



Royal Academy
of Engineering



Australian Academy of
Technological Sciences
& Engineering

Frontiers symposium

Empowering resilience

Integrating innovation, sustainable
communities, and climate adaptation
strategies

1 to 3 October 2024



**Royal Academy
of Engineering**

Introduction to Frontiers

The Royal Academy of Engineering's Frontiers programme connects and empowers researchers, innovators and practitioners from the UK and around the world to work together on new ways to solve complex global challenges. The programme hosts thematic symposia events, bringing together around 70 of the best early- and mid-career researchers and practitioners from industry, academia, non-governmental organisations (NGOs), and the public sector in multidisciplinary workshops that address fundamental development challenges.

The symposia's objectives are to encourage collaborative work that addresses international development challenges and to promote cross-disciplinary thinking among the next generation of engineering leaders.

Following the symposium, competitively allocated seed funding is available to small groups to strengthen and facilitate continued collaboration and development of ideas from the symposia.



Contents

Symposium overview

Frontiers insights: integrating innovation and climate adaptation strategies to empower sustainable, resilient communities 5

Session one

Transformative innovations for climate adaptation 9

Session two

Social strategies for climate adaptation and community resilience 14

Session three

Integrated approaches for disaster risk reduction and climate adaptation 18

Keynote speeches 22

Insight session 24

Symposium

Delegates met for four sessions over two and a half days, which were interspersed with networking opportunities, a community field trip, receptions, and dinners. The symposium was held at the University of Western Australia in Perth, Australia, in partnership with the Australian Academy of Technological Sciences and Engineering (ATSE).

Acknowledgement of country

We acknowledge the Whadjuk Noongar people as the traditional owners of the land on which this Frontiers Symposium was held. The Whadjuk Noongar remain the spiritual and cultural custodians of their land, and continue to practise their value, languages, beliefs and knowledge.

Australian Academy of Technological Sciences and Engineering

The Australian Academy of Technological Sciences and Engineering (ATSE) is an independent non-government organisation and charity, led by a diverse Fellowship of over 900 of Australia's leading applied scientists, technologists and engineers. ATSE celebrates excellence in science, technology, engineering and mathematics (STEM) by appointing Fellows, awarding upcoming innovators and equipping the next generation with skills to build a better Australia and world.



Participants gathered in front of the University Western Club, Australia, for a group photograph.

Frontiers insights: integrating innovation and climate adaptation strategies to empower sustainable, resilient communities

The Frontiers event took place between 1 and 3 October 2024 at the University of Western Australia in Perth, Australia, situated on the banks of the Derbarl Yerrigan, the local First Nations Noongar name for the Swan River. It was organised in partnership with the ATSE.¹ The event, co-chaired by Professor Lyn Beazley AO FAA FTSE and Professor Simon Pollard OBE FREng, saw around 65 delegates from different disciplines and 19 countries come together to discuss and explore innovative approaches to climate adaptation and disaster preparedness to foster sustainable and more resilient communities across the globe.

In June 2024 on World Environment Day, United Nations Secretary-General António Guterres summed up the climate crisis global society must now face: “We are at a moment of truth. The truth is ... almost ten years since the Paris Agreement was adopted, the target of limiting long-term global warming to 1.5 degrees Celsius is hanging by a thread.”² This statement was before the sweltering northern summer, which pushed average global temperatures to their highest on record.³ Instead of falling, annual global carbon emissions continue to rise, up by 1% in 2023.




Participants discussing their findings from the session activities.

¹ <https://www.atse.org.au/>

² <https://www.un.org/sg/en/content/secretary-general/speeches/2024-06-05/discurso-especial-sobre-la-acci%C3%B3n-clim%C3%A1tica-%E2%80%99la-verdad%E2%80%9D>

³ <https://climate.copernicus.eu/copernicus-summer-2024-hottest-record-globally-and-europe>



It is no wonder that while countries and organisations wrestle with carbon budgets and pathways to net zero, that they are working in parallel to help communities adapt to the complex challenges and effects of climate change. There is an urgent need to find innovative solutions and strategies that enable and empower communities – especially those who are more vulnerable and marginalised – to prepare for and withstand climatic shifts and recover more quickly from the ravages of increasingly frequent floods, fires, drought and other extreme weather events.

Professor Lyn Beazley opened by highlighting the importance of ancient knowledge. She shared a story about Indigenous knowledge sharing and paid her respects through an Acknowledgment of Country to First Nation Australians, in particular, to the Whadjuk people of the Noongar nation, as the traditional custodians of the land on which this symposium was held. The Australian Aboriginal people have lived on the land and continuously practised their culture and traditions for 60,000 years. Exhorting the participants to each draw from their own culture and traditions, she gave a rallying call to action, noting that attendees had been selected because they stood out among the 400 applications. “Every single one of you is special. Every single one of you has experience and knowledge and brings cultural experience to this table.”

“Every single one of you is special. Every single one of you has experience and knowledge and brings cultural experience to this table.”

**Professor Lyn Beazley,
University of Western Australia**


Professor Simon Pollard followed this call with a plea for thoughtful listening and collaboration. He stressed that globally interconnected challenges require cross-disciplinary, international thinking to ensure equity, resilience, and inclusivity in all solutions. He strongly advocated for design thinking to overcome the limitations of fragmented, underfunded, unfair and inflexible systems. “The challenge for us, as a community, is to redesign and rethink these systems to tackle the challenges of climate adaptation,” he said.

“The challenge for us, as a community, is to redesign and rethink these systems to tackle the challenges of climate adaptation.”

**Professor Simon Pollard,
Cranfield University**



Participants collaborating on a group task during one of the sessions.



The symposium brought participants from different disciplines to foster discussions, build future collaborations and nurture interdisciplinary discussions on how to promote resilience in a warming world. By engaging engineers and non-engineers from a wide range of backgrounds and sectors, the event offered participants the chance to explore community resilience and climate adaptation from diverse perspectives. The event centred around three sub-themes:

- Transformative innovations for climate adaptation.
- Social strategies for climate adaptation and community resilience.
- Integrated approaches for disaster risk reduction and climate adaptation.

This report summarises the wide range of expertise and insights from the discussions and activities that took place during the symposium, with the following key findings:

- **Transformation** Effective solutions require systemic change: nature-based solutions, infrastructure projects, data-informed vulnerability interventions and community participation must work together to protect populations most at risk.
- **Social and Indigenous knowledge** Incorporating Indigenous perspectives and local knowledge fosters culturally relevant climate adaptation, helping communities to shape solutions based on heritage and unique environmental insights.
- **Systems thinking** Systems approaches help to address interconnected vulnerabilities, so forecasting and scenario planning builds communities' adaptive capacity for complex, multi-faceted disaster preparedness and recovery.
- **Policy and governance** Supportive policies drive impactful adaptation and focus actions that prioritise sustainable infrastructure and develop long-term resilience.



Participants presenting their findings as part of a session activity.



Professor Lyn Beazley

Professor Lyn Beazley is a neuroscientist and educator based at the University of Western Australia in Perth. From 2006 to 2013 she was Chief Scientist of Western Australia, a role in which she advised the government on science, innovation, and technology. Lyn has served on numerous boards and committees, including those of the Australian National Health and Medical Research Council and the Australian Research Council. Currently, Lyn is a member of the Council of the Australian Academy of Science as the Secretary for Education and Public Awareness, as well as serving on the Boards of the National Blood Authority and of the Royal Institution of Australia. Lyn was awarded Officer of the Order of Australia in 2009. Lyn is a Fellow of both the Australian Academy of Technological Sciences and Engineering and the Australian Academy of Science and is a Companion of the Institute of Engineers (Australia).



Professor Simon Pollard

Professor Simon Pollard is an emeritus professor at Cranfield University and specialist in environmental risk management. Up until April 2024, he was accountable for international relations and corporate resilience at the university, having previously led the School of Water, Energy and the Environment. His research in risk, resilience and the green economy has been repeatedly funded over the last 25 years by the US Water Research Foundation, the UK Research Councils and UK government, among others. He gained his DSc through publication in 2009, was elected as a Fellow of the Royal Academy of Engineering in 2017 and awarded an OBE in the 2020 Queen's Birthday Honours list for championing the management of environmental risk. Simon has extensive experience working in the collaborative spaces that Frontiers attempts to span, sharing his wealth of knowledge and strategic partnership skills.

Transformative innovations for climate adaptation

Session chair presentations

1. Conceptualising transformative innovations for climate adaptation

Dr Urvaksh Patel, Green Climate Fund

2. Innovative adaptations to coastal hazards: how innovative do they really need to be?

Dr David McGovern, London South Bank University

3. Can data-led innovations help communities facing drastic weather conditions?

Marie Williams, Dream Networks / University College London

Key takeaways

- Cities are particularly vulnerable to climate impacts such as extreme heat, requiring innovative greening and cooling strategies.
- Local knowledge and community-driven adaptation efforts are essential for effective climate resilience.
- Governments, businesses and communities should work together to ensure funding and resources are allocated for impactful projects.
- Big data, technology, and crowdsourcing can enable better analysis and more informed decisions, helping to manage climate risks efficiently.
- Listen to diverse voices and ensure that marginalised and vulnerable communities are part of decision-making processes.
- Strong policy and governance frameworks are necessary to support innovation at national and local levels.

Climate adaptation can no longer rely on traditional, top-down solutions. Given the existential threat of climate change for some communities, adaptation needs its own cutting-edge methods to balance seemingly conflicting priorities. How can cities continue to grow and incorporate resilient infrastructure and disaster preparedness, yet still offer a good quality of life and sustainably manage natural resources? And when it comes to decision-making, is it based on sound evidence and who should be in the room?



Participants listening to session chair presentations.

Conceptualising transformative innovations for climate adaptation

Dr Urvaksh Patel, Green Climate Fund and consultant

Urvaksh began with a useful starter to frame the symposium: climate adaptation aims to address the consequences of climate variability, particularly the frequency and intensity of extreme weather events. Of course, mere exposure to extreme weather does not inherently necessitate adaptation, only when vulnerable populations and infrastructure are involved.

Unlike developmental goals, most adaptation actions aim to reduce risk – through more resilient infrastructure, technological innovation and policy changes. Often, adaptation is about isolated interventions, but more transformative action tries to effect broader resilience-building at scale through system change, although this typically requires country-level commitment and ownership, but should not ignore local contexts and needs. Stakeholders, including governments, NGOs and community leaders, should work together to co-create initiatives that prioritise flexible climate adaptation strategies tailored to local contexts.

But it is tough to make these big commitment and design interventions without good quality data on climate vulnerabilities, Urvaksh admitted. Fortunately, international support is now available to help countries build evidence-based adaptation strategies, although investment in enhanced data collection, sharing and analysis remain a priority.

Urvaksh asked what innovative climate adaptation should look like, when traditional infrastructural responses are no longer enough. He suggested that truly transformative approaches will need

to integrate nature-based and technological solutions, working hand in hand and with sustainable funding to build long-term resilience, not just quick wins. Local communities and institutions will also need training and resources to develop and implement effective local solutions, with mechanisms in place to share learning, insights and best practices.

By adopting these approaches, stakeholders could significantly contribute to the effectiveness of climate adaptation strategies.

Truly transformative approaches will need to integrate nature-based and technological solutions, working hand in hand and with sustainable funding to build long-term resilience, not just quick wins.



Dr Urvaksh presenting during Session 1.

Innovative adaptations to coastal hazards: how innovative do they really need to be?

Dr David McGovern,
London South Bank University

David spoke about the importance of innovation and transformation in climate adaptation. Pointing to civil engineering, he noted that the field is often conservative, understandably relying on tried and tested solutions. Innovation can be achieved through incremental improvements in existing designs, for example the development of recurve sea walls. Transformation, however, involves significant shifts on strategy and methodology, such as the pivot towards nature-based solutions – although innovation is needed here too, as engineers require new methodologies and models to harness the mitigating effects of nature from flooding and coastal erosion.

David illustrated his position with stories from the 2011 tsunami recovery in Japan, and responses to sea level rise in the UK. In Japan, comprehensive reclassification of tsunami risk has improved equity in disaster resilience, driven by data integration and enhanced public awareness.

In the UK there has been a massive rethink in the design of sea walls, which were previously based on historical data and predictions that assume overarching environmental conditions remain relatively constant over time. Now, traditional practices must meld with ecological principles, and consider insights from socioeconomics, behavioural science, social equity and wider stakeholder perspectives too.

Now, traditional practices must meld with ecological principles, and consider insights from socioeconomics, behavioural science, social equity and wider stakeholder perspectives too.



Dr David presenting during Session 1.

Can data-led innovations help communities facing drastic weather conditions?

Marie Williams, Dream Networks / University College London

Marie's talk focused on the urgent need for transformation in addressing climate change, particularly in relation to urban environments and data utilisation. She highlighted the impact of climate change on poverty, noting that by

2030, an estimated 118 million people would live on less than \$2 a day, largely due to climate-induced challenges. African countries are losing 2-5% of GDP due to the impacts of climate change and the costs of adaptation.⁴

Focusing on the topic of urban heat islands, Marie noted that Adelaide experiences temperatures up to 5.9°C higher than rural areas.⁵ In Medellín, Colombia, however, green corridors have led to 2°C reductions in average temperature.⁶

As our built environments account for almost two-fifths of global carbon emissions, urban transformation is urgent. Marie argued that using big data could help, for example to identify cooling zones in cities. But she also warned against top-down approaches to data extraction, highlighting the success of the inclusive approach of NatureMetrics to map and understand the economic impact of biodiversity net gain policies in the UK. Working with communities in data gathering could help them to advocate for culturally relevant practices and solutions to climate challenges. Educate and empower, argued Marie. People need to be aware of the impacts of climate change on vulnerable populations, and they feel able to act in their own lives and advocate for community resilience. By uniting our efforts and committing to actionable steps, we can collectively combat climate change and create sustainable, resilient communities for future generations.

By uniting our efforts and committing to actionable steps, we can collectively combat climate change and create sustainable, resilient communities for future generations.



Marie Williams presenting during Session 1.

⁴ State of the Climate in Africa 2023, World Meteorological Organization, 2023. <https://library.wmo.int/idurl/4/69000>

⁵ <https://doi.org/10.1016/j.foar.2017.08.001>

⁶ <https://www.weforum.org/agenda/2024/01/nature-positive-cities-tackle-extreme-heat/>

Group activity

Small groups collaborated on a practical stakeholder mapping exercise related to different climate adaptation innovations. They addressed three questions:

- Which stakeholders could provide you with the data and information you need?
- How will you convene those stakeholders and who will convene them?
- Do you foresee any gaps in data, knowledge, and/or expertise that is needed?

Reflecting on the mapping process, the participants noted the diversity of perspectives, approaches and opinions within and between groups. They recognised the need to develop excellent people skills to engage and listen actively to different viewpoints with open mindsets. Climate adaptation will invariably require tricky trade-offs, so building communities of trust, respect and consensus helps to produce better overall outcomes.



Participants working together on a group activity.

Social strategies for climate adaptation and community resilience

Session chair presentations

1. Integrating accessibility-based community vulnerability scoring in bridge maintenance decision-making

Dr Myra Lydon, Queens University Belfast / University of Galway

2. Ways of being and doing in climate adaptation and community resilience

Dr Leanda Mason, Centre for People, Place and Planet, Edith Cowan University

3. Climate change adaptation and a just transition

Dr Leslie Mabon, The Open University

Key takeaways

- Reflect on your own identity, biases, and background – and how they shape your research.
- Appreciate the limitations of your skills and experiences.
- Engage meaningfully with stakeholders, so solutions are relevant and practical.
- Integrate Indigenous knowledge in scientific research.
- Adapt solutions to the unique needs and circumstances of different environments and communities.



Participants engaging in group discussions.

From flood defences to landscape restoration, societies are making major physical interventions to adapt our environments to the impacts of climate change. However, risks and harm from climate change are not distributed evenly across society; people underserved by society often bear the brunt of disruption and crises. This session explored how different ways of knowing, including the integration of Indigenous knowledge and systems, and people's different experiences can be brought together to adapt in ways that are socially fair, technically appropriate, and ecologically resilient.

Integrating accessibility-based community vulnerability scoring in bridge maintenance decision-making

Dr Myra Lydon, Queens University Belfast / University of Galway

Myra started out monitoring the structural health of bridges, using advanced sensors to detect early damage. But she eventually came to realise managing old and already-damaged bridges was a much bigger priority. Myra discovered that of the approximately 30,000 bridges in Ireland, almost three-quarters are old masonry arches, some even 800 years old. Many do not have proper inspection records, so do officials know which to prioritise for maintenance?

As she grew her network of stakeholders, Myra began to realise that decisions must also consider many social factors. So rather than focus purely on a bridge's structural integrity and its exposure to climate change risks, Myra's decision support tool also assesses community connectivity. What would be the impact of bridge failure on community access to services like hospitals and schools?⁷ This spatial accessibility modelling can help bridge managers prioritise monitoring and repairs more effectively and efficiently.

Reflecting on her experience, Myra highlighted the importance of focusing on local needs and practical solutions over purely technological advancements "Stakeholder collaboration reshaped my project and made it more impactful," she acknowledged.



Dr Myra presenting during Session 2.

Ways of being and doing in climate adaptation and community resilience

Dr Leanda Mason, Centre for People, Place and Planet, Edith Cowan University

Leanda brought a local Noongar perspective to climate adaptation as they shared their heritage and the significance of acknowledging the traditional custodians of the land.

Exhorting participants to be their own truth tellers, Leanda shared how they have had to reconcile their identity and the impact of historical assimilation policies with their research. Today, they focus on equity, diversity and inclusion in ecological research. This has led them to critique some of the inadequacies of "Western science", which often overlooks Indigenous knowledge systems and fails to recognise the validity of non-human perspectives. "Everything is equally important," said Leanda, explaining Indigenous ways of knowing which promote inclusivity and sustainability. Consequently, they advocate for amplifying often-overlooked voices in scientific discourse.

"Everything is equally important."



Dr Leanda presenting during Session 2.

⁷ <https://www.universityofgalway.ie/embrace/>



Climate change adaptation and a just transition

Dr Leslie Mabon, The Open University

Showing an image of a fence on the Isle of Tiree in Scotland, Leslie discussed how traditional farming (crofting) practices can mitigate coastal erosion while preserving local livelihoods. “Coastal erosion is something that is threatening crofting, but also that traditional way of life has some of the capabilities and skills to manage and co-exist for that erosion,” he explained.

But according to Leslie, there is no such thing as a natural disaster. Vulnerability to environmental hazards arises from socio-political and economic decisions, rather than just physical exposure.

A case study from Glasgow, Scotland, illustrated this point, as community gardening shows how local knowledge and activism is helping to enhance resilience, for example by greening vacant and derelict land. This work is helping to create social cohesion as well as food sustainability. It reveals a need to incorporate local voices into decision-making processes so that adaptation strategies truly reflect community needs.

The image of the croft is a reminder that traditional practices can promote ecological diversity and resilience in the face of climate change. “If you can support the crofters with the grazing that they’ve done for hundreds of years, you’ll have a more diverse ecosystem,” Leslie concluded. “You might be able to stop this kind of erosion whilst also maintaining a traditional way of life.”



Dr Leslie presenting during Session 2.

Group activity

Participants worked with people who “didn’t look like them” to explore the concepts of positionality (how social, political and personal identities, experiences and backgrounds influence knowledge interpretation and engagement with others) and intersectionality (how identities of race, class, gender and other characteristics combine to create new experiences).⁸ Greater self-awareness helps people to identify and mitigate their biases, Leanda stressed.

Participants collaborated in groups to identify their group strengths and potential deficits, using diagrams and word associations. They then created “rich pictures” - detailed visual representations combining drawings, symbols, and annotations - to articulate understandings of climate change impact scenarios from multiple perspectives, as well as highlighting missing viewpoints.

Reflections from this person-centred approach, included:

- Advocacy for more culturally sensitive decision-making regarding climate-driven relocation projects.
- Decision-making led by trusted community representatives rather than imposed government directives.
- Creation of AI-optimised ‘green route’ navigation to promote walking, reduce emissions, and enhance urban sustainability
- Need for specialist science communication to align developers, policymakers, and community interests around green space preservation in urban planning.



Professor Simon engaging in discussion with participants during a group activity.

⁸ Kimberlé W. Crenshaw, Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics, 1989 U. Chi. Legal F. 139 (1989).

Integrated approaches for disaster risk reduction and climate adaptation

Session chair presentations

4. Defining the scope of a 'resilient system'

Annette Zou, The Superpower Institute

5. Paradigm gaps in climate resilience for effective risk management

Dr Yasemin Didem Aktas, University College London

6. Community-centred recovery – a call to change the narrative

Professor David Sanderson, University of New South Wales

Climate adaptation is complex. It encompasses preparedness, risk mitigation, disaster response and recovery. There is an interplay between resilience building, innovation, public health and urban planning, but navigating tricky trade-offs between seemingly conflicting priorities is hard. Design methodologies, systems thinking and interdisciplinarity can help to enhance community resilience and adaptive capacity. These approaches help to create multifaceted, coordinated solutions that collectively work to make communities safer, healthier and more sustainable.

Key takeaways

- Socio-economic conditions and environmental stressors contribute to complex climate vulnerabilities.
- Vulnerabilities are often hidden and only become apparent post-disaster.
- Building resilience requires a proactive approach to identify and address what matters most.
- Disasters and crises cause societies to swing between chaotic and complex states, which requires system thinking to solve.
- Contextualised forecasting and community-informed scenario planning improve community preparedness for disasters.
- Interventions should assess unintended consequences and avoid their negative impacts.
- Communities should champion human wellbeing and social equity alongside environmental and infrastructural interventions.



Annette Zou (Above) and Dr Yasemin Didem Aktas (Below) presenting during Session 3.



Defining the scope of a 'resilient system'

Annette Zou, The Superpower Institute

Annette talked about integrated approaches to climate adaptation and disaster risk reduction. She explained that systems can be categorised as simple, complicated, complex, and chaotic. When a disaster strikes, systems can be disrupted and transition first to a state of chaos, then return to a complex state, albeit in an altered form.

The only way to really address complex systems is through interdisciplinary collaboration, Annette asserted. "No one view can account for the whole picture," she emphasised. Each discipline offers valuable insights, such as timescales, human and ecological factors, and governance structures, which contribute to a holistic view and collective problem solving.

But breaking out of disciplinary siloes is daunting and hard work, Annette acknowledged. She gave participants a series of critical questions to kickstart their collaborative problem solving: identify the location, understand who and what matters within the system, and determine the critical functions that support resilience.

Although systems are complex and unpredictable, they often exhibit certain regularities. By understanding the boundaries and dynamics of a system, patterns may emerge that can then guide decision-making, although rarely is a single intervention sufficient – complex systems need synergistic actions that work together to enhance resilience.

"No one view can account for the whole picture"

Paradigm gaps in climate resilience for effective risk management

Dr Yasemin Didem Aktas, University College London

Yasemin emphasised the importance of understanding vulnerabilities in disaster systems, rather than solely focusing on hazards. Vulnerabilities are also complex and dynamic – and often only revealed following a disaster. Vulnerabilities exist across multiple domains – social, physical, political, and environmental – and interact to create secondary hazards and cascades of failures.

In the aftermath of the February 2023 earthquakes in Türkiye and Syria, Yasemin noted how critical infrastructure failures, such as damaged roads and telecommunications, hindered rescue efforts. The lack of preparedness alongside political and economic vulnerabilities and extreme weather conditions exacerbated the disaster. Ongoing vulnerabilities persist, including air quality issues, access to drinking water, and poorly managed debris.

Yasemin proposed two strategies to address these vulnerabilities: forecasting and scenario planning. She warned that forecasting tools often fail to account for key factors like humidity because they are not adequately developed for the Global South. Scenario planning, meanwhile, helps communities and disaster relief services identify unmapped vulnerabilities and interdependencies. However, planners should pay careful attention to local geographies and contexts, and assess for any unintended consequences.



Community-centred recovery – a call to change the narrative

**Professor David Sanderson,
University of New South Wales**

David addressed the limitations of disaster recovery systems, particularly after immediate relief. While emergency assistance and disaster relief can save lives, recovery frequently falters because existing systems fail to adequately involve communities in the process. David highlighted the importance of 'community-centred recovery', which is widely recognised as the ideal, but challenging to implement due to systemic issues.

David critiqued the traditional 'command and control' approach, where external organisations

impose solutions that do not align with local needs, for example spending funds on predetermined items, regardless of what communities truly require. He pointed out that despite vast resources, recovery efforts often lack long-term sustainability; funding and political interest dwindle once the media cycle shifts.

Mary Anderson interviewed 5,000 people globally and found communities want to be active agents in their recovery rather than passive recipients – they are not “helpless victims”.⁹ Sanderson argued that current systems are outdated and need reform, urging for more effective, locally driven recovery efforts that respect the dignity and voices of those affected. David's new initiative, HowWeSurvive,¹⁰ seeks to amplify community voices and push for systemic change, emphasising the need to listen more and impose less.¹¹



Professor David presenting during Session 3.

⁹ <https://www.cdacollaborative.org/publication/time-to-listen-hearing-people-on-the-receiving-end-of-international-aid/>

¹⁰ <https://howwesurvive.com>

¹¹ <https://howwesurvive.com/>

Group activity

A role-play simulation exercise required participants to develop a housing recovery and resilience plan in response to a major earthquake disaster in a fictional city called Michelle. Groups played different organisations (such as a UN relief agency, community groups, government agencies and NGOs) and had to negotiate, develop and pitch their high-level 3-point plans.

Key reflections

Participants discussed why the complexities of different organisational viewpoints were so difficult to navigate:

- Some organisations argued for impractical solutions they didn't really believe in.
- Some teams wanted to impose solutions rather than let people decide.
- Cultural ties and people's deep sense of place were frequently overlooked.
- Organisations such as local authorities felt they had the legal authority and responsibility to act – but no actual power or ability to implement plans which were being by outside organisations without proper coordination.
- Too much talking and shouting, rather than listening.
- Limited effort to negotiate consensus on recovery efforts.
- The needs of the most vulnerable were not prioritised in plans.



Participants collaborating on a group activity.

**Professor Andrew Blakers
FAA FTSE FRSN¹²**

Australian National University

Professor Andrew Blakers presented a picture of hope: a 100% renewable energy future, driven primarily by solar power and supported by hydro storage. Solar energy has seen unprecedented growth, expanding at an annual rate of 20 to 25%, and now constitutes 85 to 90% of new global energy capacity. Meanwhile, traditional energy sources like nuclear, coal, and gas are declining, with nuclear specifically “going backwards” as closures exceed new plants.

Solar’s rise has been fuelled by its affordability – today costing just \$0.03 per kilowatt-hour – and the abundance of raw materials like silicon, making it both scalable and sustainable. Targeted policies and market incentives have also helped to accelerate the energy transition. By 2030, solar and wind are projected to surpass all other energy sources combined. Andrew said that just 40 square metres of solar panels per person are needed to power a fully decarbonised world – with offshore wind and hydro storage added to the mix. A complete transition to renewable energy is possible by 2042, Andrew said. Solar is not just the future of electricity, but the future of energy as a whole. Electrifying transportation, heating, industry, and even aviation using clean energy will enable the world to fully decarbonise.

**Professor Kingsley Dixon
AO FTSE¹³**

Curtin University

As part of the external activity and a short visit to the Kings Park and Botanic Garden, Kingsley spoke about the urgent need for biodiversity conservation and ecosystem restoration to combat the devastating impacts of environmental degradation and climate change. A leading global expert on ecological rehabilitation and restoration, in particular at mining sites, Kingsley advocated working in partnership with traditional landowners to create “two-way learnings”. He called for large-scale, science-based restoration efforts, collaboration with Indigenous knowledge-holders, and a global commitment to protect endangered species and prevent further loss of biodiversity. While nature can heal, he remarked, immediate and coordinated action is essential to preserve both ecosystems and humanity’s resilience in the face of ecological crises.



Professor Andrew delivering his keynote speech.

¹² <https://www.atse.org.au/who-we-are/our-fellows/all-fellows/andrew-blakers/>

¹³ <https://www.atse.org.au/who-we-are/our-fellows/all-fellows/kingsley-dixon/>

Professor Peter Newman AO FTSE¹⁴

Curtin University Sustainability Policy Institute (CUSP)

Peter stressed the urgency of collaborative innovation to address climate change and create sustainable cities. Opening by acknowledging the Whadjuk Noongar people, he underscored the importance of integrating cultural wisdom with modern solutions. We need only look at the devastating impact of mega hurricanes on places like Asheville, North Carolina, to recognise the need for transformative action.

Peter outlined the waves of industrial innovation, explaining we are now in the sixth wave centred on sustainable technology: renewable energy, electric vehicles and smart cities. He emphasised that while solar, wind and battery advancements are promising, true sustainability requires rethinking urban mobility beyond individual electric vehicles. Cities, he argued, need comprehensive public transit to enhance

liveability and reduce emissions. The example of “trackless trams” shows how an affordable, flexible transit solution could reshape urban landscapes and reduce car dependency.

Drawing from examples in Western Australia, Peter highlighted other successful initiatives: community batteries, electric vehicle infrastructure and nature-based solutions that demonstrate sustainable urban transformation is possible. He stressed that government, industry and local communities must collaborate for these innovations to succeed, promoting resilience and adaptability in cities worldwide. The call to action was clear: embracing disruptive innovation, collective problem-solving, and collaboration can drive essential changes for a sustainable future that supports both people and the planet.



Professor Peter delivering his keynote speech.

¹⁴ <https://atse.org.au/who-we-are/our-fellows/all-fellows/peter-newman/>

Insights Session

The three days of learning, activities, sharing and discussion culminated in the Insights session. This provided participants to reflect as well as form interdisciplinary collaborations to develop solutions. The symposium co-chairs summarised the insights and learnings over the previous days. Symposium attendees could offer anonymous support or votes on specific feedback.

Key learnings and personal reflections:

Networking and collaboration

- Connecting with participants
- Stepping outside of the comfort zone to network with others
- Developing networking skills
- Consciously seeking opportunities to engage
- Collaborating among different cultures and backgrounds

Personal learning

- Reigniting hope in humanity
- The importance of future optimism
- Understanding my 'why'
- Ask questions and listen more

Diversity and different perspectives

- Interdisciplinarity is key, not just a buzzword
- Embracing diversity opens up the scope of possibility



Participants working together during the insights session.

Participants were asked to share short-term, medium-term and long-term goals they hoped

to reach related to the themes of the symposium, summarised below:

	Transformative innovation	Social strategies and community resilience	Integrated approaches
Short-term goals	<ul style="list-style-type: none"> • Improve open-source data collection, control and sharing • Drive mindset change 	<ul style="list-style-type: none"> • Invite people from non-leadership or technical backgrounds to workshops and conversations • Co-create and implement projects with external partners • Engage with stakeholders to achieve the best decisions 	<ul style="list-style-type: none"> • To identify fields and collaborators with shared goals • Connect with relevant collaborators • Consult with businesses – not just research collaborators • Find the community that could support me to grow • Find an industry mentor • Establish a closer rapport with the Academy • Empower radical interdisciplinary models of work • Regular events to engage with people outside our traditional boundaries
Medium-term goals	<ul style="list-style-type: none"> • To create engagement with early-stage professionals to foster innovation • Work for a Pacific regional organisation designing and implementing sustainable development projects • Use knowledge of work being done in specific contexts to create new projects • Make sense of the confusion in expectations about how work should be done with solutions in place 	<ul style="list-style-type: none"> • To act as a mediator between the older generations and the younger generations to collaborate for a sustainable future • To encourage young people from disadvantaged backgrounds to join conversations on sustainability • Bring rich place-specific knowledge into wider conversation on sustainability 	<ul style="list-style-type: none"> • Engage wider stakeholders in project ideas • Acknowledge the beauty of diversity within engineering communities • Apply solution-driven methods to my work and project proposals • Engage frontline networks to build future projects
Long-term goals	<ul style="list-style-type: none"> • Focus on continuity and scalability of solutions • Foster a solar revolution in agriculture • Start up an organisation to support STEM education in the Pacific. • Influence workplace cultural change 	<ul style="list-style-type: none"> • Influence building codes and standards • A safe, happy, secure Earth with a happy and healthy population 	<ul style="list-style-type: none"> • Lead a project, balancing real-world problems with solutions that have big, long-term impacts • Craft and master my skills beyond academia, for tangible impact • Mentor the next generation • Make more connections and collaborations • Have a lifetime network of global friends to solve the world's problems

To conclude the event, Professor Lyn celebrated the transformative power of international cooperation, when knowledge and experience combine to help build the world's capacity to solve complex challenges, keep people safe and empower communities to thrive.

She reiterated the importance of community connection, asking participants to get involved in their different communities of place and practice. The diversity of backgrounds, skills, and personal stories surfaced during the symposium reflects such a rich resource. "Aligning one's head, heart and gut instincts is essential for effective decision-making," she said, praising participants' mutual respect and collaborative attitude.

"Aligning one's head, heart and gut instincts is essential for effective decision-making,"

Professor Lyn Beazley

She urged the group to mix and meld their individual skills and experiences to develop solutions for global challenges, sharing her hope that science, technology, engineering, and wise policy decisions can create a sustainable future for the next generations.

It was fitting to conclude the event with a quote from an Aboriginal elder: "It's not how smart you are, it's how you're smart."




Participants seated at a round table during the insights session.





All images used with permission from participants unless otherwise stated.

For more information, including eligibility, please visit
raeng.org.uk/frontiers, engineeringx.raeng.org.uk
and follow  @RAEngGlobal

Royal Academy of Engineering
Prince Philip House, 3 Carlton House Terrace, London SW1Y 5DG