Strategy *Sustainability and Resilience 2030*, reinforcing and ratifying the following Priority Statements:

- **Climate Action** - Step up efforts to support climate action in our region.
- **Regenerative Systems** - Value biodiversity linking human wellbeing to environmental health.
- **Resilient Cities** - Enable urban resilience and adaptive capacity in our region.
- **Economic Transitions** - Enact new visions for economic transitions through ethical economic and ecological relationships.
- **Partnerships** - Collaborate with regional, national and international organisations across all sectors to deliver impact across these priority statements.

The first symposium (March 2023) focussed on learning from expert researchers in the field of Zero Carbon. Industry needs are at the centre of the second symposium (August 2023). In the second symposium, participants will learn about the research needs of private industry, land and resource managers, government organisations and those active in the carbon abatement sector. The third event will be held in November 2023 and bring industry, government, not-for-profits and researchers together to co-design new interdisciplinary funding proposals to assist in the move to Zero Carbon.

Acknowledgement of Country

Western Sydney University acknowledges the peoples of the Darug, Tharawal, Eora and Wiradjuri nations.

We acknowledge that the teaching, learning and research undertaken across our campuses continues the teaching, learning and research that has occurred on these lands for tens of thousands of years.

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SYMPOSIUM 1

ZERO CARBON RESEARCH – OUR COMMON RESPONSIBILITY

24 March 2023
9:30am–12:30pm
Level 9, Peter Shergold Building,
Parramatta City Campus

PURPOSE OF THE EVENT

Decarbonising our way of life is necessary to prevent continued damage to, and potential collapse of, our planetary life support systems. Decarbonisation requires coordinated inspiration, innovation, and collaboration amongst all research disciplines.

In 2022, the University's **Research Theme Champions** selected Zero Carbon as one of two **priority areas** that will receive concerted attention from all four Research Themes. Following on from outreach events in 2022, the Research Theme Champions are hosting a series of three workshops in 2023 that will assist WSU researchers to identify how their expert knowledge can contribute to our greatest challenge.

The first event titled, **Zero Carbon Research – Our Common Responsibility** kicks off the workshop series. Future events will support the building of partnerships with industry and identifying ways of funding research in this space.

In this document, our expert panellists highlight the role of research in addressing climate change and in the transition to a zero (or net zero) carbon society from the perspective of their unique disciplines. This is followed by the outputs from a workshop that asked:

- **Activity 1** – What Zero Carbon research area or topic could you pursue in your field of expertise?
- **Activity 2** – The Proposal: Using a current broad research grant opportunity, develop an interdisciplinary grant proposal idea. Why is this important? Who are the industry partners? Pitch your proposal.





EVENT OPENING

PROFESSOR JUAN SALAZAR SUTIL



Professor Juan Salazar Sutil

School of Humanities, Communication Arts
Western Sydney University

Expertise: Social Dimensions of Climate Change

Juan is a researcher, author and documentary filmmaker who engages with communities and places where the environmental and cultural challenges of living sustainably are starkly exposed. He is passionate about the socio-environmental impacts caused by the transition towards Zero Carbon.

TRANSCRIPT OF PROFESSOR SALAZAR'S PRESENTATION

In pretty much one decade, the notion of net zero has gone from science to policy to mainstream. Net Zero is considered the benchmark standard for decarbonisation and has become a global rallying cry in the race to tackle climate change. But the problem we face is far more complex, and relates to our insatiable thirst for energy. We have become a species ravenous for energy in order to maintain our unsustainable way of life.

According to the Paris agreement, which soon will already be a decade old, in order to keep global temperature rise at 1.5 degrees Celsius, global emissions need to be reduced by 45% by 2030 and reach net zero by 2050 - information that you all know very well. Many argue that might already be too late, and others argue that we are significantly behind schedule in terms of these targets. There are only three carbon negative countries: Bhutan, Panama, and Suriname and only five carbon neutral countries: The Comoros, Gabon, Guyana, Madagascar, and Niue.

On the other side of the fence we have a 2022 report from the United Nations Environment program which determined that roughly 75% of all the emissions come from a small group of only 20 emitters, 19 countries, and the collective European Union. Roughly 50% of

all emissions come from a mere 7 countries that we all know: China, United States, India, European Union, Indonesia, Russia, and Brazil. And Australia is the number one emitter per capita in the world.

So the issue we're facing is far from being just a scientific or a technical problem that requires only scientific or technical solutions. If you look at the history of the IPCC assessment reports, you might see how these have changed from being just scientific reports to becoming important political statements on the urgency to act. The latest AR6 synthesis report, launched only a few days ago, is clear in stating that to reach net zero by 2050, we need to reduce the level of greenhouse gas emissions by 45% during the current decade alone. This action will largely determine whether warming can be limited to 1.5 degrees. In other words, we only have this decade. That's it. Last warning.

The IPCC Synthesis Report states that deep, rapid, and sustained reductions in greenhouse emissions would lead to a discernible slowdown in global warming only within around two decades. It acknowledges that future changes are unavoidable and are also irreversible. The report also acknowledges unequal historical and ongoing contributions

to global greenhouse emissions arising from unsustainable energy use, land use and land use change, lifestyles, and patterns of consumption and production across regions, between and within countries and among individuals.

Most importantly to those who are working not in the sciences, but in the social sciences, in finance and economics or in policy, the report states that current global financial flows for adaptation are insufficient for, and constrains, implementation of adaptation options, especially in developing countries, and finance also continues to be a big inhibitor here in Australia.

As previous reports have stated, and the IPCC AR6 concurs, vulnerable communities who have historically contributed the least to current climate change are disproportionately affected. Workers in many regions of the world suffer under poor working conditions in order to satisfy the resource needs of the low carbon and energy infrastructures in the global North. The massive extraction of lithium, which is required in large quantities if electro-mobility is being expanded on a grand scale, is destroying ecosystems and local economies. That's the place where I work in the north of Chile.

Let's not turn our gaze. Fossil fuel depletions are disproportionately affecting indigenous, black, brown and low wealth, economically disadvantaged people worldwide. At the same time non-human populations on our planet are being devastated to the brink of, and into extinction. So, every discussion we have about net zero must address these challenges, claims, contradictions and struggles for just energy futures. I think it's important to listen to voices from science, to policy, to activism that are asking that we be mindful of technical solutions such as 'net zero' when a gradual substitution of energy sources is far from sufficient.

In fact, we continue to choose not to listen. The imperative is not only an energy transition but a societal and civilization transformation. Not more Lithium batteries for our EVs necessarily, but changing how we depend on energy for a new way of inhabiting our earth.

Net zero is not a solution when it externalises the problem out to nature. Net zero incorporates the limits of every techno fix. It's part of a complex matrix where a significant part of the problem is in our dominant economic model. The race towards net zero is intrinsically a mission to decouple economic growth from carbon dioxide emissions. But as I am trying to hint at, the problem lies elsewhere, on the mantra of economic growth itself.

The world Economic Forum estimates that the world needs 2 billion electric vehicles to get to net zero. But is there enough Lithium to make all the batteries? And are we to accept the destruction of whole ecosystems and local communities to achieve this?

The Australian government's short-sighted and hopeless long-term emissions reduction plan developed under the Coalition Government aims to achieve net zero emissions by 2050, placing all the focus on funding and on reaching a net zero economy only through a technology-based approach while protecting relevant industries, and according to them, regions and jobs. Despite timid public support for the safeguard mechanism, we shall see how

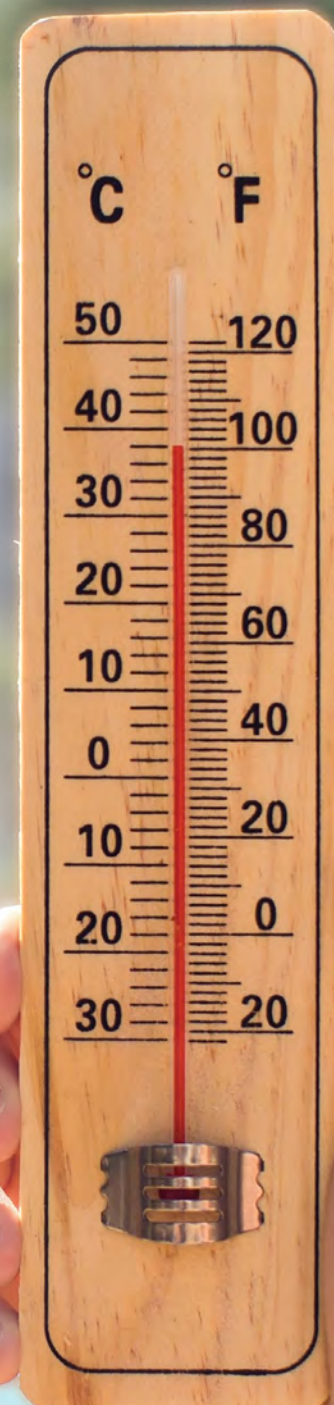
the Australian Parliament votes in the next few weeks and how it confronts the gas and oil lobby.

The safeguard mechanism was designed during the Coalition Government, but never fully implemented. Now Labour wants to revamp it and to impose for the first-time binding caps on Australia's 215 biggest polluters, including mines, factories, smelters, and processors, to force them to reduce their carbon footprint by a cumulative 205 million tons by the end of the decade. But this would only deliver one-third of the cuts needed to achieve Australia's legally binding climate target to reduce emissions by 43% on 2005 levels by 2030.

All of this is happening while the Government refuses to shut down new oil and gas in the context of record profits for gas and oil companies. Santos recently announced 221% increase in profits and Woodside 300%.

Let's not forget that in any transition to cleaner energy, just or unjust, critical minerals bring new challenges to energy security. PV plants, wind farms, and EVs generally require more minerals to build than their fossil fuel counterparts. A typical electric car requires 6 times the mineral inputs of a conventional car and an onshore wind plant requires 9 times more mineral resources than a gas fired plant. Since 2010, the average amount of minerals needed for a new unit of power generation capacity has increased by 50% as the share of investment in renewables has reached new record highs.

Not everyone will agree with these words. But I wanted to articulate them, just to capture the urgency and the importance of events like this one today. We don't come here just only to talk, but to try and work together to change, because, as I said, and the latest IPCC report clearly states, there are no more other decades to work it out. This is it!



SPEAKER 1

PROFESSOR LAUREN RICKARDS



Professor Lauren Rickards

La Trobe Climate Change Adaptation Lab

La Trobe University

Expertise: Social Dimensions of Climate Change

“ Unless we rapidly lower atmospheric carbon concentrations, the resultant climatic impacts will be more severe than anything we can adapt to. ”

TRANSCRIPT OF PROFESSOR RICKARD'S PRESENTATION

The IPCC Synthesis report came out this week and I've been fortunate to be one of the lead authors in the Working Group 2 report it draws on, focused on impacts and adaptation.

The big conclusion from the Synthesis report is not a surprise: there is no silver bullet. What we know is that rapid and far-reaching transitions across all sectors and systems are necessary to achieve deep and sustained emissions reductions. We know that to secure a liveable and sustainable future for all, these objectives have to be massively up-scaled across both mitigation and adaptation.

What that means is, of course, that universities need to start looking inwards as much as they look outwards. And that's something that we've been investigating explicitly in the Climate Change Adaptation Lab that I'm a part of at La Trobe University. In the first instance, we've been looking at what Australian universities are doing on climate change. In one sense – and this event is evidence – the results are really encouraging. There's rapidly growing engagement with climate change as a topic in teaching and research, reflecting a growing demand, of course, from our students who are holding us accountable, and from our research partners as well. Even though we haven't had conducive policy settings, or

even really conducive research priorities here in Australia in the last decade, this activity in Universities is really encouraging.


However, in another sense universities' engagement is wanting in a number of key ways. First of all, climate change is not actually a speciality. It's not a mere topic. Some of us put it in our titles, but that's actually not very helpful. More than specialists, we need climate change to be mainstreamed across research. You don't need to be a climate scientist to do climate change research. Climate change is something we can look at and study and contribute to, regardless of what we research. There are in-built synergies. For example, we know that research is future oriented by default, so it necessarily intersects with a climate changed world. Research is also of the world and so, for instance, we encounter climate change in the planning stage of our projects. I predict that in the future, climate change and the more volatile conditions that it's creating, will be a much greater feature of risk mitigation plans.

In addition, we need to think about how our research is affecting climate change outcomes. I want to highlight 2 examples. First of all, there is the very obvious fact that, being of the world, our research produces emissions. It

contributes to emissions directly and indirectly, shaped by the choices that we make in terms of how we set our research up. Again, to offer a prediction: as companies and other organisations are forced to look at their scope 3 emissions – all the emissions that come from their supply chains – and as research starts to feature as an input to what organisations are doing, we might find that we are actually forced to prove that we're doing low carbon research, not in the topic sense, but in the material sense. That's especially significant for some of the lab-based processes, which have some pretty intense emissions.

Even more influential than our research processes, though, is how our research affects the world. So what impact is our research having in tilting the world towards accelerating mitigation? Are we taking the opportunity to use our research to tilt the world in that way? Or are we implicitly tilting it towards the new form of climate change denial – the delaying of deep emissions cuts? One way many of us are tilting it towards the latter is by perpetuating the silence and inertia around climate change, pretending that it's not part of our context, pretending that it's not our responsibility.

The second way that our research affects climate change outcomes is through the fact



that, particularly in our work, climate change impacts don't just fall from the sky. Sometimes we talk about climate change impacts as if they are literally the climatic change itself. I was in a big forum on drought yesterday, and it was starkly evident that the impact of drought is always an impact – an intersection – between some kind of climate related stress and existing circumstances. Those circumstances are dynamic, and they are continually being shaped intentionally, and unintentionally, by research, by what we do in the world, how we interact with the world. So again, we were forced to ask ourselves, in what way is our research affecting things? Are we influencing things towards being less vulnerable to climate change, to being stronger, to having greater wellbeing, to having the right systems in place so that the additional stress of climatic changes is less consequential? Or, are we actually not actively reducing vulnerability, which unfortunately equates to increasing vulnerability in the current situation, given escalating disasters. We need to push our research sector to think about our intentional and unintentional research impact in more climate-change oriented ways.

One of the big discourses of delay is individualising the responsibility for action. We need to really be careful not to pin this need for action on individual researchers or research teams, but to see that we're part of the institutions that are having large effects. I mean here universities, clearly, but also the broader academic world, the broader innovation ecosystems that we're part of.

We need to think about how we can influence these broader systems that we're part of through our research – and related activities such as the event here today.

It's fantastic to be part of this event, thank you. There is so much that we can do together. At the moment, less than half of Australia's Universities have net zero type plans and only 4 out of 44 have climate change adaptation plans. So through our research associations, our institutes, our collaborations, we need to all help each other to do better.

SPEAKER 2

DR REBECCA PATRICK



Dr Rebecca Patrick

Deakin Sustainable Health Network

Deakin University

Expertise: Climate Change and Human Health

“Zero Carbon – To head off the worst climate-health scenarios and protect and promote human health and wellbeing in a climate-impacted world.”

TRANSCRIPT OF DR PATRICK'S PRESENTATION

Being in a climate impacted world, we're already experiencing health impacts, in particular mental health impacts of climate change. We have a lot of work to do to head off the very worst scenarios for mental health. With respect to the state of the evidence, as it relates to climate change and mental health and well-being, we position mental health as a cross cutting issue, arising from the many primary, secondary, and tertiary effects of climate change. Other people frame that as direct and indirect impacts of climate change and there's several mental health related outcomes that have been associated with the impact of climate change. These range from one end psychological or climate distress, which may simply be a normal response to a terrifying situation that we're finding ourselves in, right through to the more severe and clinically significant mental health outcomes which require mental health care.

Most research on mental health outcomes has focused on trauma-related disorders, which develop in response to extreme weather events or disasters such as bushfires or floods, and outcomes such as PTSD, which is a chronic

and disabling mental health outcome. We also have evidence for the impacts on mood, such as depression and anxiety disorders, which follow on from climate events or the ongoing disruption to livelihoods. We have a fair amount of evidence around the effects of heat, which leads to people presenting in emergency departments and hospitals with severe mental distress, suicidal ideation and suicide attempts.

Research I have led involved a collaboration between Deakin University and Monash University in Victoria on a nationwide survey on climate change and mental health. About 5,500 people participated across all demographics (young through to old) and in rural, regional and urban Australia. One of the insights from this survey was that overall 25% of the people surveyed screened positively for either eco-anxiety (ecological distress or climate distress) and or some kind of PTSD either pre or post trauma. We know that young people are experiencing significant rates of eco-anxiety compared to older age groups, and in Australia as many as one in five Australian young people aged 18-34 are experiencing anxiety related to climate change at a level which impacts

both cognitive and functional impairment, affecting their family, work and social life. We also found that the majority of Australians, over 55% that participated, reported having a direct experience of a climate change event such as bushfire or flood. And that's significant, because often the research related to this has found that if you've had a direct experience, then you experience some level of distress and therefore you may develop a clearer position that climate change is happening – that it is affecting you and your local area – and you may be more willing to act. So, a little bit of stress is good for motivating people and encouraging action. But we don't want to have people that are overly stressed and who move into a non-coping space. The survey also identified that one in four people who had a direct experience of a climate change related event may have some post traumatic disorder symptoms.

In terms of future work in this space, it is pretty clear who the priority population groups are and it is well understood that drivers occur at systems right through to individual levels. A review by Dr Fiona Charlson at the

University of Queensland articulated the need for further work and research in this space, which corresponds with the World Health Organisation's global research priorities. There have been very few studies that have addressed the identification of the most effective interventions that have co-benefits for mental health, but also that track our mitigation and adaptation and resilience goals. Improving decision support is another priority research area.

We also need research to improve vulnerability and adaptation assessments, and really key health economic research to estimate the cost and benefits of protecting mental health from climate change. This research needs to consider benefits to mental health of preventing poor mental health outcomes.

Some of the promising interventions nationally and internationally include green and social prescribing interventions, which are based on the co-benefit idea of promoting connection to nature, a sense of attachment, and connection to place, which results in increased environmental awareness and in turn beneficial impacts on physical and mental health from participating in nature. We also know that climate resilient development, as documented in IPCC reports, is another promising approach arising in the international space.

We are poised for the implementation of a national strategy on climate and health. This work arises from a nation-wide network of health professionals and advocacy efforts by organisations within the [Climate and Health Alliance](#) and has been picked up as a policy platform by MP Mark Butler's office in Australia. We anticipate the strategy will include a pillar around research and evidence, as well as cross-cutting issues, such as mental health and well-being.

SPEAKER 3

PROFESSOR ZORA VRCELJ



Professor Zora Vrclj

Collage of Sport, Health and Environment
Victoria University

Expertise: Low Carbon Engineering and Infrastructure

“To become carbon neutral is not a luxury; on the contrary, it’s something we cannot afford to lose focus on.”

TRANSCRIPT OF PROFESSOR VRCELJ'S PRESENTATION

I am the head of the Built Environment program at Victoria University and my background is civil engineering. One of our research priorities as a built environment group is to align our research with zero carbon strategies, as well as the United Nations' Sustainable Development Goals and Planetary Health goals. I also coordinate the Built Environment and Construction Stream of the Circular Economy Research Network with colleagues from Monash and RMIT. As professionals and practitioners in the built environment, we have a huge responsibility. I agree with my co-panellists that carbon zero cannot be achieved in isolation. Multidisciplinary research efforts are needed in this area. It is not uncommon for engineers to create solutions that are considered part of the problem in the past. It might have seemed like the best solution at the time, but time proved that it could have been improved upon. Aquifers (a great solution at the time for providing local communities with drinkable water) were responsible for arsenic poisoning in India during the 1990s, and many other examples exist.

It is clear that the construction industry, along with all associated industries, has huge responsibilities. It is one of the largest carbon

dioxide emitters, a very carbon-intensive industry. In addition, the industry consumes raw energy and materials. In the construction industry, raw materials account for half of all consumption. Construction, demolition, and all associated activities account for more than a third of the waste that we find in our wastelands. We cannot ignore the circular economy, and its implementation is not satisfactory at the moment. For an understanding of what happens to infrastructure projects over the course of their life cycle, it is crucial to quantify greenhouse gas emissions at every stage, including design, manufacture, delivery, and consumption, along with repairs, reuses, repurposing, republication, and recycling. The word recycle is not liked by some people since we should not be recycling in a circular economy. We should avoid recycling altogether and just circulate.

While cities only occupy 2% of the earth's surface, they contribute more than 70% of greenhouse gas emissions. Clearly, this is where most activity occurs. Thankfully, this is where most of the change is possible, and we cannot work alone given the rapid urbanisation and intensifying social, health, and well-being impacts. The three pillars of sustainability should be brought together: economic, social,

and environmental. There is no separation between them. In the face of climate change adversity, sustainability and resilience go hand in hand.

One of the key aspects is digitalisation, and our team has conducted extensive research in this area. Digitalisation holds great potential. Some of our work on construction defect detection and prevention can divert waste from landfills. The use of waste material in concrete has also been a focus of our work. A construction project's sheer size allows it to consume a large amount of waste. Using takeaway coffee cups as construction materials, our research team created concrete. Each day, Australians contribute two million takeaway coffee cups. As with plastic, a large percentage still ends up in landfills. The same applies to waste materials such as fabrics, glass, tires, medical waste, solar panels etc.

There is still a long way to go. Electric cars are not guilt-free, and solar panels have a 30-year life span. Composite materials are used in wind turbines, which cannot be recycled, and large quantities have already been disposed of in landfills. Researchers in this room and across the globe must tackle these problems and find solutions quickly.



SPEAKER 4

PROFESSOR BEN SMITH



Professor Ben Smith

Hawkesbury Institute for the Environment
Western Sydney University
Expertise: Carbon Modelling

“The transition to decarbonisation in our state, nation and the world is vital for the environment and underpinning conditions for human well-being. But, it also represents a profound opportunity for businesses, communities and governments to embrace the growth of new industries and markets in clean energy, bioproducts, sustainable food production and many other areas.”

TRANSCRIPT OF PROFESSOR SMITH'S PRESENTATION

I am the Research Director at the Hawkesbury Institute for the Environment at Western Sydney University and I want to speak about the “net” aspect of net carbon zero and what research can bring to the discussion as well as some activities that are ongoing at the Hawkesbury Institute for the Environment.

Zero carbon is a great aspiration, but of course that's not what we've decided to pursue as a global community. In Australia and in the State of New South Wales, the current policy targets are for net carbon zero. Of course, the “net” aspect recognises that it's a tough call or a high bar to completely decarbonise the economy at different scales, and that for quite some time going forward we're going to need to rely on offsets. Offsets are carbon uptakes or sinks that achieve net zero carbon emissions by deducting the offsets from the remaining emissions.

There's a lot of talk about different approaches to offsets through carbon uptake, including using geological reservoirs, carbon capture and storage, and the like. But in fact, the only “technology” that we have at our disposal to

take up carbon at scale is through the retention and enhancement of natural sinks on the land. Developing work also strives to manipulate the very significant sink that exists in the oceans as well.

Around about a third of our global emissions every year are taken up by natural processes on land, through enhanced growth of forests and other woody systems, such as savannahs. The oceans also take up around a quarter of our emissions. So, in fact, the increase in atmospheric CO₂ each year is equivalent to only about half of the emissions of CO₂. Net zero is then dependent on taking care of the forests and oceans and trying to enhance them.

There's a lot of scientific questions here, which are often left a little bit under the carpet, especially when it comes to the policy making side of things. For example, we don't know for sure where the sinks are. We don't know for sure which processes are responsible for them. We don't know for sure what the drivers of those processes are, or at least the relative importance of different respective drivers. And we know even less, of course, about what

will happen to these sinks in the future, as the climate and land use continues to change. But nevertheless, we rely on the sinks today, and we'll do so even more in the future.

And so it's all about the land. Today we have, through the Paris agreement, global work to get to net zero by mid-century as well as interim targets. Here in New South Wales, likewise, the official policy is to get to net zero by 2050, and to get to a 70% emissions reduction by 2035, relative to 2005 levels. We're talking about just this decade to more than halve our emissions, which is very ambitious. We're going to be relying hugely on the “net” aspect of zero carbon again, and it's what the land can provide in that regard.

As I mentioned, there are a lot of scientific questions, and they are STEM (science, technology, engineering and mathematics) related questions. That's what I've been working on for 20 years but it seems to have had very little traction with policymakers or the business community or governments. But suddenly we've gone from science to policy to the actual mainstream. And now it's really



happening. The business sector is on board and everybody wants to target net zero. But that doesn't prevent the fact that we still have a lot of scientific and other issues to resolve.

I could talk all day about the science. But I thought I would turn my attention to talking about what disciplines other than the natural sciences can bring to this and why it's needed. If we're talking about the state of New South Wales and those ambitious targets, we're going to be looking at a massive transformation in the use of land across our State. Consider all those landholders from public lands, but also very importantly private landholders such as the farms, and the forestry lands that are in private hands of individual families, or smaller or larger corporations. They are going to need to be incentivised to change their practices in order to not only retain sinks but enhance sinks. There's a lot of belief in the ability to change carbon storage in soils, and there are lots of co-benefits when doing that. But, above all, it's the very traditional practices of increasing the share of woody vegetation on the land. So it's basically about the regeneration of native forests in the context of our State, and the increase in woody components on farms and rangelands, and in the forestry sector as well.

We're talking about a massive change if we're going to achieve those targets. And of course this is going to annoy some people. It's going to require farmers to, for example, move away from their traditional practices that they're used to, that their family maybe have been doing for generations. And how do we do that? It's about behavioural change. It's around social license. And from a research perspective, these issues will benefit from and require that HASS (humanities, arts and social science) research comes to the table, and in fact collaborate

with the STEM researchers who can look at the processes, the natural processes, going on. HASS researchers can help to understand how management levers can adapt to enhance those natural processes in order to retain and enlarge carbon sinks, and without perverse impacts, for example, on biodiversity. More carbon, less biodiversity is not an outcome we want. So there is a huge opportunity, and, in fact, a need for collaboration across disciplines

Coming back to the net zero target in New South Wales, in recent months I've been involved in a program, the New South Wales Decarbonisation Innovation Hub, which is a nine year program funded by the Government. It is a big program that's designed to underpin, support and accelerate the transition to net zero as part of the Net Zero Industry and Innovation Program. The decarbonisation hub involves most of the universities in New South Wales with one or two exceptions at the moment, a number of Government departments, as well as core partners contributing financially. It has three underpinning networks in the energy space – one on power fuels, one on electrification, and the third network is on land and primary industries. The land and primary industries network is led by Western Sydney University at the moment and I am the director for that network.

We're in an establishment phase and have been for almost a year now. There's been some quite intense work with a lot of collaboration, and a lot of co-design among that large group of university and government partners. But there has also been engagement with the wider innovation ecosystem of different actors, including large and small companies, other programs, such as CRC's, working in

relevant aspects of the research and the science, development and innovation start-ups, large corporates, and many other different actors. They all need to come together to see accelerated progress towards the net zero targets. And we're trying to talk to the key people, identify who they are for a start, talk to them, bring them to the table, and look at where research, in collaboration with all those end users and actors in the innovation system, can make a difference.

You may not have heard that much about the Hub yet, as it's in the establishment phase. There are rules as well about how much we can communicate about what's happening, but I can promise that here at Western and beyond, there has been a lot of talk and a lot of information will be coming out. And there is a very genuine desire to engage across the University and across the University sector and beyond to the innovation ecosystem around getting the most salient and targeted research happening with clear impact at the end aligned with the Government's goal, and of course our goal here as a society, of being successful in achieving the ambitious targets.

To summarise, we're going to need that cross-disciplinary collaboration. We need to be impact focused. We need to work with the end users as well. We have a wonderful opportunity in being at the table with Government for an important program that's designed, at least in an aspirational sense, to really bring things together. It will be a bit of a one-stop shop for where research can come in and support these activities in our state. So there'll be further opportunities in the future, and I do hope to see new collaborations involved, including with some of you here in the room.



SPEAKER 5

PROFESSOR GREG MORRISON



Professor Greg Morrison

Urban Transformations Research Centre

Western Sydney University

Expertise: Climate-sensible Urban Transformation

“The transition to Net Zero and ultimately Zero Carbon is a great opportunity for industry and society.”

TRANSCRIPT OF PROFESSOR MORRISON'S PRESENTATION

At Western Sydney University, of course, we are the number one Uni in the world with regard to the Times Higher Education Impact ratings for the Sustainable Development Goals and we have achieved Climate Active certification for being net zero. I'm pleased to note that the UN held back their report until this week when we have our zero carbon workshop. Or perhaps that isn't entirely accurate, but I'd like to think it is so. The latest report is very important as it shows that the global community is unequivocally increasing greenhouse gas emissions, and we really need to do something about it. I'm going to double up a little bit on the aspect of 'net' zero as well.

So, this is our challenge for the next 10 years, and it is going to need action. I'm working with Nicky Morrison, who's in the audience and who is also a Professor and Director from the Urban Transformations Research Centre. At the Centre we are all about action-oriented research and, like Ben, we are on a path of working with multiple stakeholders. This is what we need to do as a University. But we also need to discuss

the fundamentals and understand what we are targeting; what zero carbon and net zero really means for us.

I just love the net zero story. It was really a meeting of thirty leading women in Glasgow, who'd been disappointed with the 2009 Copenhagen COP meeting, which was a bit of a washout. They met in 2015 at an estate in Scotland and introduced net zero as a concept. They discussed zero carbon, just as we are here today, and decided that it was not going to be possible. Primarily, it was going to be too difficult because it was hard enough trying to get people at the 2009 COP! So they talked about net zero as providing some wriggle room. Zero carbon was just going to be too difficult.

I think today, actually, we are at a point where we can discuss zero carbon, and whether it is going to be too challenging, and from an academic point of view, how do we move ahead to that?

But back to net zero, I've written a review paper on the meaning of zero. Certainly, a lot of the work that's been published has been about net zero energy and net zero emission in buildings. So, there's been a lot in the built environment space, and that's the space I work in. This is a science-based technology but there are other aspects to it, and some of the biggest challenges we have are in the more people-centred space.

My own research on net zero buildings and precincts is very much about what Zora was talking about earlier. We've taken a circular economy approach. We've gone on to do something very practical because it's one thing to discuss. It's another thing to actually do things and show what can be done. So, for the past 6 years, I was in Perth and we found an innovation precinct with developers which was just above business as usual – double bricks and single glazing – but with ambitions to be a net zero precinct and relatively nature positive. We use that sort of terminology, which also refers to hybrid water systems, and the reuse



of rainwater into the built environment. So, they had ambitions. Not huge ambitions, but important ambitions all the same. So, we went in, found the money, and working with 26 commercial partners we showed commercially that you can actually build a circular economy building. We got to 67% using design for reuse. We concluded that it isn't just about downcycling and recycling. It's about keeping the value in the supply chain and sourcing well. There are huge challenges in doing that. We didn't use any concrete. Everything was screws and you could take the building apart and place it somewhere else. So we did it as a demonstration building. The great thing is that the developers could then show what can be done, so that when they do the next precinct, they're going to do a little bit more. Eventually, when we get these all-electric precincts, people will start to understand what can be done.

We need to do this. We need to work together with the stakeholders in very practical developments. We have a huge potential here at Western Sydney University. We have roughly 13 campuses and there's a lot of development. Nicky and myself are working on the developments at Werrington North and South with Estate and Commercial to create a 100-hectare development, which is absolutely fabulous. We are working with the developer and energy providers to ensure they know what we can do on a precinct that's very close to University land. We are also doing some work at Hawkesbury with Sydney Water,

with a circular economy utility model looking at waste, and how we can do an industrial-metabolism waste study. That's what we need to be getting involved in and working closely internally in the University, and showing what we can do, but also working with external stakeholders.

I would also like to mention that from my work on the net zero precinct, when you actually build something, you get into the whole aspect of how we create change for people. Now one of the biggest changes that has been happening, regardless of policy, is the renewable energy transition. It is happening in Australia and Australia is world-leading in this aspect. But it's a huge challenge – having solar on roofs, introducing batteries, all-electric precincts, and eventually electric vehicles. It is a complete change of the energy system, to the point that in WA in 2030 there will be no coal-fired power plants – 80% of the energy will be renewable, and 20% gas. That means that you've got an energy system, an interconnected system the size of the UK, which is reliant on renewable energy, and all the challenges that implies where you've got decentralised systems, where it's actually the people who own the energy, and not the providers. Then there are no longer providers. They're going to be distributed service operators. That decentralised system means that we've got to a point where people in their homes can use solar batteries, storage, electric vehicles behind the meter and also build

automation systems, insulation and so on. They can keep energy bills down despite increasing energy prices, because energy will cost more due to the change in the system.

So this is an area where we've been looking very carefully. There are a lot of opinions about this. For example, whether we should pay attention to behaviours or whether we need to build automation systems to enable people to live a sustainable life. The people-centred approach for a new sort of built environment that we are moving into is a huge area to consider.

So, this a techno fix, but there are so many other aspects that I haven't even gone into in detail. I mentioned certification and business, but the practicalities are hugely challenging. While we can go and build a circular economy precinct, will that happen in reality next week or in the next 10 years? Doubtful. Are value chains there? Is there potential there? There is an awful lot more we need to do and this is research, but it's also research, innovation and implementation together.



GROUP WORK

In the workshop that followed, we asked the question: What Zero Carbon research area or topic could you pursue in your field of expertise? Create up to three entries. The word cloud that developed is opposite.

Next, we asked our multi-disciplinary teams of researchers to respond to the following question and pitch their proposal for a research grant opportunity. Specifically, we asked: *“Using a current broad research grant opportunity, develop an interdisciplinary grant proposal idea. Why is this important? Who are the industry partners?”* Pitch your proposal.

While teams are still developing their proposals and will be engaging with industry in the events that follow, we can provide a summary of the kind of ideas being discussed. For example, some of the groups discussed the following research projects:

- Researching ways to collect plastic waste from hospitals and its use in other areas such as reinforced concrete.
- Focussing on an existing pilot study on the impact of Box Divvy – a community-owned, healthy grocery, box sharing system – an expanded and interdisciplinary study could explore the social return on investment, methods to support local farmers to engage, and policy research.
- Research on decarbonising WSU with the use of electric shuttle buses, EV charging stations, and greening the campuses.
- Researching methods to improve the reliability of information related to energy efficient solutions and systems within the building stock in Australia to drive our societies towards zero carbon.



policy levers
 health economics
 crop genetic modification
 sustainable cities
 disaster preparedness
 sustainable hotels
 green infrastructure
 fire effects
 carbon farming
 biomimicry
 renewables
 social license
 climate responsive
 carbon sequestration
 energy economics
 community resilience
 stabilisation
 resilience planning
 behavioural change
 novel bioproducts
 green concrete
 construction technologies
 regenerative materials
 storage
 energy optimised building
 water stress destinations
 statistics and modelling
 sustainable design
 sustainable materials
 sustainable consumption
 communication
 systems
 tree mortality
 recycling
 health impacts
 education
 climate adaptation
 biodiversity
 economic impact
 transition risk
 bushfire emissions
 recycled fibres
 decision support tools
 lifestyles and behaviour
 carbon transition plan
 environmental sustainability
 health impacts effects
 low embodied energy and carbon
 people centred
 zero buildings
 sustainable destinations
 zero buildings
 people centred
 embodied energy and carbon
 health impacts effects
 environmental sustainability
 carbon transition plan
 lifestyles and behaviour
 decision support tools
 climate justice
 living labs
 circular economy
 extractivism
 community
 health promotion
 construction
 energy
 action
 fear
 social license
 living labs
 circular economy
 climate justice
 transition
 people
 degrowth
 waste use
 capture
 sociology
 energy
 action
 fear
 social license
 living labs
 circular economy
 climate justice
 transition
 people
 degrowth

FUTURE EVENTS

SYMPOSIUM 2
INDUSTRY NEEDS FOR ZERO CARBON
AUGUST 2023



SYMPOSIUM 3
FUNDING ZERO CARBON RESEARCH
NOVEMBER 2023



ZERO CARBON RESEARCH

AT WESTERN SYDNEY

Research at WSU relates to this Priority Area in each of our four Research Themes.

EDUCATION & WORK

Transformative education and building the zero carbon workforce are opportunities to address social and societal goals.

Our theme researchers have expertise on:

- Education and behavioural change
- Carbon accounting
- Sustainable enterprises
- Digital transformation
- Energy transition
- Entrepreneurship and innovation

Theme Champions:

- Associate Professor Maria Estela Varua
- Associate Professor Katrina Barker

ENVIRONMENT & SUSTAINABILITY

Transitioning to a zero-carbon economy and society will help protect the ecological systems that people, plants, animals and cultures depend upon.

Our theme researchers have expertise on:

- Economic and cultural transition to zero-carbon economies
- New materials and processes that reduce the embedded carbon in our buildings
- Circular economy - converting waste to resource to reduce the fundamental throughput of energy and materials in our economy
- Enhancing the resilience of natural systems to climate change
- Sequestering carbon

Theme Champions:

- Associate Professor Neil Perry
- Professor Brendan Choat

HEALTH & WELLBEING

A better understanding of the impacts of CO2 emissions on H&W and development and testing of CO2 emission interventions will be critical to improve public health, especially for indigenous and CALD people.

Our theme researchers have expertise on:

- Behaviour change
- Quantifying the impact of introducing new carbon emission policies on health
- The impact of the built environment and CO2 emissions and health
- Effective health communication
- Community capacity building strategies

Theme Champions:

- Associate Professor Freya MacMillan
- Professor Paul Breen

URBAN LIVING FUTURES & SOCIETY

Building safer greener communities through implementing measures such as urban cooling, affordable housing, social justice, smart construction with integrated supply chains, and new materials to develop high tech cities.

Our theme researchers have expertise on:

- Urban Innovation
- Industrial and Digital Revolution
- Equitable Societies
- Just Transformation
- Digital Societies
- Cultural Vibrancy

Theme Champions:

- Associate Professor Nichole Georgeou
- Associate Professor Olivia Mirza

URBAN TRANSFORMATIONS RESEARCH CENTRE

Addressing one of the greatest challenges facing humankind: How to transform our communities and infrastructure into sustainable, equitable and regenerative futures.

Our Centre focusses on:

- Systems innovation and demonstration
- People-Centred Sustainable Precinct Design
- Resilient construction and infrastructure

Directors

- Professor Greg Morrison
- Professor Nicky Morrison

If you wish to contact any of the presenters, the Research Theme Champions, or discuss any ideas around Zero C, please email researchtheprogram@westernsydney.edu.au





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