

# IMPACT

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ATSE

Australian Academy of  
Technological Sciences  
& Engineering

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# ATSE New Fellows Showcase & ATSE Awards 2024

**ATSE New Fellows 2024 Reception**  
Wednesday 16 October  
Evening

**ATSE New Fellows 2024 Showcase**  
Thursday 17 October  
Daytime

**ATSE Awards 2024 Gala Dinner**  
Thursday 17 October  
Evening

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The Academy acknowledges the Traditional Owners of the lands on which we meet and work and we pay our respects to Elders past and present. We recognise the deep knowledge and practices embedded in the oldest continuous culture on the planet. Australia's history of engineering, technology and applied science spans more than 60,000 years.



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Australian Academy of Technological Sciences & Engineering

We are a Learned Academy of independent experts. We bring together Australia's leading experts in applied science, technology and engineering to provide impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

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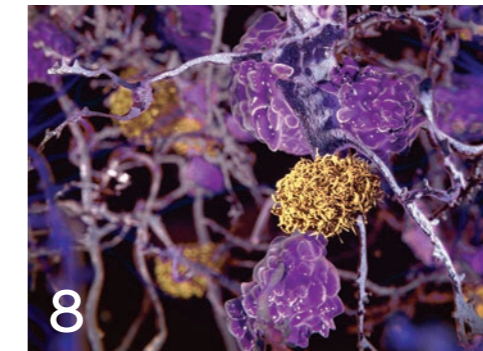
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Cover image: Scientist in a lab holding up a glucose molecular model. iStock

August 2024

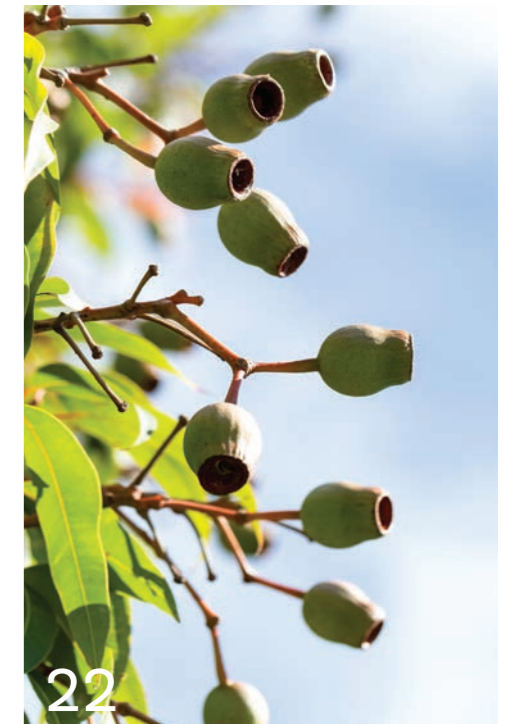
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**ATSE**

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**SUSTAINABLE DEVELOPMENT GOALS**

The Australian Academy of Technological Sciences & Engineering supports the United Nations' Sustainable Development Goals (SDGs). The wheel symbol (right) is shown when an article relates to one or more SDG. The SDGs are explained at the back of the magazine.

## President's introduction



**Dr Katherine Woodthorpe**  
AO FTSE FAICD

Dr Woodthorpe is President of the Australian Academy of Technological Sciences and Engineering and a Fellow of the Australian Institute of Company Directors. She holds a PhD in Chemistry (Manchester) and an Honorary Doctorate from the University of Technology Sydney. In 2017, she received an Order of Australia for her ongoing service to research and technology innovation in Australia. Dr Woodthorpe has a strong track record of achieving outcomes in a range of technology-oriented industries, including medical devices and health services, and a deep knowledge of governance, leadership and the private equity and financial sectors.

▲ Elected 2015

### Australian applied scientists, engineers and technologists are making breakthroughs every day to solve our more urgent challenges.

THIS ISSUE OF ATSE'S IMPACT magazine looks at the innovations we need to improve our environment, our health and our society. We focus on critical priorities for Australia: achieving net zero emissions, combating climate change, safeguarding the environment, creating healthy communities and elevating Traditional Knowledge.

In this issue you will find articles on building a modern low emissions electricity grid, controlling invasive species, monitoring bushfires from space, diagnosing Alzheimer's disease, moderating the impacts of AI on misinformation and disinformation, teaching Aboriginal and Torres Strait Islander kids that they can be scientists and much more. It is inspiring to see such high-impact work being carried out around the country by so many brilliant minds.

Since the last issue of IMPACT, ATSE has released four significant reports: a series of essays on the development of *Responsible AI*, a *Diversity and Inclusion Toolkit* to help businesses diversify their STEM workforce, the *Thriving Murray-Darling Basin in 50 years* essay collection, and a report on nuclear Small Modular Reactors informing the national conversation on technologies for our future energy mix. These three reports provide strategic advice for both government and society, showcasing the breadth of our Fellows' expertise and their invaluable contributions to national discourse.

We're also spotlighting our STEM education programs, including thoughts from three mentors from our industry mentoring program - IMNIS - who share their experiences. It's gratifying to see the mutual benefits of their participation and the exceptional support they provide their mentees.

Their contributions are vital to developing our STEM workforce. By bridging the industry-academia divide and supporting the next generation, we can help our emerging leaders maximise their impact and contribute to the next game-changing Australian innovations.

Finally, we are thrilled to announce the 2025 International Council of Academies of Engineering and Technological Sciences conference, which we will host in Brisbane in September 2025. Themed *Generations: Shaping a sustainable future*, this conference will position Australia as a global leader in engineering and applied science.

It will be an opportunity for leaders from all over the world to come gather and work together on what breakthroughs are needed to shape a sustainable future in the next 50 years.

I hope you enjoy this issue of IMPACT and take inspiration from its message of progress - we are all capable of breakthroughs in the world around us. ▲

## Creating space for national and global STEM leadership.

### Australian experts are at the heart of the breakthroughs we need to create healthy communities and thriving environments.

ATSE's strength lies in the tremendous diversity, expertise and real-world experience of its Fellows. Driving change across bushfire modelling, Indigenous education, disease prevention and the energy transition requires invention, collaboration and creativity. It requires blue-sky thinking and on-the-ground knowledge.

The four major reports we have published over the past 6 months are testament to this. We have informed the national conversation across living rooms, boardrooms and parliamentary offices on topics as diverse as Artificial Intelligence, Diversity in STEM, the Murray-Darling Basin and nuclear Small Modular Reactors. Each of these areas features significant debate around the country, between experts and even within the Fellowship. It's a mark of the strength of our Forums and Fellows that we continue to make such highly regarded contributions many times per year, truly reflecting a diversity of perspectives while injecting a robust evidence base into our critical national discussions.

The work we do builds resilience into the technological science and engineering community. This means supporting the next generation of STEM leaders to work alongside the current one. Our Emerging Leaders Network gives young scientists and engineers the chance to sit with our

ATSE Forums and take an active role in their deliberations and project planning. Soon enough, these Emerging Leaders will be taking ownership of their own innovations, project teams and ambitious goals.

If Australia is to create global solutions, we will do so based on our people. The young people, the engineers in training, the inventors reaching for new opportunities, the technologists dreaming of new possibilities. We can only be the source of our future breakthroughs if the science, technology and engineering ecosystem enables them to happen.

We see the potential for Australia to create the solutions that will power a future world. Breakthroughs are coming - new inventions alongside clever ways of implementing them. If they are to be created, built, commercialised and distributed here in Australia, we need to invest in the people, and the many stages, along the development pipeline.

The stories of invention, ingenuity and insight highlighted in this issue of IMPACT show just what our research and development capability can do. I hope these stories show some examples of the breakthroughs we are already building - achievements to celebrate, and to push us all even further forward. ▲



**Kylie Walker**  
Chief Executive Officer

Kylie Walker is the CEO of the Australian Academy of Technological Sciences & Engineering. She works with Australia's leaders in applied science, technology and engineering to advise decision makers, lead crucial national conversations to solve complex challenges, and support Australia's technology-powered, human-driven future.

# New skills & new energy

Every day more than 14 million homes and businesses across Australia depend on a reliable and affordable supply of energy.

By Daniel Westerman FTSE



ELECTRICITY THAT POWERS our computers and refrigerators. Gas that heats our homes and schools. Liquid fuels that transport food to our supermarkets.

Today, Australia is in the middle of a historic transition of both how we produce energy and how energy will be consumed.

With all Australian governments now committed to a net zero economy by 2050, the race is on to decarbonise. The first step in a net zero economy is a net zero energy system.

The transition in how we generate electricity is well underway. Australia's fleet of coal fired generators are reaching the end of their technical lives, and investors have told the Australian Energy Market Operator (AEMO) that in the next two decades they will all exit the market.

Harnessing Australia's abundant sunshine and winds to generate electricity, building energy storage in the form of batteries and pumped hydro dams, and facilitating flexible gas generation that will step in when shorter term storage runs out will be the lowest cost methods to replace our existing energy generation.

Electricity has traditionally been generated in the regions rich with coal deposits, but this will increasingly shift to generation from the sunniest and windiest parts of the country. These new energy producing regions are different, and will require us to build a new transmission system to connect them to our towns and cities.

Building new transmission is something Australians have not done for several decades. This is because our electricity system was stable for a long time.

But today the evidence is clear. If we want to continue to enjoy a reliable and affordable supply of electricity, then ten thousand kilometres of new transmission must be built between now and 2050.

This expansion of the transmission system is one of the greatest infrastructure challenges Australia has faced in many decades. The term

'expansion' is deliberate, because existing transmission lines will also be utilised. So, this is not a matter of replacing existing transmission, it's a matter of complementing the existing network.

The reason we will need so much more transmission is two-fold. Firstly, the road to net zero will require us to electrify many more parts of the economy. Whether it is replacing gas for home cooking or gasoline for personal transportation, we will need more electricity. Secondly, the intermittent nature of low-cost renewable generation means geographic diversity will help the energy system be reliable at the lowest cost. For example, when the sun is not shining in one region, wind from another region can still power our homes and businesses.

Building this new energy system will require thousands of skilled Australians. Electrical engineers to design new terminal stations, civil engineers to design towers, and the skilled workers to construct and assemble this new infrastructure.

Like previous nation building projects, such as the National Highway Scheme or the original Snowy Hydro Scheme, the

## Ten thousand kilometres of new transmission must be built between now and 2050.

energy transition is an intergenerational challenge. Studies in science, technology, engineering and maths are the pathway for many of the skills that will be needed.

It's possible that keeping skills in the economy for longer will also be needed, perhaps with retraining opportunities, and we will need existing engineers to be involved in the process of training future generations.

Of course, it means that every Australian with an interest or aptitude for engineering and technology must have the opportunity to contribute.

Building a diverse and inclusive engineering profession, whose demographics reflect our community, is imperative to solving the greatest challenges in this energy transition.

The energy industry is already welcoming engineers from diverse backgrounds. But our workplaces must continue to become more diverse, more accepting of the perspectives that diversity brings, and more flexible and accommodating to people that need to juggle their work lives with their lives outside of work.

But perhaps the biggest challenge of the transition will be bringing the community on the journey with the industry. Because people are at the heart of this transition. The vision of a net zero energy system must be shared across society, and the benefits must be shared equally between energy consumers and communities that host new infrastructure.

New careers in delivering low-cost energy, and in the industries that emerge in an economy where the wind and sunshine provide low-cost reliable energy, can provide some of these benefits. But ultimately, how our communities benefit must be defined by our communities. While Australia's energy transition is well underway, it still has a long way to go. ▶



#### UN SDGs

- 7 Affordable and clean energy
- 9 Industry, innovation and infrastructure
- 11 Sustainable cities and communities
- 13 Climate action



**Daniel Westerman**  
FTSE

Daniel Westerman FTSE has a national leadership role in Australia's energy transition. As CEO/MD of the Australian Energy Market Operator, he is responsible for planning the energy systems of tomorrow while managing the systems of today. Daniel is actively leading the participation of women in AEMO and the energy industry.

▶ Elected 2023



UN SDGs  
3 Good health and well-being

By Professor Ashley Bush FTSE,  
Professor Scott Ayton and  
Dr Emilio Werden

# A blood test for Alzheimer's disease

## Dementia is a growing burden on Australian healthcare resources and causes major productivity losses.

DEMENTIA AUSTRALIA CURRENTLY estimates that over 421,000 Australians live with the disease and an even larger number of people experience memory loss that will develop into dementia with time, a condition called mild cognitive impairment.

Alzheimer's disease is the most common cause of dementia, accounting for about 80% of people with dementia. It can be especially difficult to diagnose in its early stages. New disease-modifying treatments for Alzheimer's disease may slow it down, but an early diagnosis is required to achieve a robust response. Our team at the Florey Neuroscience Institute is trialling new blood tests for Alzheimer's disease to determine whether they improve and accelerate diagnosis.

### HOW THE DISEASE WORKS

Alzheimer's disease symptoms commonly begin when people are in their mid-60s and early 70s. While some treatments for Alzheimer's disease exist to boost remaining cognitive function,

it is currently an incurable disease. The cause of Alzheimer's disease is still unknown, although we do know advancing age, high blood pressure, diabetes and genetics can increase the risk.

Certain proteins congeal in the brain in Alzheimer's disease, mostly proteins called amyloid and tau. The presence of amyloid is an early feature of brain damage from Alzheimer's disease, accumulating decades before the onset of symptoms. Crucially, it is needed to make a positive diagnosis of Alzheimer's disease. Because amyloid accumulation is such an early feature of Alzheimer's disease, and because genetic studies also implicate amyloid as a contributor to Alzheimer's, a large volume of research has focused on therapies that clear the protein from the brain.

### GAME CHANGING THERAPIES

In the last two years, large clinical trials have reported for the first time that thoroughly removing amyloid from the brain can slow cognitive deterioration from Alzheimer's disease. This has led to the first FDA approvals for amyloid-clearing drugs to treat Alzheimer's disease, representing the first ever treatment that modifies the disease rather than just improving the symptoms – a major step towards an eventual cure.

This exciting milestone is being followed by a flurry of clinical trials aiming to determine whether treatment of Alzheimer's disease in the earliest stages, even before symptoms emerge, cause an even better response to the drug. The hope is that by removing amyloid while it is accumulating in the brain in the decades leading up to dementia, the disease can be slowed or avoided all together.

### FINDING A CURE

While there has been substantial research and progress, there are many barriers to overcome on the road to a cure. One barrier to treatment is that the disease is slow. Cognitive decline occurs gradually, and the clinical trials required to test whether the deterioration is being successfully interdicted take years to complete and require thousands of patients. This also makes the trials very expensive. The average benefit of treatment with these amyloid-clearing drugs is modest in people with early Alzheimer's disease. By the time the disease is diagnosed, the brain is already severely damaged.

Therefore, research in this field has become more focussed on the detection of amyloid in the earliest phases of the disease, while it is beginning to accumulate and before cognitive symptoms are apparent.

There are two ways to detect amyloid. One way is with a measurement from cerebrospinal fluid collected by a lumbar puncture (spinal tap) – an uncomfortable procedure not performed in a GP's office. Another way is with an amyloid positron emission tomography (PET) scan of the brain. A small dose of a radioactive chemical that binds to amyloid is injected intravenously and clings to any amyloid in the brain, allowing it to be measured by a PET camera. This is an expensive scan, costing around \$4,000. Neither the lumbar puncture, nor the amyloid-PET scan, are Medicare rebated in Australia and both can only be performed at a limited number of major medical centres in Australian capital cities.

### NEW TEST POSSIBILITIES

Excitingly, over the last five or more years, there has been an explosion of research reporting that the signature amyloid of Alzheimer's disease causes an increase in forms of tau protein that can be measured in the blood. This is important research because a blood test for amyloid would enable many more patients to be assessed for Alzheimer's disease. Several companies have developed blood tests that measure protein changes in the blood that conform to the amyloid changes in the brain, but they are not yet available for patients in Australia.

The Florey Institute has several research projects that are collaborating to help bring blood tests for Alzheimer's disease to Australia for clinical use.

Assisted by funds from the National Health and Medical Research Council, these include the Australian Imaging Biomarker & Lifestyle study of Ageing, the Medical Research Future Funded "Blood Testing to Predict and Discriminate Dementias", and the Centre for Research Excellence for Enhanced Dementia Diagnosis.

While we have ample data that shows these blood tests are reliable from cohort studies, this type of research previously has had limited sampling for a greater diversity of people (e.g. cultural, socioeconomic and comorbidity factors), which we are currently trying to remedy.

We need real-world evidence that these new blood tests perform well against existing biomarkers and make a difference to clinicians.

The outcomes of this work will facilitate the introduction into clinical practice of the first blood tests to detect early Alzheimer's disease.

Early detection of amyloid enables us to act sooner, enhance people's lives through early treatment, and contribute to creating healthy communities. ▶



**Professor Ashley Bush**  
FTSE

As an accomplished author and renown expert on Alzheimer's disease, Professor Bush FTSE has made major contributions over the last 30 years to our understanding of the role of metal-mediated oxidative stress in ageing and disease pathogenesis, and is leading the research into developing therapeutic strategies to deal with debilitating conditions caused by oxidative stress (including Alzheimer's disease, Parkinson's disease and psychosis). Professor Bush has cultivated commercial opportunities from his discoveries, obtaining numerous international patents and creating three Australian biotechnology companies.

▶ Elected 2009



**Professor Scott Ayton**

Professor Ayton is the Director of the Centre of Research Excellence in Enhanced Dementia Diagnosis and head of the Dementia Mission and the Translational Neurodegeneration Group at The Florey. Scott's research encompasses both laboratory and clinical research relating to neurodegenerative diseases, such as Alzheimer's disease, in order to investigate disease mechanisms, discover new biomarkers and develop therapeutics. He is particularly interested in iron neurochemistry, cellular metabolism, and the regulated cell death pathway called ferroptosis.



**Dr Emilio Werden**

Dr Werden is an early career researcher and manager of the Vascular Neurodegeneration and Clinical Cognitive Neuroscience laboratories at The Florey Institute of Neuroscience and Mental Health in Melbourne. In his PhD research, Emilio examined cognition in middle-aged people with a genetic predisposition to Alzheimer's disease to identify a cognitive endophenotype for the condition. His research at The Florey focuses on the identification of risk factors for cognitive decline, and the characterisation of cognitive and brain volumetric trajectories in stroke, dementia, and cardiovascular disease.

Image credit: Amyloid plaques (in yellow) damaging neurons. iStock, selvanegra

“Our programs are not designed to tell kids to do STEM; they’re designed to tell them they can do STEM.”

Corey Tutt OAM, Founder, DeadlyScience

By Associate Professor Corey Tutt OAM

# Teaching Indigenous kids they can be scientists

2018 SEEMS LIKE a long time ago for most readers, but for me, it feels like a lifetime ago. I was working in Redfern with young mob, teaching them all about topics like CRISPR-Cas9, and why a blue tongue lizard has a blue tongue. After finding that some schools had little to no STEM resources, I discovered a vast need that would take us on a journey and a mission to create STEM equity for First Nations communities around the country.

It wasn't easy in the early days – I experienced a lot of rejection and invested effort upon effort, including a second job and a GoFundMe page. Raising funds to provide 7,000 books to the community was the starting point for DeadlyScience. This convinced me that as individuals, we can have a lasting impact on communities and the futures of young people around the country.

As DeadlyScience has progressed and I became an author, we now create our own resources and visit schools across the country to deliver First Nations STEM workshops. Although we still provide resources to schools and now have a warehouse, it's also grown to include a few new really 'Deadly' staff. A big thing for me as a CEO and Founder is seeing the next generation of scientists come through DeadlyScience – people like Holly Austin who works on the resources project. She's only 21 and now has a job where she makes a huge difference for her people and schools across the country.

I now get to share DeadlyScience with some incredible staff. Creating solid and positive employment for Aboriginal and Torres Strait Islander peoples in

DeadlyScience will be my greatest legacy to the organisation, because we are bringing more mob into the world of STEM. Every day I am just so proud of what the team at DeadlyScience delivers, not just for the 3% of mob in our country but the other 97% in terms of education and bringing First Nations voices to the forefront of STEM – where we should be. I am grateful to have a fantastic programs team that I can rely on. This has allowed me to work more on business development, and focus on my STEM books and career as an author. It has allowed me to grow with the organisation.

Last year, we connected with over 30,000 students, which is on par with any large organisation, despite still being a somewhat small charity. However, I think it's important for our kids to have an identity in STEM, and that's what DeadlyScience does – it allows our students to say, “I am a Deadly Scientist.”

Our programs are not designed to tell kids to do STEM; they're designed to tell them they can do STEM. Four of the twelve remote students from our recent Pathways Camp went on to obtain engineering scholarships. This wouldn't have been possible without DeadlyScience and our commitment to working with the whole pipeline of STEM talent from primary school to university.

Our work in the community allows the next generation of Indigenous youth to be exposed to the vast possibilities of pursuing higher education or a career in STEM. Most importantly, it increases the representation of our First Nations



Associate Professor Corey Tutt OAM

Corey Tutt OAM is a proud Kamilaroi man and STEM professional, author, social entrepreneur. He founded DeadlyScience in 2018 as a not-for-profit organisation to provide STEM resources and to regional and remote schools in Australia and connect young Indigenous people with STEM professionals. DeadlyScience has grown to be Australia's leading Indigenous STEM charity working with over 800 schools and organisations across all states and territories. In 2020 he was named the NSW Young Australian of the Year.

people in STEM roles. After all, we know that you can't be what you can't see.

DeadlyScience is developing pathways for Indigenous youth to discover what a career in STEM could look like and the varied range of opportunities that are available to them. It is such important work we are doing, and we are grateful to be helping pave the way towards a future of STEM equity for Indigenous learners. ▶

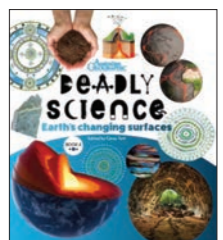
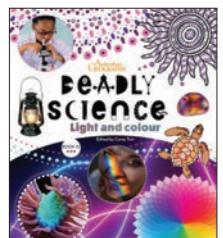
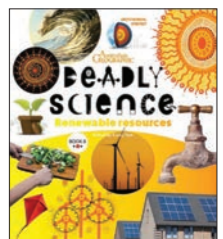


UN SDGs  
4 Quality education  
10 Reduced inequalities

**DEADLY SCIENCE**

DeadlyScience provides science, technology, engineering & maths education & resources for Aboriginal & Torres Strait Islander learners.

[deadlyscience.org.au](http://deadlyscience.org.au)





Rooftop solar



Electric hot water



Electric heating



Electric cooling



Electric cooking



Electric transportation



Battery storage

By Professor Lachlan Blackhall FTSE

# An energy transition journey for all of us



Professor Lachlan Blackhall FTSE

Professor Blackhall FTSE is the Deputy Vice-Chancellor (Research and Innovation) at The Australian National University. He was previously Entrepreneurial Fellow and Head of the Battery Storage and Grid Integration Program at ANU, where he led the development of capabilities to monitor, optimise and control residential solar generation and battery storage, as well as the development of virtual power plant technology to aggregate energy storage to deliver services to energy networks, markets and utilities.

► Elected 2017



- UN SDGs
- 7 Affordable and clean energy
  - 9 Industry, innovation & infrastructure
  - 11 Sustainable cities and communities
  - 13 Climate action

## THE CASE FOR ELECTRIFICATION

In responding to the existential threat of anthropogenic climate change, it is clear that the world must rapidly decarbonise all areas of our economy. The starting point for economy wide decarbonisation is to electrify everything while simultaneously transitioning the electricity system to be powered by renewable generation and energy storage. In Australia, renewable generation, supported by energy storage to ensure a secure and reliable electricity grid, is now the cheapest form of new build energy generation. In this context, residential electrification is an increasingly important activity that households and communities can undertake to contribute to emissions reduction, while also reducing their cost of electricity.

## WHAT DOES RESIDENTIAL ELECTRIFICATION LOOK LIKE?

Residential electrification will mean a dramatic transformation of many homes. It will include installing solar photovoltaic (PV) generation, and shifting to electric hot water, heating and cooling. An electrified home will also swap its gas stove for an electric induction cooktop, and use an electric vehicle and eventually some form of battery storage.

Residential electrification really begins with residential solar PV. Australia has the highest per capita adoption of solar PV of anywhere in the world. Currently over three million homes in Australia have solar on the roof and the uptake of solar will continue well into the future as the benefits of residential solar PV

become more widely known and the cost continue to decline.

Once you have solar on your roof, the next step is to install an electric hot water system and an electric heating and cooling system. A heat pump hot water system and reverse cycle air conditioning unit (that can provide both heating and cooling) offset significant amounts of fossil fuel use (typically gas) in the home. Importantly, they are incredibly energy efficient which will help reduce costs for householders at a time when energy prices are driving a significant cost of living increase.

For many people, the transition from a gas to electric cooktop is controversial. However, the reality is that induction cooktops are significantly more efficient. There is also overwhelming evidence that gas stoves contribute to poor respiratory health, particularly for children.

To complete our residential electrification journey, we now need to think about electrifying our transportation. As the price of electric vehicles continues to fall, and the availability of different models increases, the transition from internal combustion engines to electric should pick up speed over the years ahead.

Last but not least, residential electrification might mean the use of a battery. Across the sector we are seeing uptake of residential batteries and emerging interest in medium-scale storage which we refer to as neighbourhood batteries. Both residential and neighbourhood batteries are located physically and electrically

close to the solar generation and are able to charge up during the day when we have significant amounts of solar generation and discharge back into the grid to satisfy customer electricity demand in the evening.

## ELECTRIFICATION AND INTEGRATION

As we electrify dwellings across the country, we are going to have to grapple with the challenge of ensuring all of our new assets work together. Grid integration capabilities – the control, optimisation, coordination, and orchestration techniques – are critical in bringing the electrification puzzle together to deliver energy reliability and energy security for the future.

## WHAT ARE THE ECONOMICS OF RESIDENTIAL ELECTRIFICATION?

The economics of residential electrification are overwhelmingly positive, resulting in potential savings of up to many thousands of dollars per year. The upfront cost of electrifying everything can be expensive. However, most state governments are supporting subsidy schemes in one form or another to ensure that the benefits of residential electrification are available to as many people as possible.

## HOW DO WE PROTECT CONSUMERS DURING THE TRANSITION?

While technology can often be at the centre of the discussion about residential electrification, the social dimension is critically important. We need to be really clear about how to operate all of these assets for the benefit of customers, whilst also maintaining energy reliability and energy security. As a consequence, it is vital that we ensure that our future electricity system supports the needs and expectations of these very householders whose residential electrification technologies are being incorporated into the operation of the electricity and energy system and market.

Not only will residential electrification represent a change for many householders, it will ensure that our future energy system is cleaner, healthier and cheaper for everyone.

Viva the electric revolution! ►





By Therese Flapper FTSE and John Radcliffe AM FTSE

# Building healthy Murray-Darling Basin communities



**Dr John Radcliffe**  
AM FTSE

Dr Radcliffe AM FTSE has an agricultural science degree from the University of Adelaide and a PhD in Crop Science from Oregon State University. After research in dairy science and pasture production, he became Chief Executive and Director-General of the South Australian Department of Agriculture. In that role, he became a Commissioner of the Murray Darling Basin Commission. Subsequently he was appointed an Institute Director and later Deputy Chief Executive of CSIRO and he was a Commissioner of Australia's National Water Commission.

▲ Elected 1994



**Dr Therese Flapper**  
FTSE

Dr Flapper FTSE deploys technical and personal leadership attributes to navigate paths in complex relationships to deliver infrastructure for community impact. She is a global leader in water management, including optimisation, design, monitoring, digital, policy, operations. Therese has directed research programs that commercialised new technology. She has more than 30 years of honorary association roles advancing STEM every step of the way.

▲ Elected 2023

## The Academy's Thriving Murray-Darling Basin project states what is needed in the Basin for a resilient, healthy and sustainable river system and a thriving, resilient community in the face of a changing climate over the next 50 years.

THE MURRAY-DARLING BASIN (MDB or the Basin) is a critical Australian environmental and economic asset. It covers one-seventh of Australia's landscape, represents an economically important proportion of Australia's environmental resources and is home to substantial biodiversity. It is responsible for delivering a major share of Australia's Gross Domestic Product, with half of the Basin's production coming from irrigated agriculture. To safeguard and protect this resource for the future, Australia needs to take urgent action to prepare for the climate challenges of the next 50 years.

Active management of and investment in the Basin is required to protect its ecosystems, ensuring that water is available for diverse economic, cultural and social needs. Long-term governance featuring regional and rural community development is needed, along with the evolution of an agriculture industry based on decreased water supply and water sharing policies.

Successful implementation of this 50-year vision would give the Basin new life. Australians will benefit from a healthy environment and thriving ecosystems,

vibrant and resilient communities, Indigenous self-determination and engagement in water management, and secure water for productive regional industries.

Improved irrigation practices and technology for water allocation would secure food production, while helping us produce more with less land, less water and less intensive infrastructure.

The Basin Plan has formidable challenges of management, governance and stakeholder engagement in achieving any successful implementation and the imminent 2026 review comes at a critical time. Significantly, The Basin Plan will require adjustments to respond to the impacts of climate change and ensure a fair distribution of water between the four Basin States and the Australian Capital Territory, facilitating outcomes for the environment, industry, communities and First Nations peoples for resilience and productivity as well as its protection.

As water has been progressively diverted from the environment since European colonisation, the rivers in the Basin have become less healthy, especially during droughts. Reduced river flow has resulted in more salt in the Basin's rivers and increasing outbreaks of blue-green algae. There are now fewer native fish, birds and mammals in the Basin than there were before Europeans arrived. At least 20 mammal species have gone extinct, and conservation is needed for around half of the Basin's fish species. The nine essays of the *Thriving Murray-Darling Basin* project present some key considerations for the Murray-Darling Basin Authority Climate Workplan and the 2026 Basin Plan Review to provide the best outcome in 50 years' time. ▲

The full set of essays is available: [atse.org.au/thrivingsdbessays](https://atse.org.au/thrivingsdbessays)  
Public webinars featuring the authors of the essays will take place in September 2024.

## Our 50-year vision



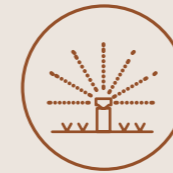
**A healthy environment**  
With greater surface flows, stable groundwater reserves and water flow regimes that support aquatic and terrestrial ecosystems with high quality water.



**Vibrant communities**  
Vibrant and resilient regional, rural and remote communities with sustainable economic futures and improved mental health outcomes including a skilled and thriving workforce.



**Aboriginal and Torres Strait Islander self-determination**  
Engagement, including for cultural water.



**Water for industries and regional transition**  
Sufficient water of the right quality allocated to sustain a variety of industries, enabling regional transition, where required, for productive profitable outcomes.



**Sustainable food practices**  
A potentially smaller irrigated land footprint while adopting improved sustainable irrigation practices which secure domestic food production and international food market opportunities.



**Technology transformation**  
Innovation and adaptation, infrastructure and automation, for responsive water allocation.



**More productivity**  
Producing more from less land, less water and less intensive infrastructure.



**Address the SDGs**  
Addressing the Sustainable Development Goals (SDGs) and applying an Environmental, Social and Governance (ESG) framework.



- UN SDGs**
- 2 Zero hunger
  - 6 Clean water and sanitation
  - 8 Decent work and economic growth
  - 11 Sustainable cities and communities





In innovation and technology circles,  
we often hear the question posed:

“Why, as a nation, have we struggled to innovate, to take discoveries or inventions and turn them into real-world impact?”



**Dr Doug Hilton**

AO FTSE FAA FAHMS

Dr Hilton is the Chief Executive of CSIRO. He is a molecular and cellular biologist and previously Director of the Walter and Eliza Hall Institute of Medical Research (WEHI). At WEHI his medical research focussed on understanding how blood cells communicate and using this knowledge to improve disease treatments. Beyond research, Dr Hilton has emphasised the importance of strong institutional cultures, and furthered diversity in science including as a member of the Champion of Change Coalition and a board member of Australians Investing in Women.

▲ Elected 2010

THE ANSWER IS that for thousands of years we haven't struggled. You don't get to be the oldest - and I would argue the richest - continuous culture in the world without the ability to adapt and create and innovate in an environment that can be extraordinarily harsh and unpredictable. When we talk about impact and innovation, it is Aboriginal and Torres Strait Islander Peoples - Australia's First Scientists - who have set the standard for what we should be trying to achieve.

In more recent times, we have a system that generally supports research at small scale, for short and interrupted periods and which pits researcher against researcher, groups against groups and institutions against institutions in a 'Hunger Games' of funding, recognition and rankings. Part of what's missing is the mindset, framework and incentives for collaboration.

I had the privilege, some years ago, of sitting at a lunch in Canberra beside Bart Cummings, widely regarded as Australia's most successful racehorse trainer and famous for his 12 Melbourne Cup winners. He is not famous for his 77 Melbourne Cup losers.

Cummings' success came from the fact that every one of his horses that entered the Melbourne Cup had a track record of success, was well trained in a state-of-the-art facility using modern techniques, had a good diet, great veterinary care, an excellent jockey and a plan. Every horse was prepared to win.

We need to think about our national research and innovation portfolio in the same way - we don't want to be laying bets - we want to be training horses. It means bringing together 50, 100, 200 or more people (including researchers, technologists, innovators etc) from across organisations like CSIRO, universities, research institutes, private companies, not-for-profits and government for 5, 10, 15 or more years. It means considering the entire pathway from discovery, through prototyping or testing, to delivering benefit at scale to the community. It means communicating with the public, building a social license to operate and maintaining trust in the process of science.

If we tackle 89 problems, and we win big on 12 of those, we can expect all manner of lesser but meaningful impacts from the other 77. It is not all or nothing. I am confident that if we can work together across research, industry, government and NGOs and if we can bring the community along - we can succeed.

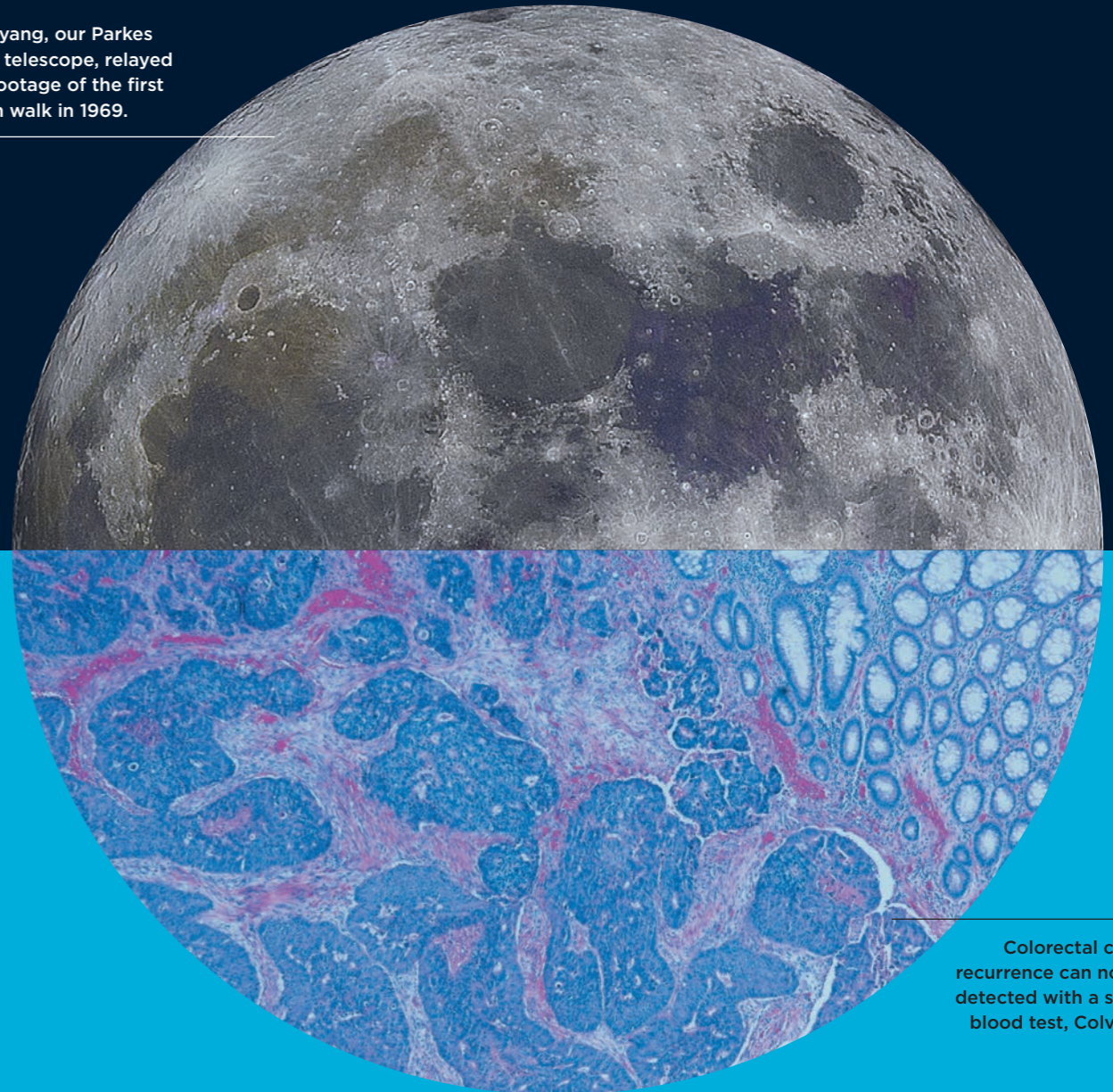
My invitation to you is to come and talk to us at CSIRO or if we knock on your door, please give us some time - as well as being Australia's national science agency, we want to become Australia's national research collaborator.

This is edited from a speech Dr Doug Hilton gave at the 2024 CEDA State of the Nation on 27 June in Canberra.



Collaborate with us to  
create a better future

Murriyang, our Parkes radio telescope, relayed live footage of the first moon walk in 1969.



Colorectal cancer recurrence can now be detected with a simple blood test, Colvera™.

From helping the world watch the first steps on the Moon to developing new cancer treatments and diagnostic tools, we collaborate with partners across the globe to solve today's biggest challenges through innovative science and technology.



Australia's National Science Agency

By Dr Ellen Cottingham

# Could gene drives be the answer to Australia's invasive species crisis?



**Dr Ellen Cottingham**

Dr Cottingham is a postdoctoral research fellow at the University of Melbourne. She investigates virally vectored immunocontraceptives and gene drives for invasive species management in Australia. She was also one of ABC RN's Top 5 scientists for 2023. She was a contributor to a recent ATSE report on synthetic biology research.



UN SDGs  
15 Life on land

## THE SIXTH MASS EXTINCTION

The planet has experienced five mass extinctions and experts believe we may be living through the sixth.

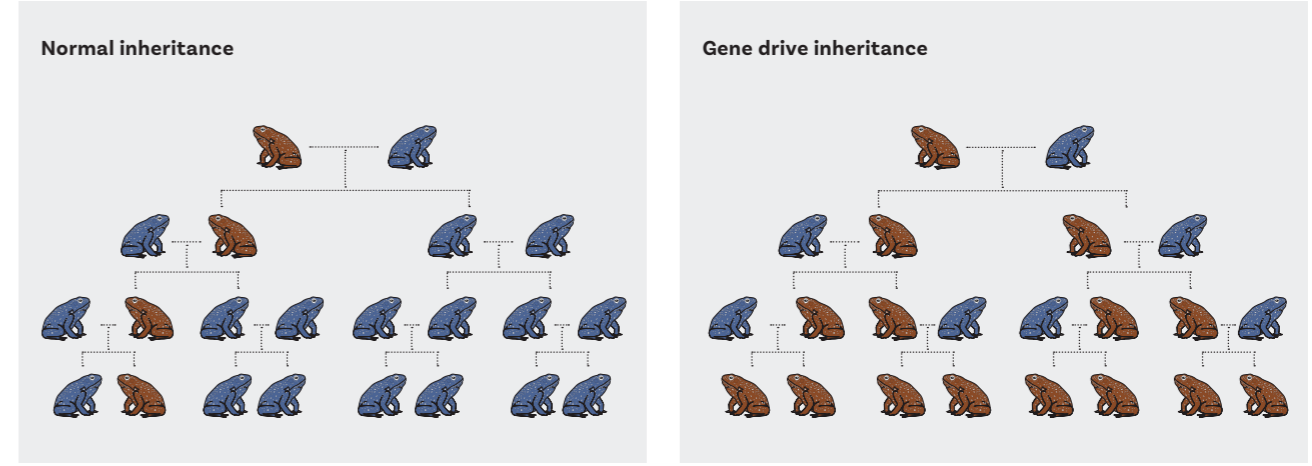
Climate change, habitat loss, pollution and disease are all major contributing factors to the loss of biodiversity globally. In Australia however, invasive or introduced animals are among the most destructive forces driving species loss. Cats, rabbits, foxes, pigs, deer, cane toads, carp and even camels are only a handful of the species that now run rampant across Australia where they kill millions of animals a day, outcompete native species for resources, and spread disease. Cats alone have driven 27 species to extinction and consume 2 billion native animals a year.

## INVASIVE ANIMALS IN AUSTRALIA ARE CHALLENGING TO CONTROL

How do we control the hordes of invasive animals across a landmass as vast as Australia? The answer is – we can't. Not with current tools such as baiting, trapping and physical removal. These methods are resource intensive and animals from nearby regions can quickly recolonise areas where removal has occurred. The only locations where physical removal has worked is on small islands or in fenced reserves.

## BUT THERE MAY BE A SOLUTION

Gene drives could be used to manage Australia's invasive species.



**NORMAL INHERITANCE** of a gene through a population where it has a 50/50 chance of being inherited by offspring.

**GENE DRIVE INHERITANCE** where all offspring inherit the gene if it is carried by only one parent.

All living animals contain stretches of DNA called genes which encode for different traits like eye colour or blood type, and which are passed down from parent to offspring.

Normally, one parent has a 50/50 chance of passing on their DNA to their offspring. But a gene drive can rapidly spread through a population, even if only carried by one parent. In fact, some gene drives can be passed on to 100% of offspring. Because of this, gene drives can rapidly spread and change a population structure.

With the rise of powerful gene editing technologies like CRISPR (a technique for accurately modifying the genomes of living creatures which is used widely in biotechnology and medicine), scientists could use gene drives to achieve a variety of outcomes. For example, gene drives could be used to prevent mosquitoes from transmitting malaria, which is responsible for the deaths of thousands of people every year. So far, gene drives have been developed for various insect species and in 2019, mice were successfully engineered to contain

gene drive elements in their DNA.

In Australia, gene drives might be used to reduce numbers of invasive animals by ensuring they can only produce male offspring or any female offspring are infertile. Over time, the population would decline, then crash.

Because gene drives are transmitted via breeding (from parent to offspring), they stay restricted to their target species. Most native Australian animals cannot interbreed with introduced animals like cats or cane toads, so a gene drive will not negatively impact native animals.

The feral dog is the only animal that cannot be targeted with a gene drive as they can interbreed with the native Australian dingo, a critical apex predator. Gene drive technology does not rely on lethal control which is an additional major welfare benefit.

## WHAT ARE THE RISKS?

As with any new technology, there are some major considerations. What if a gene drive animal escaped Australia and made its way back to its native range? While animals such as foxes or cane toads do not belong in Australia, they are important native species elsewhere in the world.

Every effort must be made by Australia's biosecurity sector to prevent gene drive animals from leaving the country. For larger animals, this may be easier to police, but restricting smaller animals

like rodents may present more of a challenge.

For smaller animals, we might employ what are referred to as 'self-limiting' gene drives which disappear over a few generations.

In the case of a self-limiting gene drive for mice or rats, it might reduce the population over a few generations but then 'run out of steam' and disappear. This means that if a gene drive animal escaped, the gene drive would not persist in the population for long.

We might also tweak the DNA of a small number of animals to make them gene drive resistant, ensuring that a population of resistant animals can be deployed to combat a gene drive 'escapee' if required.

## IS THERE A ROLE FOR GENE DRIVES IN AUSTRALIA?

The development of gene drives for invasive species will take some time. As with any new technology, experts must consider the environmental, safety and societal implications of using a technology as powerful as gene drives.

But for Australia, the issue of invasive species is not going away, and we desperately need new tools and new options to manage their numbers. With careful and considered development, gene drives may be one of the most impactful tools ever developed for Australia's war on invasive species. ▶



By Professor Iven Mareels FTSE

# Regulating for free speech in an AI world

## FAKE NEWS

Misinformation is getting the facts wrong. Disinformation is purposefully disseminating wrong facts with the intent to harm or lead astray.



**Professor Iven Mareels**  
FTSE  
Professor Mareels FTSE is Executive Dean at Federation University Australia, and a non-executive Director of Rubicon Water. Previously, he was with IBM, inter alia as Director of IBM Research in Australia; and Dean of Engineering at the University of Melbourne. He is a Commander in the Order of the Crown of Belgium, and received the Centenary Medal of Australia for contributions to engineering education and research. He sits as a Director on the ATSE Board.

▲ Elected 2000

A DEMAGOGUE CAN use disinformation as a tactic to exploit emotional responses to have their particular misinformation accepted as truth in a large section of society.

The bias imbued in misinformation may be subtle. Moreover, truth is not universally accepted. Also, our human understanding of what is truth is in constant flux, evolving with human experience and as society progresses.

In general, the threat of disinformation does not stem from vastly wrong information, plain lies, made up information or hallucinations that are all too easily rejected. However, plausible, near or almost truths are particularly difficult to deal with, and will easily persist. (Consider for example the amazing impact that a little unconscious bias in recruitment and promotion processes has on the steady state distribution of gender across an organisation.)

It is entirely conceivable to bias and deploy Large Language Models (LLM) for particular disinformation purposes. Introducing a biased LLM to power a deep fake AI agent, on a social platform, their disinformation will readily spread through the AI agent's network. It becomes alarmingly easy for a person or an organisation intent on this action to polarise and to fracture opinion, and in general to influence human opinion to achieve a particular intent. The dynamics

of how multi-agreements (consensus within social groups) are formed in social networks is presently a hotly studied topic in the scientific literature, in applied mathematics and social sciences alike. The state of knowledge is such that one is able to design or to control the agreement end state in many social networks by utilising key influencers and group dynamics.

The fact that our social media platforms are designed using neuroscientific principles to be addictive for the human participants, both physically and psychologically, only enhances the impact of disinformation.

ATSE has made the Australian Government aware of these challenges in the 2023 rapid report on generative AI for the National Science and Technology Council (which ATSE authored together with the Australian Council of Learned Academies, Australian Academy of Humanities, and the Australian Academy of Science). At that time, with generative AI having rapidly gained a profile with the public release of ChatGPT, the potential for LLM-powered misinformation spread was clear. The report noted that, in addition to disinformation spread by social and traditional media, LLMs could be used to bias the democratic process, such as by flooding consultation opportunities.

An out-of-the-box demagogue is not (yet) for sale, but the do-it-yourself

opportunities are readily available. Our own institutions warn us that they do not have the resources to counter this threat to democracy, nor protect human free speech on social networks. It is indeed very hard to detect deep fakes, and almost impossible to weed out AI agents from social media platforms, in the arms race between deep fakes and AI-powered detection technologies.

With AI agents increasingly populating online spaces, informed debate becomes less feasible. There is an information asymmetry between the limited knowledge and experience of humans, and LLM-based AI agents that can, in principle, draw from the entire internet's body of knowledge.

Nevertheless, there is a defence, providing hope for democracy and free speech. AI agents, even powered by LLMs, are not superhuman, despite the fact that the AI tools may exploit a vastly superior database of information that can be rapidly accessed. LLMs use statistics. There is no logic nor understanding, no truth, merely statistical distributions. An AI agent has an appearance of knowledge, and presents a convincing veneer of human language, but it is entirely without understanding. The latter can be probed, and using superior human logic and reasoning can reveal the lack of understanding, despite the enormity of facts and knowledge. In a similar fashion, bias can be revealed. Education

is key. And we, humans, must test all (mis)information coming our way. We must all be vigilant and question the veracity of information presented to us, especially in an algorithm-driven environment.

Governing social media platforms to ensure that biased AI agents cannot participate is inherently a difficult task, if not impossible for current technologies. Instead, international cooperation (nations, together with

recommended in ATSE's submission - mitigate some of the risk, especially where AI applications are used by government services. However, there is more to be done in Australia on getting the legal settings right, including on misinformation. Governance is essential, but does not eliminate bad actors. Appropriate laws and their enforcement will equally be necessary to ensure that our human notions of free speech and democracy remain trusted.

**We must all be vigilant and question the veracity of information presented to us, especially in an algorithm-driven environment.**

the large IT corporations that enable LLMs), and strong human oversight to ensure the ethical, humanistic development of LLMs, AI, and its deployment is essential to preserve our human rights. The Australian Government's Safe and Responsible AI initiative provides a strong foundation for this work. Expert testing and public reporting for AI system usage - both

In closing, let us reflect on a quote from Norbert Wiener, from his 1950 book, *The Human Use of Human Beings: Cybernetics and Society* "The world of the future will be an even more demanding struggle against the limitations of our intelligence, not a comfortable hammock in which we can lie down to be waited upon by our robot slaves." ▲

Image credit: iStock, stevanovicigor



- UN SDGs
- 4 Quality education
- 8 Decent work and economic growth
- 9 Industry, innovation and infrastructure

“It’s undeniable that Australia faces a future living with bushfires.”

## Space can enable a more resilient Australia

By Professor Anna Moore FTSE

Continental-scale “eyes in the sky” are an essential part of the international response to minimising the devastating impact of disaster events. When it comes to bushfires, by embracing technical and scientific innovation and cheaper access to space as an enabler, Australia has an essential part to play.

Catastrophic bushfires are increasing all over the world. It’s undeniable that Australia faces a future living with bushfires. Between climate volatility and a rise in extreme weather events, it’s vital that we work with our communities, our industries, and our governments to build our resilience infrastructure to ensure a safe environment for us all to live in.

Just as with people, bushfires have a complex life cycle.

It begins with the “right” vegetation conditions that can evolve over the previous weeks or more, perfecting the necessary fuel to host the fire. The fire event is then initiated through an ignition mechanism, such as lightning during a storm. The growth and expansion phase of the fire is influenced by many factors including changing weather conditions and human response. Finally, we see the eventual extinction of the fire, and in many cases, the long journey to recovery.

To complicate the problem further, for countries the size of Australia, many fires begin in remote locations and can occur anywhere over continent-wide areas with the result that the response is limited to the critical function of damage mitigation and minimisation of loss of life.

But what if we could drive a different outcome? What if there was a way to observe our vast landscape not during

fire season but well before it, to identify the highest risk areas with pinpoint precision and with enough time to change the outcome through a holistic “ecosystem” approach on the ground?

The Australian National University and its partners have developed a resilience-focused satellite mission called OzFuel, to provide landscape flammability risk data at a continental scale to support effective planning and preparation. By doing so, it is the first of its kind.

OzFuel is designed to monitor Australian ecosystems and their associated fire risk. The mission is sensitive to leaf-level flammability traits in eucalypt trees as well as being capable of detecting changes in the flammability traits of other bushfire fuels.

The mission highlights the importance of multi-disciplinary collaboration to drive meaningful impact. Co-designed by the ANU Institute for Space and the ANU Bushfire Centre of Excellence, and partners, the mission success hinges on two innovation strengths: in-situ sensing of Australian eucalypt forests and translation to accurate flammability, and space borne observations using infra-red detector technologies and manipulation of the multi-spectral data.

With the data provided by the OzFuel sensor observing the Australian continent from space, we can mitigate fire risks by knowing where the fuel is, how much there is, how dry it is, and what the risk is to communities. The data is freely available to anyone involved in assessing bushfire risk, predicting fire behaviour, informing suppression efforts, planning prescribed burns, and other users to make our communities more resilient.

By providing actionable data early enough for groups and individuals to act, we move from an urgent response driven ecosystem to accurate forecasting based on ground truth, and a calmer, preventative future.

While satellites orbiting in space today greatly contribute to understanding various components of the bushfire life cycle, they remain foreign owned for the most part. While international cooperation is vital in this game, it raises concerning questions of Australia controlling its own destiny when facing a future of increased events and competition for access to accurate forecast data that drives adaptability. ▲



**Professor Anna Moore**  
FTSE

Professor Moore FTSE is founding Director of the multi-disciplinary ANU Institute for Space (InSpace) and is a Professor of Astronomy at The Australian National University. She was awarded Executive of the Year at the Australian Space Awards, is an AFR Top 100 innovator, and an ATSE Fellow.

▲ Elected 2023



**UN SDGs**  
11 Sustainable cities and communities  
15 Life on land



By Professor Chris Matthews FTSE

# Indigenous education in mathematics



**Professor Chris Matthews**  
FTSE  
Professor Matthews is nationally and internationally renowned as a leader in mathematics education for Indigenous learners. He has made exceptional contributions to Indigenous education in mathematics by creating new pedagogical approaches that acknowledge the cultural challenges faced by Indigenous mathematics students. He has also made highly impactful cross-cultural contributions working with remote Indigenous communities while positively influencing national mathematics education policy and curricula at both state and national levels.

▲ Elected 2023

AUSTRALIA CONTINUES TO fail on the Close the Gap (CTG) targets and, with respect to mathematics education, the gap persists and, in some cases, has become wider. The Productivity Commission has released a CTG report investigating the lack of progress, claiming that initiatives under the CTG scheme are simply rebadged “business-as-usual” initiatives. In other words, there is no innovation in the programs that Government has invested in.

Currently, the perceived solution to the lack of progress in Indigenous education in any subject area is plagued with simplistic ideas such as improving school attendance. This has been implemented in draconian ways such as “no pool, no school” but it has

also seen investment of \$30+ million into football organisations as ways of enticing Indigenous students to attend and succeed at school. To be clear, the simplistic logic here is that attendance equals student success. There is no understanding of why the schooling system is failing Indigenous students.

The Aurora Foundation is currently undertaking a 5-year project called Refining Indigenous Success in Education (RISE), which will interview over 800 Indigenous students about education and what support is need for them to be successful. In the recent RISE Impact report, one of the key aspects of Indigenous students’ success in education is support for their cultural identity.



LEFT: Yirrkala is a small community in Arnhem Land, 18 kilometres southeast of the mining town of Nhulunbuy, and over 1,000km by road from Darwin. ABOVE: ATSIMA held a conference in Yirrkala that brought together a broad range of people in education to share ideas and workshop ways forward in mathematics education for Indigenous students.

I am currently the CEO of the Aboriginal and Torres Strait Islander Mathematics Alliance (ATSIMA). Our vision is that all Aboriginal and Torres Strait Islander learners will be successful at mathematics. To achieve this vision, ATSIMA creates resources and offers professional learning for teachers on culturally responsive education for Indigenous students. ATSIMA is working to transform mathematics education for Indigenous learners: education that supports their cultural identity and explicitly builds connections between mathematics and Indigenous culture. As an example, I will discuss my last visit to Yirrkala, Arnhem Land, Northern Territory where I worked with Yolngu and non-Indigenous educators in the high school at Yirrkala School.

Like all remote schools, the high school students at Yirrkala are stuck in early numeracy i.e. they understand numbers and operations like multiplication and division. From a student perspective, revisiting the same content year after year is frustrating and it is no surprise that they are disengaged. The non-Indigenous teachers that work in any remote school, usually for a short time, have had very little training in Indigenous education and have no understanding of the cultural background of the people. This is not their fault; it is a fault of the system. Also, Indigenous educators in remote schools are usually not trained teachers and they partner with the non-Indigenous educators to help with each lesson. The non-Indigenous teacher designs a lesson, and the Indigenous educator interprets the lesson for the

students and manages the behaviour. This circumstance is not conducive to a healthy learning environment.

During my week, I declared that I wanted to teach a high-school class how to add positive and negative numbers in connection to Gurruṯu, which is the Yolngu kinship system. Gurruṯu is a complex system of relationships that, through group theory, is recognised as an algebraic group. The connection between Gurruṯu and adding positive and negative numbers is as follows.

The first level of Gurruṯu is moiety where all the elements of the world, including people, are placed in two categories. In Gurruṯu, these categories are Yirritja and Dhuwa, which exist to understand and maintain balance in the world. In a similar fashion, positive and negative acts to maintain balance in the maths world; it is a type of moiety. Also, numbers carry their moiety like people (and other elements) carry their moiety. Drawing these connection works fine if we are adding two positive numbers or two negative numbers but how does this work within Gurruṯu, when you are adding a positive and a negative number?

When discussing these ideas with Yolngu and non-Indigenous educators, the Yolngu educators became excited about the connections that were discussed and strengthened the connection by assigning positive as Dhuwa and negative as Yirritja.

When we discussed the problem of how we add a positive and negative number, the Yolngu educators immediately said

this is the same as Rrambarji, a process that exists to balance elements in the Gurruṯu system. When these ideas were taken into the classroom, the students’ engagement increased and within 15 minutes each student understood how to add positive and negative numbers.

The point of this story is to highlight how the system is failing Indigenous students across Australia. We need to shift the conversation away from incentive-based strategies to strategies that support the cultural wellbeing and intellect of the students. The above is one example of how mathematics is connected to Indigenous cultures across Australia.

More work needs to be done with all Indigenous people across Australia to bring these connections into the education of our children. ATSIMA is working across many communities across Australia and is one of the innovative programs that has the potential to close the gap in Indigenous education.

I want to acknowledge my Mukul and Dhuway, Merrkiyawuy Ganambarr-Stubbs and Djawundil Maymuru, for their guidance, expertise and knowledge that made the lesson described in this article possible. ▲



**UN SDGs**  
4 Quality education  
10 Reduced inequalities

# The path to sustainable infrastructure in Australia

By Scientia Professor Deo Prasad AO FTSE

## Why we need resilient, nature-positive, net-zero infrastructure

Talking about sustainable infrastructure evokes different meanings in different groups of professionals. Much of it is about the boundaries – what is included and what isn't. Economic, environmental and social impacts are broad issues and our desired focus is still evolving. For instance, the UN Sustainable Development Goal (SDG) 9 – 'Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation' has a broad ambition. Its success depends on its interconnection with the other SDGs and in Particular SDG 11 – 'Make cities and human settlements inclusive, safe, resilient and sustainable'. Infrastructure of the future will need to embrace more holistic and system-wide thinking in its design, construction, operation and extension beyond current useful life.

Going beyond the basic economic and environmental considerations, we now find a number of increasingly important overlaying considerations:

### RESILIENCE

Climate change is increasing the frequency, severity, and duration of extreme weather events such as floods, heatwaves, bushfires, droughts, and high-intensity storms. The World Economic Forum estimates that by 2050, this will lead to 14.5 million deaths and \$12.5 trillion of economic impact globally.

Infrastructure in the built environment is increasingly susceptible to our changing climate and extreme weather events.

### Floods

Overwhelmed water management infrastructure can lead to deaths, uninsurable areas, poor mental and physical health, water and food quality issues, property damage and homelessness.

### Extreme heat events

The deadliest natural hazard for Australia which can cause increased pressure on emergency services, peak electricity demand blackouts and infrastructure damage.

This calls for urgent requirements to ensure all infrastructure is not only designed to mitigate but also be adaptable to changing environmental considerations. What we build, where, why and how for the long term requires a lot more attention in light of the role of new and emergent technologies, materials and designs. For instance, future transport vehicles like EVs and the changing behaviour of consumers may make current BAU in infrastructure delivery outdated sooner.

### NET ZERO CARBON

There are many roadmaps, policies and standards in place globally on delivering on a net zero carbon future for all sectors. As a co-author of one of the roadmaps – 'Race to net zero carbon buildings 2030', I am confident that with design stage efficiencies, onsite generation and appropriate offsets we can meet 2030 and 2050 goals of net zero carbon for new construction and

2040 for existing ones. This requires a whole-of-building and whole-of-life consideration.

### CIRCULARITY

'Circular by design' is now increasingly important for all materials, buildings and infrastructure. Circularity not only delivers on decarbonisation but has significant impact on the new economy derived from reducing waste in all sectors and creating new materials from old. Infrastructure is a massive consumer of materials, especially the high-embedded carbon ones like concrete, steel and aluminium. Innovation in these areas is driving significant change but a lot more needs to be done.

### NATURE POSITIVE

Design, delivery and use of infrastructure has impacts beyond the site and in particular on biodiversity, heritage and amenity. We have conceived of sustainable infrastructure historically from the viewpoint of 'doing less harm'. However, there is now renewed focus on 'doing more good' – using system-wide thinking about downstream and upstream impacts.

In all of these, it is vital to have very high quality measurements, standards, consistent methodologies and tools. Some of these include the life cycle assessment methodology and the Infrastructure NSW guide for embodied carbon assessment; ecological footprint analysis and biodiversity net gain for environmental factor analysis; and the Material Circularity Indicator for circularity measurement.



## Implementation and design factors for our infrastructure of the future

There are increasing numbers of exemplar developments demonstrating all the above considerations, including the North West Rail Project in north-west Sydney. This project set and exceeded measurable benchmarks for performance including carbon, efficient use of energy and onsite generation, station area biodiversity and Indigenous heritage among others.

Synergistic infrastructure can open possibilities to address multiple key objectives simultaneously for a sustainable future:

### Heat-resilient

Respond to increasing heat in the future and the urban heat island effect.

### Nature-positive

Provide biodiversity gains and a diversity of ecosystem services. Tools such as 'which plant where' can be used to determine which trees are future climate appropriate for specific locations.

### Decarbonisation

Align with decarbonisation pathways for a 1.5C world through material choices and carbon sequestration potential.

### Circular

Be designed, built, and operated aligned with circularity principles.

To successfully deliver the sustainable infrastructure of the future, good science and engineering is already delivering a better understanding of what makes them so, the range of inputs required from benchmarks and targets, standards and tools, and new materials and technologies.

These are increasingly under whole-of-life considerations and it is good to see government policies and support aligning. However much more is needed much sooner. Parts of industry are well engaged in the vision and now the rest of industry and supply chains need to come onboard. ▶



### UN SDGs

- 9 Industry, innovation & infrastructure
- 11 Sustainable cities and communities
- 13 Climate action



### Scientia Professor Deo Prasad AO FTSE

Scientia Professor Deo Prasad AO FTSE is the CEO of the NSW Decarbonisation Innovation Hub based at UNSW and previously CEO of CRC for Low Carbon Living. Professor Prasad is a passionate advocate of sustainable development. From the design of his award-winning showcase home to large-scale cities throughout the Asia-Pacific, he has demonstrated national and international leadership through his work as an architect, academic and expert.

▶ Elected 2014

ABOVE: The Sydney Metro North West Project involved the construction of a new metropolitan train line north-west of Sydney, connecting Chatswood station with Cudgegong Road. The works in the section between Bella Vista station and Cudgegong Road involved the construction of the "Skytrain" bridge. It is supported by two towers 40-metres tall, each with 16 suspension cables. The bridge comprises 88 cement segments, each weighing between 70 and 140 tonnes. Image source: webuildgroup

# ATSE's international program



## Global Science & Technology Diplomacy Fund – Strategic Element

The start of 2024 has ushered in a period of growth and excitement for ATSE's international activities. ATSE is implementing the Global Science & Technology Diplomacy Fund Strategic Element, in partnership with the Australian Academy of Science, on behalf of the Australian Government Department of Industry, Science and Resources.

After extensive planning, the \$6 million grant was announced by Ed Husic, Australia's Minister for Industry and Science, and Senator Penny Wong, Australia's Minister for Foreign Affairs. This flagship international program, now in its assessment phase, presents a significant opportunity for ATSE to play a prominent role in enhancing Australia's regional science diplomacy.

The grant focuses on bolstering Australia's regional diplomacy by supporting Australian researchers in their collaborations with Asia-Pacific nations. Expressions of interest for the first round of the grant have now closed. A substantial number of expressions of interest were received across the five priority themes: Hydrogen Production, Advanced Manufacturing, Artificial Intelligence, Quantum Computing and RNA Vaccine Production. Applications were also received in relation to all of the priority partners for the scheme: Indonesia, Malaysia, Singapore, Thailand, Vietnam, New Zealand, Japan, the Republic of Korea and Brazil.

Successful applicants are expected to be announced in October this year.

## China Association for Science and Technology Visit

In early May, ATSE had the pleasure of hosting counterparts from the China Association for Science and Technology (CAST) at its Canberra office. CAST is China's leading science and technology organisation, comprising 217 national academic societies and more than 150,000 community organisations.

Discussions focused on ATSE and CAST's shared objectives of providing evidence-based advice to inform policymaking and nurturing the next generation through STEM education initiatives. ATSE has a long history of practical engagement with counterpart organisations in China, successfully delivering projects such as technical workshops and exchanges with various China-based partners.



ABOVE: ATSE CEO Kylie Walker with China Association for Science and Technology (CAST) Director-General, International Affairs, Madam Luo Hui.

## CAETS 2024

ATSE recently sent a delegation to the annual meeting of the Council of Academies of Engineering and Technological Sciences (CAETS) in Helsinki, led by ATSE's President, Dr Katherine Woodthorpe AO FTSE FAICD. The four-day conference included sessions of the CAETS board and council, and a public symposium on Carbon Neutral Technologies and Society.

This year's meeting is particularly significant for ATSE as we are preparing to host the 2025 CAETS conference in Australia. The conclusion of the event marked ATSE's transition to host status as well as taking over the CAETS presidency. Dr Woodthorpe, who will assume this responsibility, delivered a presentation to the CAETS council previewing the forthcoming conference. Dr Woodthorpe announced that the 2025 conference, titled "Generations," will be held in Brisbane, Queensland.

ATSE's presentation highlighted the theme for the CAETS 2025 conference, which aims to look ahead to 2075, informed by technological and societal change over the last 50 years. This theme is particularly significant because it will coincide with ATSE's 50th anniversary. The conference will include panels featuring expert speakers, including participants from Academies across the CAETS membership and international experts on sustainability and society.

ABOVE: ATSE representatives at CAETS 2024 in Helsinki. L>R: Professor Keith Hampson FTSE; Dr Katherine Woodthorpe AO FTSE FAICD; David Kilham, International Affairs Manager; Peter Derbyshire, Director, Policy and International Affairs.

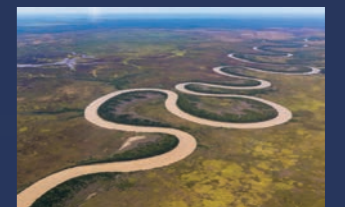
CAETS<sup>2025</sup>

# Generations

An international symposium shaping a sustainable future in 50 years

BRISBANE | AUSTRALIA | 8-11 SEPTEMBER 2025

Scan the QR code to explore the CAETS 2025 website [caets2025.org](https://caets2025.org)



PRESENTED BY



# An international forum on large engineering projects

On June 3-4, ATSE participated in an online forum on the *Design and Delivery of Large Engineering Projects*.

THIS EVENT WAS organised in partnership with the Canadian Academy of Engineering (CAE), the Royal Academy of Engineering of the United Kingdom (RAEng), and the National Academy of Engineering of the United States (NAE). The two-day forum focused on challenges, solutions, and trends in delivering large engineering projects, aiming to generate practical recommendations based on participants' experiences.

Discussions about this forum began last year, motivated by the need for shared objectives in major infrastructure projects. Relevant experts from each academy were identified and invited to share their insights, leading to the formation of four panels covering challenges, solutions, cooperation, and the skills pipeline required for large-scale projects.

## DAY 1

On June 3, the Presidents of the four academies delivered opening remarks. ATSE President Dr Katherine Woodthorpe AO FTSE FAICD highlighted the importance of major infrastructure in addressing climate change and securing national interests. John Anderson FNAE (NAE), Sir Jim McDonald GBE FREng (RAEng), and Catherine Karakatsanis (CAE) also spoke.

Sir John Armitth CBE FREng FICE of the UK National Infrastructure Commission delivered the keynote address. The first panel, "Technical, Organizational, and Geographical Forces Affecting Large

Projects," was moderated by ATSE Fellow and Engineers Australia CEO Romilly Madew AO FTSE. ATSE's contributions to the panel were delivered by Louise Adams FTSE, who was joined by Brenda Kenny FCAE (Canada), Dr Juliano Denicol (UK), and Ahmad Abdelrazaq FNAE (USA). The panel identified structural challenges in large projects, such as stakeholder buy-in, governance, budgets and timeframes. These discussions set the scene for the following discussions on effective practices for managing megaprojects.

The second panel focused on managing megaprojects and overcoming the challenges identified by the first panel. Moderated by CAE Fellow Oskar Sigvaldason, this session featured ATSE representative Professor Peter Quinn FTSE, who drew on his experience with the Square Kilometer Array. His insights were well received alongside contributions from James Marzocca (Canada), Mark Enzer OBE FREng (UK), and Lillian Borrone FNAE (USA).

## DAY 2

On June 4, the forum continued with two more panel sessions. The first, chaired by NAE Fellow Donald Winter, a former United States Secretary of the Navy, discussed "Shaping Global Coordination and Collaboration on Megaprojects." ATSE's Dr Sarah Pearce FTSE shared her experiences with international collaboration on the Square Kilometer Array. Key themes included ensuring openness and collaboration among international partners. Other panelists



Australian example of a large engineering project: the M7 Clem Jones Tunnel (CLEM7), known during its development as the North-South Bypass Tunnel (NSBT), is a A\$3.2 billion motorway grade toll road under the Brisbane River. Source: Wikipedia

included Arup joint deputy chair Dervilla Mitchell FRAEng, CAE's past president Eddy Isaacs FCAE, and former NASA Administrator Charles Bolden FNAE.

The final panel session addressed "Guiding Engineering Education and Skills Development." ATSE Fellow Jane MacMaster FTSE discussed the importance of a robust skills pipeline for project delivery, alongside Kevin Hall FCAE, Jarka Glassey FRAEng, and Asad Madni FNAE. The session was moderated by session 2 panelist Mark Enzer OBE FREng. The panel emphasised long-term investment in engineering skills to support future large-scale infrastructure projects.

Dr Hayaatun Sillem CBE, CEO of the Royal Academy of Engineering, delivered the concluding remarks. The two-day forum effectively identified challenges, constraints and opportunities in

delivering large projects. It provided a valuable platform for the sister academies of Australia, Canada, the United States and the UK to discuss collaborative approaches to shared infrastructure goals.

The sessions across both days were recorded and can be accessed on the web site of the National Academy of Engineering of the United States (NAE).

## KEY TAKEAWAYS

Experts on the panels drew from their extensive experiences from a variety of large-scale engineering projects, ranging from transport systems, telecommunications, event infrastructure, astronomy arrays and skyscrapers.

The learned experiences shared by panel participants emphasised the inherent complexity, scale and financial cost

associated with large infrastructure projects.

A few examples of recurring themes were budgeting challenges, time frame delays, political influence over projects, the necessity for scoping and coordination, and the STEM skills pipeline.

To address these challenges, the panelists highlighted several key strategies: maintaining clarity of purpose and objectives, setting realistic budgets and timeframes, securing political support and stakeholder buy-in, adopting a systems approach for effective governance and technical assurance, fostering a culture of openness and collaboration, committing to long-term skills development, and being mindful of unique geographical constraints. ▲



# Supporting STEM literacy with a range of innovative programs

ATSE's programs aim to support STEM literacy and increased diversity within STEM cohorts, from high-school students through to university students and graduates.

DEMAND FOR STEM skills in Australia is clear. Three quarters of the fastest-growing occupations require significant STEM skills and knowledge. STEM-based employment is projected to grow at almost twice the pace of other occupations. Yet employers are still having difficulty recruiting STEM-skilled professionals, particularly in mining, manufacturing and electricity, gas, water and waste services.

Increasing the use of inquiry-based and problem-based pedagogies within STEM and other subjects, taking advantage of industry partnerships where appropriate, and exploring the use of new educational technologies will significantly improve the quality of education in Australia.

It is also critical that teachers are trained to be skilled and confident in STEM as a subject matter.

A report from the Australian Curriculum Assessment and Reporting Authority earlier this year revealed alarming results for science literacy.

Only 57% of Year 6 students nationally attained the science proficiency standard in 2023. For Aboriginal and Torres Strait Islander Year 6 students, this dropped to one third. Only 54% of year 10 students attained the proficiency standard across NSW, Victoria and WA.

All Australian students need a strong, relevant and empowering science education so they can understand and make decisions in our increasingly complex world, make use of and develop new technologies, guard against misinformation and, one day, develop future generations of science-literate Australians.

STEM-based employment is projected to grow at almost twice the pace of other occupations.



## STELR

### Science and Technology Education Leveraging Relevance

STELR is a hands-on, inquiry-based and in-curriculum program designed for secondary schools. It is designed to be taught within the curriculum so that all students participate in inquiry learning that engages and challenges them in STEM.

[atse.org.au/STELR](https://atse.org.au/STELR)

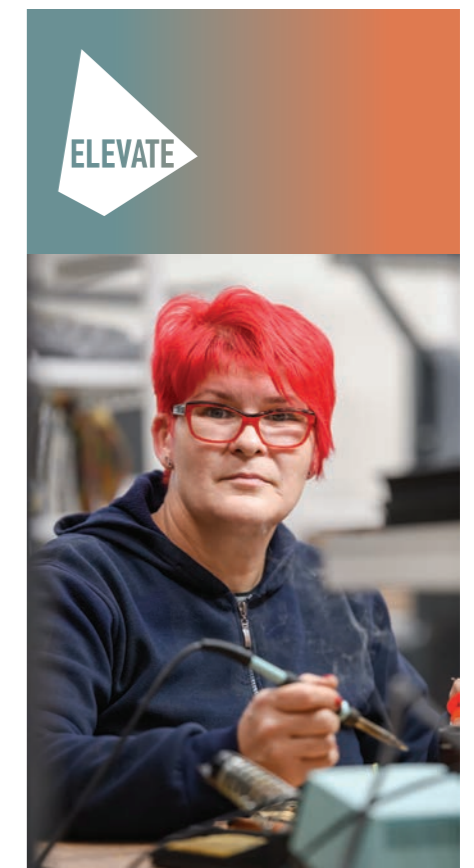


## IMNIS

### Industry Mentoring Networking in STEM

IMNIS helps PhD students and early career researchers increase their understanding of industry, identify the skills needed to succeed, learn about different career opportunities and extend their professional network.

[atse.org.au/STELR](https://atse.org.au/STELR)



## Elevate

### Boosting women in STEM

Elevate aims to address gender inequities in STEM through fostering more women and non-binary led industry-academia collaborations in applied research and business, growing professional skills of women in STEM and propelling women and non-binary people into leadership.

[atse.org.au/elevate](https://atse.org.au/elevate)



**Jane MacMaster**  
FTSE

Jane MacMaster FTSE is regarded as a thought-leader in the education sector and an ambassador for the engineering profession. She is passionate about engineering and the potential for the profession to shape a more sustainable, equitable and positive future. Her strengths include engaging and influential public speaking, ability to seek deep understanding of complex issues and commitment, determination and drive to use these strengths for better societal outcomes.

▲ Elected 2023



LEFT: Sarah Edwards from Naracoorte High School, SA, demonstrating the renewable energy STELR kit to students.

BELOW: Sarah used the STELR equipment as a student and was delighted to discover that her first school as a teacher also ran the STELR program. Hear more from Sarah on the @STELRProject YouTube channel.

By Jane MacMaster FTSE

# Inspiring students in a trade of ideas

ENGINEERING IS SUCH a wonderful profession. I often refer to it as a 'choose your own adventure' profession because no matter what your interest is, and how you want to make a positive difference to the world, there is an engineering role that is relevant. As an engineer, you have the opportunity to see and work on systems that directly impact people and our planet. It is a very fulfilling feeling knowing that you have had a part to play in designing and delivering tangible solutions that improve people's lives and have a positive impact on our natural ecosystems. There are so many different ways to practice as an engineer - there is no shortage of problems to solve and opportunities to grasp! The frontiers are as exciting as they've ever been.

From the mod-cons, clean water and power in our homes, to transport, healthcare, defence, energy and entertainment, all aspects of our daily lives are touched by engineers and the work they do. There are so many types

of engineering out there that no matter what you're into, or how you want to change the world for the better, there's an engineering career for you. But Australia is facing a serious problem - an engineer shortage. Only 8% of our graduates are leaving university with engineering degrees, and the proportion of women is still so low compared to most other professions. The current engineering workforce comprises only around 14% women, of which around 11% were born overseas. As we saw through the COVID pandemic, skilled migration is hugely important to Australia, but not something we can rely on to solve all our problems. For our economic stability, and to respond effectively to the big challenges we face, we need more engineers, including women, educated and trained in Australia.

That's why I'm so excited for the STELR program at ATSE to grow to be in more schools and more parts of the country. STELR makes engineering real. It uses

curriculum-aligned kits and teaching modules to connect students to the real-world challenges that engineering can help solve. STELR demystifies engineering. Through the STELR kits, students grapple with - and solve! - new challenges, just like they would in professional contexts.

There's a pipeline problem in engineering. Students aren't choosing engineering because they don't see how it relates to the world around them. They (and many of their parents) don't understand what engineering really is and what engineers actually 'do'. I grew up the daughter of a QANTAS pilot, and I still remember the conversation that crystallised for me how engineering in all its forms was involved in making planes work. I've been fascinated by aviation ever since. For people without the family connection or inspirational conversations, STELR can be a way of showing them what is out there.

Early engagement with STEM subjects opens new possibilities for students. It helps them see themselves in a variety of roles, solving engineering problems through technology and creative, clever methods. Greater awareness of the disciplines out there, and how these translate to real-world jobs that they find fulfilling and rewarding, helps them consider pathways for study. It lets them discover job opportunities that they will be passionate about. We should do all we can to bring STEM to them in a way that shows just how practical and relevant it is to their daily lives, and that engineering careers are a real option for them.

Importantly, in Australia, we need to raise awareness of engineering not just with students but with the community more broadly. Engineering needs a stronger 'voice' in policy and decision making to ensure that the technical aspects of important decisions are considered. Students can become our advocates! The benefits of engineering

education help the students and our society, through safe and useful infrastructure, systems, products and services.

If we take just one example, the rapid build of renewable energy in Australia and around the world will require a huge effort to develop and scale up. The faster we can make inroads the better, but it needs to be done efficiently. Responding to the climate challenge means making the best decisions to reduce emissions. And the energy system is as complex as it gets. All parts of the renewable energy value chain need to be developed and thought through: the raw materials at one end, and at the other the integration of new technologies into a whole functional system. Engineering is a critical part of every step along that journey. By supporting the STELR program, I hope to be able to open new doors for students. So that they might see themselves in careers they may not have envisaged before, and to be inspired about how

they can play a part in solving the challenges around them.

The places, experiences, people and objects that they care about are already intertwined with engineering - either built, kept safe or enabled by engineers in one form or another. Let's make that connection real. I encourage all of us to have conversations with students and young people, and their parents and teachers, about considering engineering as an area of further study and work. Australia has engineering capabilities that we deserve to be proud of, but we need more engineers, to help make more progress in building the tangible solutions that the world urgently needs. ▲



UN SDGs

- 4 Quality education
- 8 Decent work and economic growth
- 9 Industry, innovation and infrastructure

# Three IMNIS mentors and their perspectives



## Jillian Formentin

Joined IMNIS as a mentor in 2017

**Head of Engineering  
APAC West at Wood**

JILLIAN HAS BEEN MENTORING PhD students and graduates since the start of the IMNIS program. Over that time, she's seen the excellence that they are already bringing to their work and the people around them. She says, "Mentees are making this investment into something to benefit their life. They are about to be supercharged, useful and smart people. The thing that makes the biggest difference is building a context for them and finding a pathway into what they really want to do."

As a mentor, she sees her role as revealing the opportunities and context that someone needs if they are to be successful through interviews, hiring and network building. "Most mentees come to IMNIS mentoring because they want to meet people in industry - they know that they will get the best return on their investment there. And they know that industry needs them! They've got a critical thinking, evidence-based approach that's really useful."

Jillian reflects that the most joyful part of working with mentees is helping them on their pathway. "They have invested significantly to better their chances of making

a difference. I love working with them to help them realise that. I love being with them sharing in their victories - finding great positions, getting permanent residency, personal breakthroughs."

Beyond the personal benefits, Australian industry benefits from new STEM professionals. To meet workforce requirements of the resources and engineering industries, we need more engineers and scientists. And part of that is developing industry's understanding of the skills it needs to bring in. Jillian says, "Engineering is the ultimate team sport. It needs all sorts of different people, and we need to have proper teamwork across those interfaces. We need to work together to break down any barriers, perceived or otherwise."

The mentoring experience builds powerful and important relationships for Jillian. "The mentees are offering themselves up as a conduit to the future. I'm in service of those future conversations, helping them open up a completely unimaginable future. I help them answer the questions - 'If I was going to make the biggest difference, what would I do?'"

## Dr Tich-Lam Nguyen

Joined IMNIS as a mentor in 2020

**COO, ARC Centre of Excellence in Future  
Low-Energy Electronics Technologies**

THROUGH HER MENTORING, Tich-Lam has watched mentees develop a sense of self-assurance as researchers, enabling them to stay committed to completing their PhD journeys. Their meetings focus on equipping them with the tools to succeed, from building professional networks to crafting compelling LinkedIn profiles and CVs and exploring job opportunities.

They work together to identify roles that align with their strengths and interests and refine their practice job applications. She shares her career journey and experience, helping them develop essential skills like time management, teamwork, leadership, and work-life balance. Together, they practice presentations to prepare them for conferences, and share networking tips to maximise their attendance opportunities.

As an IMNIS mentor, she finds it incredibly fulfilling to know she's contributing to developing a talented pipeline. She says, "It's a joy to help students unlock their potential, knowing they'll go on to make significant contributions in their field. Being part of the IMNIS mentoring network also allows me to form connections with peers and professionals in their fields, potentially leading to future collaborations and knowledge exchange."



According to Tich-Lam, IMNIS is more than just an initiative - it's a transformative force addressing our nation's biggest challenges. IMNIS bridges skill gaps in various industries by providing targeted support and guidance, ensuring professionals stay current with the latest developments. This benefits not only individuals but also the industries in which they work. Furthermore, IMNIS fosters community among STEM graduates, creating networks that encourage engagement and skill development. By doing so, IMNIS is developing talent and driving innovation - a catalyst for change in the STEM community.

She has seen firsthand IMNIS's positive impact on mentees' personal growth. IMNIS helps students build confidence in their abilities and stay motivated to achieve their goals by providing a supportive environment and valuable guidance. As an IMNIS mentor, she is proud to be part of an initiative shaping the future of STEM fields and inspiring future generations to pursue careers in these critical areas.



## Professor Guillaume Lessene FTSE

Joined IMNIS as a mentor in 2024

**Theme Leader (Chemical biology and drug discovery of cell death)  
at the Walter and Eliza Hall Institute**

"IT MAKES ME HAPPY to see someone succeed and progress."

After around six months of IMNIS mentoring, Guillaume has been and continues to support his mentee to expand her perspective on the academic world and see all the opportunities available in industry and overseas. Guillaume reflects that while completing a PhD, it helps to have a mentor who's been there before and can remind you to look back at the progress you've made along the way. He says, "It's about reinforcing their self-worth, despite the challenges of their PhD, and emphasising their potential to contribute broadly to science."

"Otherwise, it's easy to lose sight of all the successes that helped to get you there. That support helps give mentees the confidence to contribute to their field and step into interesting new areas."

Guillaume sees himself as a guide and a sounding board. He is excited to open new horizons for his mentee, and to show her all the things that are possible. He is not simply trying to open doors for his mentee. He wants to close the traditional divide between academia and industry. He thinks "it's important to show them that the door to industry is already open."

Guillaume sees that slowly, change is coming to the local industry sector. A new generation of scientists are seeking opportunities outside academia and trying to commercialise their discoveries locally rather than overseas. Helping them make the transition and mentoring them to share their experiences enriches the sector and grows the opportunities available to all.

It's clear to Guillaume that graduates can bring their skills to different projects, businesses and interests all over the world. In Australia, this means creating practical pathways for people to move flexibly between industry and academia. Mentoring is one of those pathways. And benefits flow both ways. He finds that "Learning about someone else's experience is invaluable. You learn, you contrast and you see how things are different for them compared to you. That's a key part of the mentor-mentee relationship."

# Breaking BARRIERS



## Breaking barriers in STEM inclusion with Elevate

The challenges in the STEM workforce are clear. We need more people and more diverse people, entering the sector. Elevate is addressing these challenges by revolutionising the delivery of scholarships, to engage, support and retain students in STEM education and beyond.

By Sybilla Grady

FOR THOSE WITH diverse identities and experiences, the pathways are often so fraught with challenges that many are ultimately prevented from pursuing studies in STEM.

Elevate's approach goes beyond traditional scholarship delivery to offer holistic and comprehensive support that recognises the diverse individual identities and experiences of each of our scholars.

Our program aims to reduce or eliminate barriers to support the long-term retention of diverse students in STEM. The scholarship program offers a four-part wrap-around support framework to foster academic and social integration, which aims to provide the best opportunity for underrepresented students to thrive in STEM.

Significantly, the financial support of the program reduces a primary barrier to higher education, particularly for those students in remote or rural locations, those with caring responsibilities or other underrepresented groups. The scholarship allows scholars to focus on their studies, has the potential to reduce the need for additional hours of paid work and simplifies the financial burden of relocation from homes away from campus.

Additionally, Elevate offers access to 24-hour psychosocial support, including professional mental health and wellbeing support from trained counsellors, location-based security alerts, journey trackers and "check on me" requests. The ATSE team also conducts check-ins with each

scholar on a quarterly basis. This care for the individual anticipates the need of potentially vulnerable students to access mental health care, access early interventions to support their studies, and to build relationships with key people around them.

The wrap-around support system also incorporates mentoring and networking to allow students to connect with professionals in and across the STEM ecosystem. Scholars have access to these networks through formal mentoring and via structured and informal peer mentoring within their scholar cohort.

Finally, regular career development workshops are offered to help scholars grow essential enabling skills in communication, industry engagement, overcoming imposter syndrome, and project management, among others.

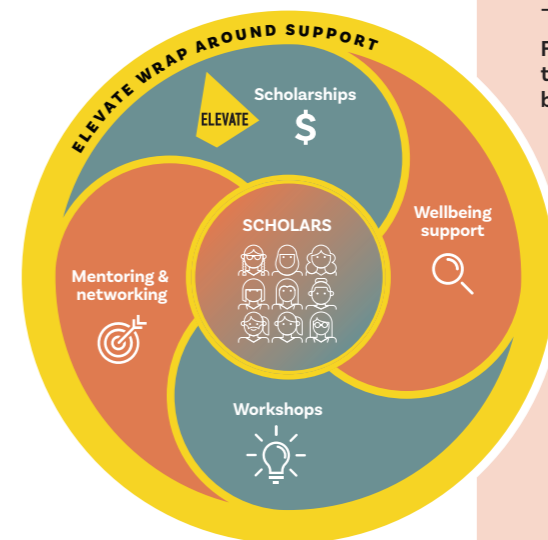
Leadership scholar Claretta says, "I have had the privilege of getting to know an amazing bunch of individuals from diverse backgrounds and have formed what I am sure will be lifelong friendships."

Elevate's innovative support system not only boosts individual success but also aims to enhance overall diversity and connectedness within the STEM sector.

Early results show high engagement with our activities and offerings and strong retention in STEM studies, underscoring the profound impact on the scholars, as well as the collective impact of the cohorts upon the sector.



**Sybilla Grady**  
ATSE Elevate Program Manager  
Sybilla is an experienced program and policy professional, dedicated to driving impactful, diverse, equitable and inclusive initiatives.



ELEVATE



## Nyalok Gatwech

Master of Cyber Security  
University of Queensland

To reflect on how the Elevate scholarship changed my university experience, I look to compare it to that of my COVID-era undergraduate degree. The program provided opportunities I may not have had access to otherwise and enabled me to pursue a full-time study load.

With the Elevate scholarship, I was able to connect with industry professionals and enthusiastic students from varying STEM disciplines across Australia. In addition to this, through the program I was able to attend various skill-enhancing workshops and industry events, and engage in mentorship to connect with the broader ATSE community.

Like many, at different stages of my education, I was not clear on what career path I wanted to pursue. I found that continuing my studies in areas that fostered my interest and excitement guided me to an industry that intersects with many and is ever evolving, that being Cyber Security. My studies over the past few years have fortified my desire to continue work within the cybersecurity industry – in whatever capacity that may be.

From this program I'm looking forward to taking with me the evidence that the barriers to education that people from marginalised backgrounds and diverse communities face are being broken. As well as excitement with the action of those making space for and actively championing diversity in STEM.

It's been a great privilege to be a part of the first cohort of Elevate scholars, I'm looking forward to following the successes achieved by other Elevate scholars and staying in touch with the ATSE community!

# Donations

## Thank you

ATSE would like to recognise and thank the generous donors whose steadfast support for the Academy's work helps us celebrate excellence in applied science, technology and engineering, and equip the next generation with skills to build a better world.

The donations we receive help sustain our work, making ATSE an authoritative and independent voice to government, building international research-industry collaborations to address global issues and allowing us to build on our proven, world-class STEM career programs.

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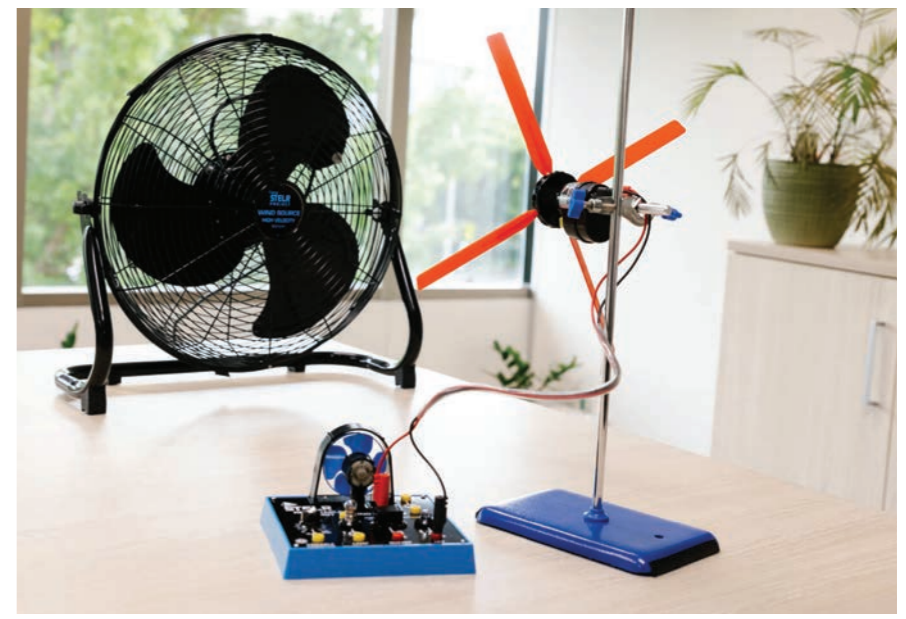
To make a donation please see the details on the inside back cover.

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- Department of Industry, Science and Resources
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- Orica
- MTP Connect
- ICM Agribusiness
- Australian Schools Canteen Association (ASCA)
- Australia Japan Foundation
- ATSE NSW Division donation to Memorial Fund



# Donations have impact



ABOVE: Wambangalang Environmental Education Centre Principal Maurice Elbourne-Binns with ATSE Fellow Professor Hans Coster. The ATSE NSW Division donated STELR equipment to the centre.

## Donation of STELR kits to central west NSW school

In May, ATSE's NSW Division generously donated STELR equipment to the Wambangalang Environmental Education Centre, located just outside Dubbo, NSW.

The Centre hosts on-site visits from schools located in regional NSW, with facilities for up to 80 students to stay the night. The Centre also travels to regional centres in NSW to support more remote schools.

This donation enabled staff from the Centre to travel to Broken Hill, where they used STELR resources to help students from six primary schools learn about renewable energy.





# News

from the Academy

## Top engineers and applied scientists launch toolkit to create more diverse and inclusive Aussie businesses

**NOVEMBER 2023**

ATSE launched a toolkit calling on Australia's small and medium businesses to capitalise on the social and economic benefits of making their STEM-skilled workforces more diverse and inclusive.

The *Diversity and Inclusion Toolkit* offers practical guidance for company CEOs and leaders to tackle shortages of people with STEM skills in the workforce by embracing and making the most of the expertise, knowledge and untapped potential represented by people from a range of cultural backgrounds, gender and sexual identities, and abilities.

## Responsible AI: Your questions answered

**NOVEMBER 2023**

In a report by ATSE and the University of Adelaide's Australian Institute for Machine Learning, 13 of Australia's top Artificial Intelligence (AI) experts found that AI has the potential to augment, simplify and improve the way we live our lives. However, to reach that point the nation urgently needs to build social license and public understanding, as well as spearhead new AI research and development activity to ensure AI technology is responsibly deployed and regulated. See more on page 46.

*Above: An artist's illustration of artificial intelligence (AI). This image represents the boundaries set in place to secure safe, accountable biotechnology. It was created by artist Khyati Trehan as part of the Visualising AI project launched by Google DeepMind. Source: unsplash*

## More than one hundred scholarships awarded to boost diversity in STEM

**NOVEMBER 2023**

ATSE announced 116 scholarships to support women and diverse people to thrive in STEM careers.

In the second round of the seven-year, \$41.2 million Elevate program funded by the Department of Industry, Science and Resources, ATSE grew the number of scholarships on offer with targeted support for 14 additional scholarships from the Department of Defence.

## Productivity Commission Report on AI highlights the need for investment in digital infrastructure and skills

**FEBRUARY 2024**

ATSE welcomed the release of the Productivity Commission Report, *Making the most of the AI opportunity* and agreed with the report's finding that Australia has the potential to be a world leader in AI, with adoption possibly boosting productivity for 90% of the workforce and filling vital skills gaps and labour shortages.

To tap into this potential, the Australian Government was encouraged to take a leadership role in AI and make immediate investment in Australia's AI capacity. This investment could be essential to building the digital literacy and skills of Australian workers, developing Australia's digital infrastructure, and preparing the Australia's future STEM workforce.

## Landmark Universities Accord presents ambitious vision for higher education and future workforce

**FEBRUARY 2024**

ATSE welcomed the Australian Universities Accord Final Report's emphasis on increasing investment in research and development, enhancing diversity and inclusion, and prioritising critical skills.

The recommendations presented far-reaching interventions to remedy the decades of neglect to the Australian higher education system and if implemented, will make Australia smarter, more prosperous and globally competitive. The Academy was particularly glad to see the sharp focus on increasing R&D investment through a whole-of-government approach.

## Traditional Knowledge representing Australia on the international stage

**MARCH 2024**

Congratulations to Mikaela Jade FTSE, CEO of Indigital, for being selected as Australia's lead entrant into the International Council of Academies of Engineering and Technological Science (CAETS) Communication Prize.

The Indigital video showcased the way they are using digital technologies to teach Indigenous heritage, and the use of First Nations culture to teach digital skills. The CAETS Communication Prize aims to highlight examples of engineering and technological science innovation addressing major challenges in our society.

## Diversity in STEM Review offers potentially game-changing solutions if implemented in full

**FEBRUARY 2024**

ATSE was glad to see the release of the *Diversity in STEM Review*, in particular the focus on proactive inclusion, equity, fairness and safety, and a place at the STEM research and development table for Aboriginal and Torres Strait Islander people.

The report's recommendations presented an actionable roadmap for enhancing diversity and inclusion within STEM fields. There is an urgent need for committed efforts across government, industry, academia, community, and education sectors to move the needle on boosting diversity in STEM.

## Supporting Australia's emerging technological sciences and engineering leaders

**MARCH 2024**

It was a pleasure for ATSE to announce the inaugural members of the ATSE Emerging Leaders Network.

The 15 emerging leaders were selected to work alongside esteemed scholars and industry leaders to develop their leadership, policy and advocacy skills. The Network is designed to enhance the contributions of rising professionals in STEM by providing opportunities to meet and work with ATSE Fellows, develop leadership skills and contribute to practical thinking to address pressing challenges. The members actively contribute to ATSE's Policy Forums, and were assigned a Fellow as mentor to support and guide them in their journey.

## Boosting board experience through Elevate as DMTC Guest of the Chair

**MARCH 2024**

DMTC Limited and ATSE jointly announced Dr Claretta DSouza as the 2024 recipient of the DMTC Guest of the Chair Fellowship.

Dr DSouza is an experienced neuroimmunologist and is currently a project manager working at the forefront of vaccine development at the Melbourne-based Burnet Institute. Dr DSouza completed her PhD at La Trobe University and is currently pursuing an MBA at the Melbourne Business School supported by an ATSE Elevate Leadership Scholarship.



### Global fund will strengthen regional science and technology capability

**MARCH 2024**

ATSE, in collaboration with the Australian Academy of Science, announced it would deliver \$6 million in grants to strengthen science and technology collaboration with regional neighbours as part of the Australian Government's \$40 million *Global Science and Technology Diplomacy Fund*.

The grants of up to \$1 million each were available to Australian researchers and businesses to partner with counterparts across the region on national priorities of advanced manufacturing, AI, quantum computing, hydrogen production and RNA vaccines.

### A future made in Australia needs to be built on Australian research and development

**APRIL 2024**

The *Future Made in Australia* vision for innovation and prosperity that the Prime Minister Anthony Albanese outlined was welcomed by the Academy. ATSE has long called for ambitious action to take advantage of the opportunities ahead of us in energy, manufacturing, advanced technologies and more.

Such action will crucially help arrest Australia's slowing productivity growth and declining economic complexity that puts us at 93rd in the World. Australia's science, research and innovation sector will need to lead the way in the required transformation – developing new industries, skills, products and opportunities for the nation.

### ATSE endorses findings on improving out-of-field maths teaching

**APRIL 2024**

ATSE welcomed the policy document *Out-of-field teaching of secondary school mathematics in Australia*, recently released by a consortium of mathematics groups, as well as its accompanying analysis of out-of-field upskilling initiatives.

ATSE believes that addressing out-of-field teaching is imperative to improving mathematics education and addressing our future science workforce needs. ATSE explored this issue and possible solutions in its 2022 report *Our STEM Skilled Future*.



### A diverse group of 16 early-career STEM leaders make up the 2024 IMNIS Catalyst cohort

**APRIL 2024**

ATSE's IMNIS Catalyst program supports budding leaders to become STEM ambassadors by providing unique professional development and networking opportunities. Catalysts represent ATSE and its prestigious IMNIS initiative as they engage with schools, industry and academia.

The 2024 cohort brings a wealth of experience drawn from their studies and professional work in STEM fields across the nation. Their exceptional backgrounds, and professional and social ambitions, make them the perfect people to catalyse change in their personal and professional spheres of influence.

### Top water experts urge renewed action to secure future of Murray-Darling Basin

**APRIL 2024**

ATSE urged a suite of actions and investments to protect the future of the Murray-Darling Basin in the face of climate change, which is threatening the river's health and sustainability.

In the essay series *A thriving Murray-Darling Basin in 50 years: Actions in the face of climate change*, ATSE urged more investment in technologies to monitor the river for climate impacts and in sustained governance with regional and rural communities at the centre, coupled with evolving Australia's agriculture industry in the face of decreased water availability and accepted water sharing policies. The essay series highlighted the vibrant, thriving potential of the Basin if sustainably managed for the benefit of communities and the environment.

See more on page 14.

### ATSE welcomes large quantum of technology investment for Queensland

**APRIL 2024**

ATSE welcomed the announcement of a new, almost \$1 billion quantum computing investment in Queensland, equally co-funded by the Federal and State Governments. ATSE had previously stated that growing the Australian quantum industry required supporting four interrelated areas: basic research, infrastructure, talent and business activity.

This landmark announcement is set to supercharge these areas and enable Australia to build on its early quantum computing success.

### Aussie science and innovation needs immediate and sustained investment to power a future made in Australia

**MAY 2024**

In response to the 2024-2025 Federal Budget, ATSE welcomed commitments to review Australia's languishing investment in Australian science and innovation, and back clean energy industries, however investment can't be kicked further down the road.

Australia lags behind the United States, Japan, and Germany, who all spend more than 3% of their GDP on the research and development which powers their economies. Ultimately, Australia's investment in R&D will make or break the Future Made In Australia investments announced in the Budget.

### National Battery Strategy provides a welcome charge to skills and sustainability

**MAY 2024**

The Australian Government's National Battery Strategy outlines a vision for boosting domestic and export battery production, reflecting advice from ATSE.

As the inaugural strategy released under the Government's *Future Made in Australia Act*, the initiative has the potential to turbo charge Australia's renewable transition.

### National Robotics Strategy a strong foundation for thriving industry

**MAY 2024**

ATSE welcomed the *National Robotics Strategy*, which recognised Australia's strengths in R&D and outlined a plan for a strong and coordinated robotics industry that could deliver significant economic gains.

The Strategy modernised definitions which enable a shared understanding of technical terminology and emphasised that growing a skilled and diverse workforce are critical to a thriving Australian robotics capability.

### National report card shows deeply concerning lack of STEM literacy Australia-wide

**MAY 2024**

The Australian Curriculum Assessment and Reporting Authority National Assessment Program report revealed alarming results for science literacy.

ATSE called on state and federal governments to collaborate to urgently address the lack of progress through a multi-pronged approach which lifts the status of science in the school curriculum, supports STEM teachers and provides resources for hands-on STEM learning.

### New South Wales Budget shows urgent need to support next generation with STEM skills

**JUNE 2024**

ATSE welcomed the additional \$481 million announced in the NSW budget for boosting the standards of New South Wales public schools. However, much more is needed to equip the next generation with the science and technology skills needed to address our most complex challenges.

### The role of nuclear technology in Australia's energy transition

**JUNE 2024**

In response to proposals regarding the role of nuclear power in Australia's energy transition, ATSE highlighted existing evidence regarding nuclear power in Australia. In order to avert the worst impacts of climate change, it is critical to decarbonise our energy systems and rapidly reduce emission across the entire economy through clean and proven technologies.



### Engineering innovator named advisory group Co-chair for Australia's leading STEM scholarship initiative

**JUNE 2024**

ATSE was delighted to announce that William (Bill) Cox FTSE, CEO of Aurecon joined the ELEVATE Advisory Group as Co-Chair. Bill is a Champion of Change and an outspoken advocate for diversity and inclusion, and a leading innovator.

### New report reveals technical and market implications for small modular nuclear reactors in Australia

**JULY 2024**

A new report from the ATSE found that the nascent state of small modular nuclear reactors globally means that a mature market for the technology may emerge in the late 2040s.

# Major reports

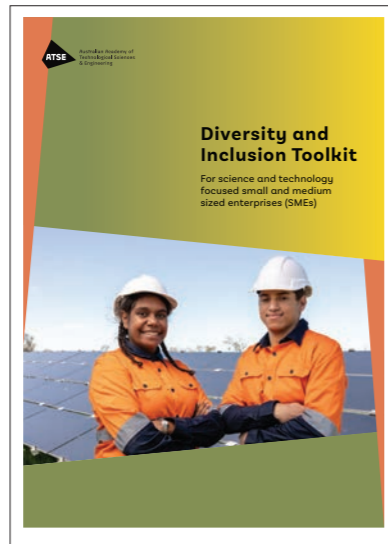


## Responsible AI: Your questions answered

*Responsible AI: Your questions answered* provides essential guidance to aid the development of AI technologies in Australia.

Australia is at a crossroads with developing AI technologies, with the potential to become a leader or laggard in technical and regulatory innovation.

In this report by ATSE and the University of Adelaide's Australian Institute for Machine Learning, 13 of Australia's top experts find that AI has the potential to augment, simplify and improve the way we live our lives.



## Diversity and Inclusion Toolkit

The *Diversity and Inclusion Toolkit* offers practical guidance for company CEOs and leaders to tackle shortages of people with skills in science, technology, engineering and mathematics.

It aims to help businesses make the most of the skills, knowledge and untapped potential represented by people from a range of cultural backgrounds, gender and sexual identities, and abilities.

ATSE has launched this toolkit calling on Australia's small and medium businesses to capitalise on the social and economic benefits of making their STEM-skilled workforces more diverse and inclusive.



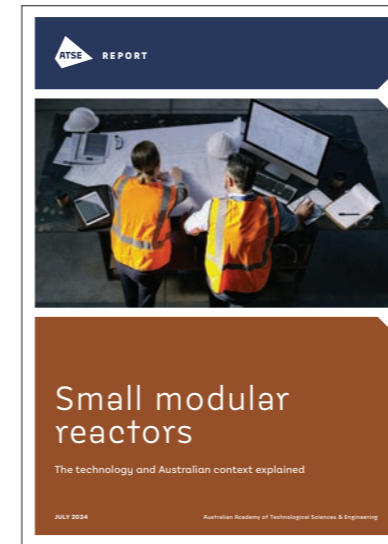
## A thriving Murray-Darling Basin in 50 years: Actions in the face of climate change

*A thriving Murray-Darling Basin in 50 years: Actions in the face of climate change* brings together leading experts across a range of water issues to outline an optimistic vision for a healthy Basin over the coming decades.

ATSE urges a suite of actions and investments to protect the future of the Murray-Darling Basin in the face of climate change, which is threatening the river's health and sustainability.

The authors highlight the need for investment in technologies to monitor the river for climate impacts and in sustained governance with regional and rural communities at the centre, coupled with evolving our agriculture industry in the face of decreased water availability and accepted water sharing policies.

See more on page 14.



## Small Modular Reactors: The technology and Australian context explained

Small modular reactors (SMRs) could potentially form part of Australia's future low-carbon energy mix, utilising existing transmission infrastructure and contributing to baseload power, or providing dispatchable power in a high-renewables grid.

The report ultimately finds that it won't be possible to fulfill the urgent energy supply gap with SMR technology this decade, and that a mature market is likely to emerge in the mid 2040s.

BELOW: Some of ATSE's Instagram posts explaining the report to our social media audiences





# Government submissions

## DECEMBER 2023

### Submission to the Wiyi Yani U Thangani (Women's Voices) National Framework consultation

ATSE offered its support and involvement in ongoing discussions about Traditional Knowledge, measurement, and knowledge sharing and learning. This submission highlighted how the new Framework for Action can leverage outcomes of Australia's Science and Research Priorities, and support data collection on STEM education and workforce participation.

### Submission to Agriculture and Land Sectoral Plan

ATSE's submission to the plan highlighted the importance of proper accounting of emissions, helping farmers adopt new low emissions opportunities and providing long-term support to research into reducing emissions across the sector.

## JANUARY 2024

### Submissions to Australian Research Council Amendment (Review Response) Bill 2023 inquiry

The joint submission from multiple Academies endorsed amendments to the Bill, including providing for a Board and restricting the Ministerial veto. In an additional individual submission, ATSE also recommended uplifting research funding to 3% of GDP, greater integration with the National Science and Research Priorities, and requiring industry expertise on the Board.

### Submission to the Draft Action Plan addressing gender-based violence in higher education

ATSE welcomed the Department of Education's initiative in developing an Action Plan to address gender-based violence in higher education. ATSE's submission recommended a risk-based approach for the Draft Action Plan with accountability from providers' governing bodies.

### Submission to the 2024-25 Pre-budget consultation

ATSE's pre-budget submission outlined a series of recommendations aimed at strengthening Australia's capacity to address our nation's challenges and seize its opportunities, including a call to increase research and development funding to 3% of GDP. Additionally, the submission outlined recommendations covering a wide range of areas such as decarbonisation, diversity in STEM, and sustainable water management.

### Jobs and Skills Australian 2024-25 Work Plan

ATSE's submission focused on the importance of a National Skills Taxonomy, and provided advice on how the taxonomy should be implemented, including the importance of ensuring it remains up-to-date.

## FEBRUARY 2024

### Submission to National Water Reform 2024 consultation

ATSE's submission called for a nationally led, locally implemented, contemporary National Water Initiative which considers climate change, urban water, water quality, Aboriginal and Torres Strait Islander interests, processes for future investments in water infrastructure, and improved data and knowledge about water. ATSE called for the establishment of a renewed National Water Commission with authority and resources sufficient to catalyse necessary reforms by water managers across Australia.

### Submission to the 2023-24 GenCost consultation draft

ATSE encouraged future GenCost reports to take a technology-neutral approach to driving down emissions from energy generation and look to international examples to inform Australia's costings and decision-making. ATSE also recommended using the Levelised Full System Costs of Electricity methodology – a novel cost evaluation metric that compares the costs of serving the entire market using one source plus storage.

### Submission to the Senate inquiry on supporting the sovereign capacity of the Australian technology sector

The joint submission by ATSE and the Australian Academy of Science highlighted concerns regarding the bill's implications for research and development in Australia. The submission urged a halt to the bill's progression until its profound implications could be thoroughly debated including the need for a clear fundamental research exemption, measures to mitigate unintended consequences on research and development, and the provision of adequate resources for compliance with the legislation.

## APRIL 2024

### Submission to the Senate inquiry on waste reduction and recycling policies

ATSE recommend using its report, *Towards a Waste-Free Future*, which explores ways to achieve a circular economy through design, product stewardship, and advanced recycling technologies. ATSE's submission recommended that more needs to be done to meet recycling targets.

### Submission to Senate inquiry on the Net Zero Economy Authority

ATSE wrote to support the establishment of the Net Zero Economy Authority (NZE). The letter also articulated support for the NZEA Board's inclusion of industry, business and research representatives; and for the NZEA's mandate to manage coal power station closures including impacts on displaced workers.

### Submission to National Water Reform 2024 Interim Report

ATSE's submission strongly supported the Interim Report's renewal of the commitment to the National Water Reform, building on the solid foundations of the National Water Initiative to ensure Australia's water resources' long-term security amid climate change and population growth. The submission focused on areas requiring further development and strengthening in the Final Report, including National Water Commission reinstatement, sustained knowledge generation, urban water, and consultation for forming responsible partnerships between irrigators, industry and communities.

## MAY 2024

### Submission to National Water Agreement consultation

ATSE supported the draft inclusion of themes for water quality, climate change and population growth, transparency in decision-making, and Aboriginal and Torres Strait Islander engagement. ATSE's submission recommended enabling the NWA's development and implementation through new national leadership and governance structures, and recommended the establishment of a National Water Commission to provide nationally recognised water management decision-making.

### Submission to the Food and Beverage Manufacturing in Australia

ATSE's submission recommended that the government works with the sector to develop a sectoral decarbonisation strategy. Emerging technologies like AI and automation offer innovation and productivity opportunities, though challenges such as infrastructure investment and workforce training require additional support.

### Submission to Adopting Artificial Intelligence (AI)

ATSE's submission considered that a coordinated response is needed to adopt and regulate AI and ensure continued public participation in AI-related decisions. Key opportunities for the application of AI in Australia include technology, finance, healthcare, education and government services. ATSE recommended that Australia needs to focus on building a pipeline of AI-literate workers, starting with adequate AI education in schools.

### Submission to the Defence Trade Control Amendment inquiry

ATSE underscored the importance of boosting R&D spending, aligning it with international standards, and establishing a comprehensive research and innovation policy framework. to prioritise commercialising domestic research and nurturing lifelong STEM learning to ensure a skilled workforce. ATSE recommended enhanced coordination in procurement processes, prioritising domestic businesses and implementing robust risk management frameworks in the procurement process from small and medium-sized enterprises.

## MARCH 2024

### Submission to the WA 10-year Science and Technology Plan

ATSE's submission focused on embracing the state's competitive advantages, tackling the valley of death, and STEM skills. The submission argued that the State Government must aim to support those areas where WA has a competitive advantage or can provide a unique perspective.

### Submission to the AEMO Integrated System Plan

ATSE noted that there are significant risks to the energy transition including cost blowouts, global competition for hardware and skills shortages. This includes the impacts of climate change itself making reaching net zero more difficult as reduced rainfall and increased evaporation impair hydro generation and storage. The submission noted the infrastructure will need the support of the communities in which it is based.

All ATSE submissions can be found on our website [atse.org.au/what-we-do/strategic-advice](https://atse.org.au/what-we-do/strategic-advice)

# Events

From renewable energy and AI applications to environmental sustainability and building standards, ATSE events continue to showcase our commitment to driving innovation and knowledge exchange across Australia.

## FEBRUARY

On 7 February, the Victoria Division commenced its year with a keynote address from CSIRO CEO, Dr Doug Hilton AO FTSE FAA FAHMS. Dr Hilton expressed the critical importance of trusting in science amidst ongoing challenges.

Then, on 22 February, in an event co-hosted with the ANU Institute for Climate, Energy & Disaster Solutions, Professors Kylie Catchpole FTSE and Ken Baldwin FTSE debunked myths surrounding renewable energy, highlighting Australia's advantageous position to lead in the transition towards sustainable energy sources. Renewable energy experts, Dr Alex Wonhas FTSE, Professor Renate Egan FTSE, Dr Martin Poole and Dani Alexander joined us on 28 February to discuss Australia's progress and ambitions in transitioning to renewable energy.

## MARCH

Dr Bruce Godfrey FTSE and Professor Amanda Ellis led discussions on 5 March, exploring advancements in battery technologies and their impact on renewable energy solutions. Their insights showcased the pivotal role of energy storage in Australia's journey towards a decarbonised economy.

On 12 March, in an event co-hosted by the Australian Academy of Science, the South Australia and Northern Territory Division celebrated their new Fellows, including Dr Susannah Elliott FTSE, Professor Bronwyn Gillanders FTSE, Professor Zaiping Guo FTSE FAA, Professor Graham (Gus) Nathan FTSE and new Australian Academy of Science Fellow Professor Shizhang Qiao FAA.

## APRIL

On 9 April, Professor Andrew Ball FTSE and Dr Minna Saaristo addressed the impact of emerging contaminants in Victoria's soils and waterways. They discussed the state of the knowledge of contaminants, the extent of their impact on human health, mitigation strategies and safe disposal methods for these persistent environmental pollutants.

RIGHT: Eildon Dam is a rock and earth-fill embankment dam with a controlled spillway, located on the Goulburn River between the regional towns of Mansfield and Eildon within Lake Eildon National Park, in the Alpine region of Victoria.



## MAY

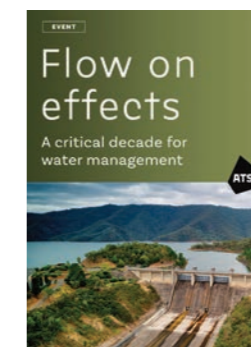
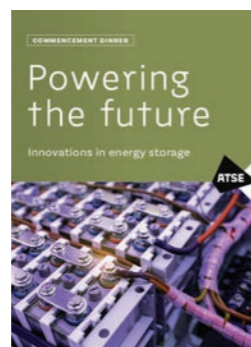
Professors Joanna Batstone FTSE and Karin Verspoor explored the applications of AI and data science in health policy and social equity on 7 May. Their presentation highlighted both the potential and challenges of AI in promoting positive outcomes.

David Chandler OAM, then-NSW Building Commissioner, shared insights on 15 May into the Commission's efforts to improve building standards and address issues in residential construction. His presentation highlighted significant strides and ongoing challenges faced by the Commission.

## JUNE

Lara Olsen FTSE and Professor Huanting Wang FTSE spoke on 4 June about future challenges and innovations in water management. They emphasised the need for sustainable practices and technological advancements to ensure water security and sustainability in the coming decade.

All ATSE events can be found on our website [atse.org.au/events](https://atse.org.au/events)



# Movers & shakers



1. Peter Andrews



2. Veena Sahajwalla



3. Anthony Weiss



4. Sally McArthur



5. Carmel Hillyard



6. Ranjith Pathegama Gamage



7. Bronwyn Fox



8. John Gooding



9. Chien Ming Wang



10. Kirsten Rose



11. Craig Simmons



12. Tony Fischer



13. Nick Austin



14. David Thodey



15. Mikaela Jade

1. Emeritus Professor Peter Andrews AO FTSE was honoured as a 2024 Queensland Great.

2. Professor Veena Sahajwalla FTSE FAA was selected to deliver the 2024 annual Ann Moyal Lecture titled “A smart vision for a sustainable future”.

3. Professor Anthony Weiss AM FTSE received the Lemberg Medal and Lecture, given by the Australian Society for Biochemistry and Molecular Biology. Professor Weiss was also awarded the 2024 Academy of Science Ian Wark Medal and Lecture.

4. Professor Sally McArthur FTSE was elected as a Fellow of the International Biomaterials Science & Engineering Society.

5. Dr Carmel Hillyard AM FTSE FAICD was appointed to the board of the Association of Australian Medical Research Institutes.

6. Professor Ranjith Pathegama Gamage FTSE was named a Foreign Fellow of the Chinese Academy of Engineering.

7. Professor Bronwyn Fox FTSE was appointed as the Deputy Vice-Chancellor Research & Enterprise at University of New South Wales.

8. Scientia Professor John Gooding FTSE FAA received \$3.7 million funding from the Australian Research Council. Professor Gooding was also awarded the 2024 Academy of Science David Craig Medal and Lecture.

9. Professor Chien Ming Wang FTSE was elected to the European Academy of Science and Arts.

10. Kirsten Rose FTSE was appointed as the Deputy Chief Executive of CSIRO.

11. Professor Craig Simmons FTSE FAA was appointed as the Chief Scientist for South Australia.



16. Mary O’Kane



17. Lachlan Blackhall



18. Salah Sukkarieh



19. Tanya Monro



20. Mark Cassidy



21. Sangeeta Bhatia



22. Catherine Livingstone



22. David Boger



22. Robin King



22. Cynthia Mitchell



22. Michael Eyles



22. Buddhima Indraratna



22. James May



22. John Ramshaw



22. Jan Tennent

12. Dr Tony Fischer AM FTSE was awarded the 2023 Crawford Fund Medal.

13. Dr Nick Austin FTSE was appointed as the President of the Policy Advisory Council for the Australian Centre for International Agricultural Research.

14. David Thodey AO FTSE was announced as the next Chancellor of the University of Sydney.

15. Mikaela Jade FTSE’s submission into the 2024 international CAETS Communication Prize was selected as Australia’s lead entrant to represent Australian technological science and engineering innovation on the world stage.

16. Professor Mary O’Kane AC FTSE was appointed as the Independent Chair of the AEMO Board, commencing 2 April 2024.

17. Dr Lachlan Blackhall FTSE was appointed as the new Deputy Vice-Chancellor (Research & Innovation) at The Australian National University.

18. Professor Salah Sukkarieh FTSE was inducted as a Fellow of the IEEE Robotics and Automation society.

19. Professor Tanya Monro AC FTSE FAA was formally elected as an International Member of the United States National Academy of Engineering.

20. Professor Mark Cassidy FTSE FAA was appointed as the new Deputy Vice Chancellor (Research) at the University of Melbourne and stepped into his new role on 1 January.

21. Dr Sangeeta Bhatia FTSE was elected as a Fellow at the Academy of the American Association for Cancer Research (AACR) in January.

22. Nine ATSE Fellows were recognised for outstanding achievements in the Australia Day 2024 Honours: Catherine Livingstone FTSE, David Boger FTSE, Robin King FTSE, Cynthia Mitchell FTSE, Michael Eyles FTSE, Buddhima Indraratna FTSE, James May FTSE, John Ramshaw FTSE and Jan Tennent FTSE.

# Top 100 Australian Scientists

26 ATSE Fellows were named in the Top100 Australian Scientists list\*



Martin Green



Emma Johnston



Thomas Maschmeyer



Veena Sahajwalla



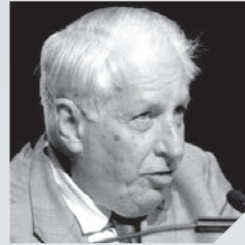
Michelle Simmons



Gordon Wallace



Graeme Clark



Gustav Nossal



Svetha Venkatesh



Ian Frazer



Ian Lowe



Helene Marsh



Peter Newman



Basil Hetzel



Tanya Monro



Mark Oliphant



Genevieve Bell



Liz Dennis



Jagadish Chennupati



Jim Peacock



Brian Schmidt



Bob May



David Henry Solomon



Alan Trounson



Lyz Beazley



Andrew Blakers

\*ABC Radio National – The Science Show

## Vale



### Professor William (Greg) John McGregor Tegart

AM FTSE

An obituary from Professor Peter Cook CBE FTSE

William John McGregor Tegart, Greg to all of us, passed away on the 4th of July 2023 at the age of 94. His knowledge, his wisdom, his boundless energy and his sense of humour will be missed by his many friends and colleagues from around the world and especially of course by his family.

By any standards, Greg was an early high achiever, with his first papers on metallurgy published at the age of 22, soon followed by more papers and a book on metallurgy, published in English, French, Russian and Polish.

Greg was awarded his Bachelor and Masters degrees by Melbourne University and his PhD by Sheffield University. Greg continued at Sheffield as a Lecturer then Senior Lecturer. After a sabbatical at Northwestern University in Illinois, Greg subsequently took up a professorial position in the Department of Materials, College of Aeronautics, at Cranfield, heading up a large group working on such diverse projects as fatigue of steels for Concorde landing gear, welding of high strength steels for Trident submarines and polymer re-entry cones for rockets. During his time in the UK, Greg married Wendy Bridger, who sadly passed away a few years later.

In 1968, Greg left academia and returned to Melbourne to start a new career in industry, setting up the BHP Melbourne Research Laboratories, working on new steel developments, the application of steel in construction, solar energy, oil from coal, and heavy railroad technology. Under Greg's inspired leadership, the BHP Labs became the pre-eminent industrial research centre in Australia for materials science. In 1977 Greg became a Fellow of the Australian Academy of Technological Sciences and Engineering.

So, in an early career spanning more than 30 years, Greg made an extraordinary contribution to metallurgy both nationally

and internationally, in fields that are still of great importance not only to Australia but to the world, in transportation, solar energy, construction, submarines and space travel. A level of achievement that would have left most people content to rest on their laurels. But not Greg! That was only his early career!

Greg's next career commenced in 1979 when he moved to Canberra as a member of the 3-man Executive running CSIRO. In 1985, Greg became Secretary of the Commonwealth Department of Science and Technology, with over 2,000 staff, in areas as diverse as meteorology, Antarctic science, patents, research grants, government laboratories, international science and science and technology policy. This gave Greg the opportunity to expand his knowledge and leadership into a whole range of new, exciting and important areas and to have a major and continuing influence on Australia's science and technology policy. Greg was awarded the AM in recognition of his contribution.

Greg was appointed to the newly created position of Secretary of the Australian Science and Technology Council in 1988. This marked another important new phase of Greg's career and perhaps the most internationally significant phase, in that he became deeply involved in the Intergovernmental Panel on Climate Change, IPCC. Greg led the Australian delegation to the IPCC for 5 years and from that position, strongly influenced the early direction of the IPCC and its modus operandi, helping to set up what proved to be, and continues to be, the world's most influential body in the climate debate. In 2007, Greg was formally recognised as a Contributor, in the award of the Nobel Peace Prize to the IPCC.

Greg retired from the Australian Public Service in 1993 and started on yet another career path! This was perhaps the most diverse career phase, in that he was Visiting Professor at three universities

– Victoria University, ANU and Canberra University. He was also the founding co-director then Executive Advisor, to the APEC Centre for Technology Foresight, based in Thailand but covering all the Pacific Rim countries. He also had a major ongoing international role through ATSE as Foreign Secretary, publishing numerous Academy reports and studies, notably on the future of work, and nanotechnology. He was instrumental in developing a range of international collaborations, especially with Asia and Europe, including one with the Basque region of Spain, a region with which Greg had strong connections over many years.

Greg's career then morphed into yet another phase, through a range of activities leading to the development of assistive technologies for the aged and disabled. I might point out that Greg did not consider himself to be aged or disabled at this stage, nor was he, though he was a mature 86! Greg was the ACT Senior Australian of the Year for 2016 in recognition of his work in aged care technologies, work that he continued until 2022.

Greg had a wonderful and incisive perspective on governments and nations and was a confirmed Francophile, so it is fitting to note that Greg passed away on 4 July, American Independence Day and was farewelled on 14 July 2023, Bastille Day. The sentiments of Liberté Egalité and Fraternité echoed throughout Greg's life.

Greg's scientific career was extraordinary, extraordinarily diverse and amazingly productive over more than 70 years and it is hard to do it justice. He was a truly extraordinary man, a wonderful friend, an exceptional scientist and engineer. He worked tirelessly for ATSE and all that it stood for. Greg will be sorely missed by us all and especially by his wife Robyn and his children Elizabeth, Andrew, Alistair and Louise. He leaves a wonderful legacy.

# Vale



**Dr John Hinton Christian**  
AO FTSE (Foundation Fellow)

**Dr John Christian was elected to the Academy as one of its Foundation Fellows in 1976.**

As a Foundation Fellow of the Academy, his contributions spanned nearly 50 years. He spent several years on the ATSE Council, was Deputy Chair and Chair of the ATSE Prizes and Awards Committee in 1988, and was a highly involved member of ATSE's New South Wales Division. He was also chair of the Membership Committee for several years and was most recently a member of the Agriculture Forum from 2014 to 2024.

He was Chief of the CSIRO Division of Food Science and Technology from 1979 to 1986. He also served as Chairman of the International Commission for Microbiological Specifications for Foods from 1980 to 1991.

Following studies at Knox Grammar School in the 1930s, he served in the Royal Australian Air Force during World War 2 from 1943 to 1945. After the war, he received a Bachelor of Agricultural Science from the University of Sydney, and then, in 1956, a PhD in Biochemistry from Cambridge University in England.

He was awarded the Officer of the Order of Australia in 1986 in recognition of his services to science, in particular microbiology.

John spent his entire career at CSIRO starting as a Research Scientist in 1951 and continuing through the ranks until he became an Honorary Research Fellow in 1990. He was also a part-time lecturer throughout his career, including at the University of Sydney, University of New South Wales and University of Indonesia.

He was married to his wife Helen for 66 years, and had 5 children, 8 grandchildren and 4 great-grandchildren.



**Dr Frank Lawson**  
FTSE

**Dr Frank Lawson was elected to the Academy in 1995 for his internationally recognised research on hydrometallurgy, and lead smelting and refining.**

Frank had a unique ability to contribute to both research and teaching, and to show leadership at the Departmental and research levels. He was held in high regard as a teacher and as a pioneer in his discipline of chemical engineering, as shown by his membership of committees overseeing the quality of university curricula in Australia and overseas.

He graduated from the University of New South Wales in 1950 with a Bachelor of Engineering in Chemical Engineering, followed by a PhD in Chemical Engineering from Monash University in 1970. He taught and researched at Monash University starting in 1962.

Over his career, Frank contributed to research across areas of minerals processing, lead refining, metal leaching, waste processing and many more. He was also granted several patents for use in processing mineral ores and associated wastes.

In 2009, Professor Lawson was the first ever recipient of a Doctor of Engineering degree in Chemical Engineering from Monash, the university's highest award in Engineering, formally recognising scholars who have made a substantial, original and distinguished contribution to knowledge.



**Dr John Gladstones**  
AO FTSE (Foundation Fellow)

**Dr John Gladstones was elected to the Academy as one of its Foundation Fellows in 1976.**

John received ATSE's Clunies Ross Award in 1991 for his plant breeding, and was a long-term member of the Western Australia Division. In 1980, he was made a Member of the Order of Australia, and in 2022, an Officer of the Order of Australia.

He was an expert in multiple fields, and is recognised for significant contributions to the Australian agriculture industry. He became one of the world's leading authorities on lupin as a cropping plant for use in animal feed and to improve the quality of soils. John bred the world's first crop varieties of narrow-leaf lupins, which are now bred all over the world.

He was also the first person to identify Margaret River as a suitable region for wine production. His 1965 papers highlighted the climatic similarities between Margaret River and the wine-producing regions of Bordeaux, which catalysed the fine wine industry now thriving in the area.



**Gordon Bell**  
FTSE (Foreign Fellow)

**Gordon Bell was elected as an ATSE Foreign Fellow in 2009.**

Over his time in the Fellowship, he was a member of multiple forums, including the Climate Change Forum, Energy Forum, Education Forum and Health Forum.

He was among the first engineers to develop designs leading to the modern personal computer in the 1960s. In an era where computers were multimillion-dollar machines run by corporations, he had a vision of widespread and personal computing available to all. He worked for Digital Equipment Corporation, and later, Microsoft, and taught at Carnegie Mellon University.

He received a Master's degree from MIT, and then studied at the University of New South Wales under a Fulbright Scholarship, where he met his first wife Gwen Druyor and with whom he founded the Computer History Museum. Later in his career, he joined the National Science Foundation and worked on an early precursor of the internet through a project networking supercomputers.



**Professor Dagan Feng**  
FTSE

**Emeritus Professor Dagan (David) Feng was elected to the Academy in 2005.**

Dagan's research interests were at the intersection of biomedical science and multimedia information technology. His approach focused on the use of information technology to manage and leverage the large amounts of data available to biomedical professionals.

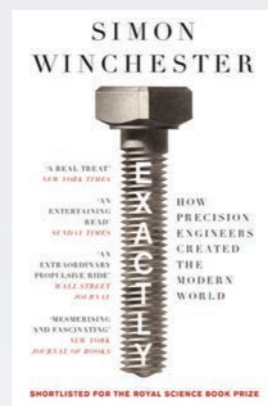
Most recently, he was working on ways of improving the early diagnosis of diseases such as cancer and dementia by enhancing the use of medical data from scans and other imaging. He was looking into the computer-assisted diagnosis of dementia through improved use of data from PET scans.

He studied in China and received a PhD in the United States before moving to Australia and joining the University of Sydney in 1988. He progressed to become Professor in the Department of Computer Science and Head of School of Information Technologies.

He was a member of the ATSE Health Forum from 2011 to 2024, and was Deputy Chair in 2012 and 2013.

# What we're reading

**BOOK**



**Exactly: How Precision Engineers Created the Modern World**

by Simon Winchester

A fascinating and approachable exploration of the progress of engineering over hundreds of years to the present. This book shows us how our ability to measure and create physical objects has evolved over time, making it possible for us to imagine, build and mass-produce items of progressively smaller sizes. A brilliant way to work through the innovations of humankind, and an eye-opening view of the many varied parts of our lives that are only possible through the advent of miniaturised measurement and manufacturing technologies.

2018, [harpercollins.com.au](http://harpercollins.com.au)

Recommended by the ATSE Secretariat

**BOOK**



**Tall Wood Buildings: Design, Construction and Performance.**

by Michael Green and Jim Taggart

With the launch of Relocating Australian Communities at Risk [an issues paper published by the ANU Institute for Climate, Energy and Disaster Solutions], I've been once again thinking about where we build, the footprint of materials, and how adaptation can incorporate the why and how of changing cities in the face of climate change.

2017, [birkhauser.com](http://birkhauser.com)

Recommended by Mark Howden FTSE

**WEBSITE**



**Human Bionics Discovery Hub**

Bionics Gamechangers Australia is a not-for-profit cluster leader, bringing together scientists, researchers, consumers, clinicians and investors to take medical bionic innovations to the next level. Linking people, ideas and technologies in new ways is key to accelerating bionic breakthroughs, and the Discovery Hub featured on the Bionics Gamechangers Australia website is a fascinating space to learn about a better future for human health.

Showcasing the explosion of remarkable discoveries that restore and enhance human function, choose from hundreds of stories about pioneering Australian and international advances across bionic senses, mobility, organs and implants, and neural and AI-enabled devices.

[bionicsgamechangers.com/discovery-hub](http://bionicsgamechangers.com/discovery-hub)

Recommended by Dimity Dornan FTSE and Robyn Stokes

**REPORT**



**Tech skills for the next generation: Digital technologies education in Australian schools**

by the ANU Tech Policy Design Centre and the Australian Computing Society

This report provides a roadmap for Australian governments and the education sector to support teachers to deliver high-quality and engaging Digital Technologies programs for primary and secondary school students. Based on a detailed survey of teacher experiences and skills, the recommendations contained in this report seek to engage young Australians in digital technologies throughout their school years and equip them with essential digital technology skills for their future studies, careers and participation in society.

[techpolicydesign.au/projects/report-tech-skills-for-the-next-generation](http://techpolicydesign.au/projects/report-tech-skills-for-the-next-generation)

Recommended by the ATSE Secretariat

# ATSE supports the United Nations Sustainable Development Goals



As a national Academy with many connections to international researchers and with a large number of Fellows working towards global solutions for issues such as climate change, pandemics, and food security, ATSE has strong alignment with the 17 United Nations Sustainable Development Goals (SDGs). In order to make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals.

IMPACT features icons alongside featured articles indicating which Goals the article relates to. We hope this helps you see the wide range of problems that ATSE Fellows are involved in solving. We believe this can shape discussions about how Australian applied scientists, engineers and technologists are driving change to create peace and prosperity for people and the planet, now and into the future. The UN SDGs provide a framework we can use to organise Academy efforts against an accepted global taxonomy, and as a logical, useful mapping tool for our reports and studies.

## What are the SDGs?

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries – developed and developing – in a global partnership. Interconnected, they recognise that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth, all while tackling climate change and working to preserve our oceans and forests.



- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li>1 End poverty in all its forms everywhere.</li> <li>2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.</li> <li>3 Ensure healthy lives and promote well-being for all at all ages.</li> <li>4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.</li> <li>5 Achieve gender equality and empower all women and girls.</li> <li>6 Ensure availability and sustainable management of water and sanitation for all.</li> <li>7 Ensure access to affordable, reliable, sustainable and modern energy for all.</li> </ul> | <ul style="list-style-type: none"> <li>8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.</li> <li>9 Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.</li> <li>10 Reduce income inequality within and among countries.</li> <li>11 Make cities and human settlements inclusive, safe, resilient, and sustainable.</li> <li>12 Ensure sustainable consumption and production patterns.</li> <li>13 Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.</li> </ul> | <ul style="list-style-type: none"> <li>14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development.</li> <li>15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.</li> <li>16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.</li> <li>17 Strengthen the means of implementation and revitalise the global partnership for sustainable development.</li> </ul> |
|---|---|--|

# Support our work

For nearly 50 years, the Australian Academy of Technological Sciences and Engineering's expert advice and world class STEM Career programs have helped grow great Australian technology and innovation.

Help us to provide evidence-based advice, celebrate excellence and equip Australians with STEM skills.

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- Support women and diverse students to access undergraduate and postgraduate STEM scholarships at Australia's leading universities.
- Guide more decisionmakers with robust, practical and evidence-based advice underpinned by science.
- Build international research-industry collaborations through grants and knowledge exchange workshops to address shared global issues.

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# ATSE New Fellows Showcase & ATSE Awards 2024

ATSE New Fellows  
2024 Reception  
Wednesday 16 October  
Evening

ATSE New Fellows  
2024 Showcase  
Thursday 17 October  
Daytime

ATSE Awards 2024  
Gala Dinner  
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