

NOVEMBER 2024 — SCIENCE & POLICY

SCIENCE VICTORIA

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Solid Waste in Victoria

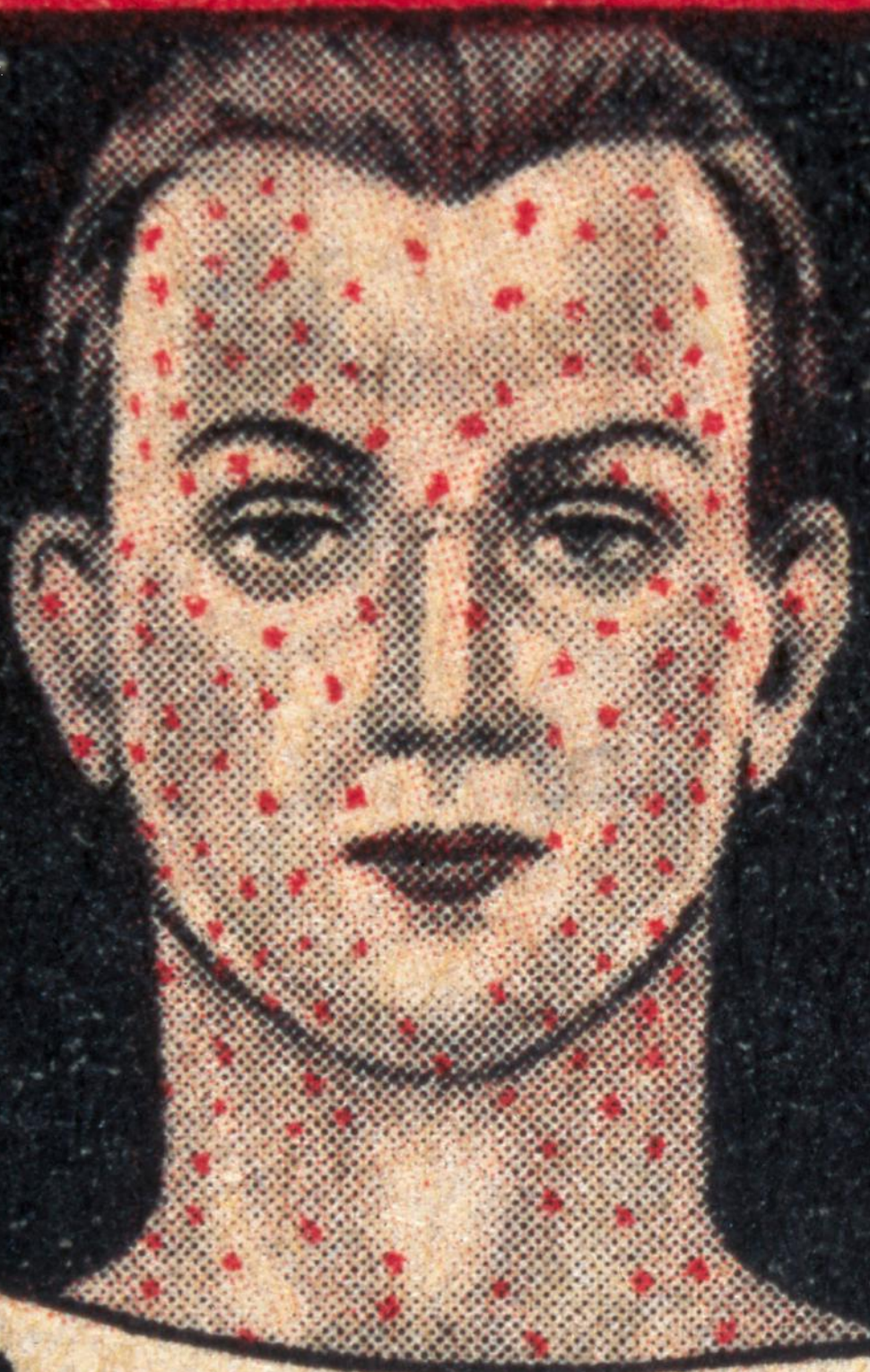
Policy Upcycling

ISSN 2981-8664



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"Get Vaccinated Against Smallpox".
Smallpox, caused by the variola
virus, was eradicated thanks
to coordinated international
vaccination campaigns. Image:
(Left) face of a man suffering
from smallpox; (right) vaccination
against smallpox. Print, ca. 1940.
Source: Wellcome Library, London,
via Wikimedia Commons (CC
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SCIENCE & POLICY

Government policies are plans and guidelines that inform and direct actions on topics such as the environment, health, and infrastructure. Effective policies are informed by evidence, after consideration and weighting of relevant data, while also being responsive to new findings. In this edition, we look at the intersection of science & policy, particularly how evidence-based approaches lead to more effective and adaptable decision-making.



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Photograph: The Climate Reality via Unsplash.



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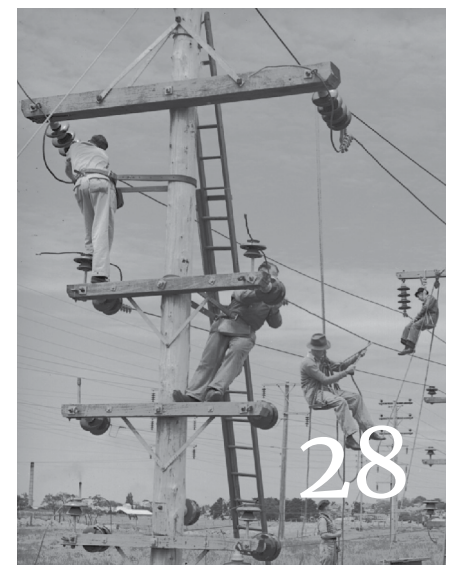
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Upcoming Submission Deadlines

For all 2024 editions and deadlines, refer to page 45.

DECEMBER 2024	DUE DATE
Science & Business	5pm, 15 November

FEBRUARY/MARCH 2024	DUE DATE
	5pm, 13 December

From the Editor

SCOTT REDDIEX

Editor-in-Chief — *Science Victoria*

Particularly when studying and working in a specific field, it can be immensely frustrating when policies of governments, communities, workplaces, and institutes don't consider (or give enough weight to) the scientifically-derived evidence that exists.

The continued, wilful ignorance of many policymakers when presented with the ever-growing mountain of evidence relating to human-driven climate change is an obvious example, but this is only one example among many. While there are many factors in play – money being a major one – a central factor is communication.

Science cannot speak for itself.

It's a key reason we need effective science communication, and also how science can effectively influence policy: you need to be speaking the same language as your audience.

If you are a researcher, publishing in field-specific academic journals, and you aren't clearly explaining your work to audiences outside of your field, then no-one else is hearing it. No-one else has any idea of why your work matters, or how it might inform research in other areas.

With respect to science informing policy, scientists need to be translating their work into the language that policymakers speak. Why is it relevant? Why should they care? And, most importantly, what are the costs of action (or inaction)?

On the other side, policy and decision makers need to have a baseline level of critical thinking and scientific reasoning skills. They need to be able to review the mountain of submissions made on every subject, sort the valid from the nonsense, and use it to make evidence-based actions.

In this month's *Science Victoria*, we've taken a close look at the intersection between science and policy. Dr Don Williams analyses the federal government's recently announced *National Science Statement*, which outlines their priority areas and actions for the next ten years. Dr Joe Pickin from Blue Environment gives a thorough explanation of the history of waste and recycling in Victoria, and what a 'circular economy' means for the future of waste management, while WEHI's Felicia Bongiovanni asks, what exactly creates the gap between evidence-based research and government policy?

Prof Euan Ritchie addresses four of the 'big lies' relating to the protection of our environment and biodiversity, and Dr Natasha Abrahams looks at how we can draw on well-informed – but unimplemented – policies from the past.

Elsewhere in this edition, Dr Catriona Nguyen-Robertson discusses the recent presentation to the RSV on the case of Kathleen Folbigg, and the relationship between science, the legislature, and the judiciary. Dr Geoff Edwards from the Royal Society of Queensland and Griffith University takes a deep dive into the subject of how competition and commercialisation fragment accountability and limit the role of scientific knowledge.

This month also features a report from the Parliament of Victoria's Bill Bainbridge, on the recent report from the inquiry into vaping and tobacco controls. With similarities to public health measures in response to COVID-19, this inquiry looked at everything from the chemical cocktails found in vapes, the individual and public health impacts, the economic impacts, and the recommendations for policy to effectively regulate e-cigarettes in Victoria.

We hope you enjoy this edition of *Science Victoria*.

SCIENCE VICTORIA

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Acknowledgement of Country

The Royal Society of Victoria acknowledges our headquarters are located on Wurundjeri land, never ceded, and convey our respect to Elders past and present. The RSV welcomes all First Peoples, and seeks to support and celebrate their continued contributions to scientific knowledge.

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A roundtable summit at COP27 on green hydrogen. Photograph: IMO via flickr (CC BY 2.0)

Science & Policy or Community Consultation?

ROB GELL

President, The Royal Society of Victoria

After more than a hundred years since the federation of Australia's states, it can be argued that our decision-making processes have become immeasurably fragmented.

Fragmented horizontally across the ever-changing government departments, vertically through three tiers of government (with overlapping areas of responsibility), and in every other direction through the interaction of agencies with different objectives and standards. Our decision-making processes on any given issue are in a dire state.

The proposition that decisions should be science-based, or evidence based, is paralleled by continuous calls to reduce the perceived 'red tape' of environmental and social protections, to allow commercial progress and economic growth. Add the overrepresented voice of well-resourced corporations and their industry associations lobbying for better outcomes for vested interests, and you can see why science-based policy has a tough time. In particular, nature – poorly resourced to represent itself in the courts – continues to suffer.

Science has also become more fragmented, through specialisation and silos of research. Then there's incomplete knowledge and scientific uncertainty. There are often different

item horizons between policymakers, and the interest of the scientist and the policymaker may not overlap — they may not be looking for the same outcomes.

At the local level, community consultation now enables anyone with an opinion to contribute to decision-making on an issue – whether the matter is based on scientific knowledge or not. It's likely that many (if not most) 'community' decisions determining policy would be better informed with an injection of up-to-date scientific information.

At the international level, we also fragment processes that might deliver better outcomes – especially when we look at coordinating any meaningful action to address climate change. As one example, the upcoming Conferences of the Parties (COP) meetings – at which UN member states meet to discuss progress and actions in addressing climate change – will individually consider Biodiversity in Colombia, Climate in Azerbaijan, and Desertification in Saudi Arabia.

Christiana Figueres,¹ former Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC) and an architect of the Paris Accord, made the following comment:

“We have built three different international systems, three different national teams, three different reporting venues and reporting forms.”

“All of this is completely interrelated ... if you look at the planet as the blue marble from outer space, would you be able to differentiate desertification, from biodiversity, from climate change? The golden thread among all three of them, of course, is water.”

“The fact that increasing temperature means a total disruption of the hydrological cycle, and the fact that biodiversity depends on the continuation of the hydrological cycle that we have been having over the past 12,000 years, and desertification the same – the hydrological cycle is moving, and hence we’re having more desertified areas.”

“It’s all about water. And so ... why did we not have a convention on water?”²

Instead, we will have these three separate COP meetings on interconnected issues back-to-back.

Essentially, we need to be having smarter conversations when developing policy. Policy should be informed by the

sciences, and a scientific method employed. Rather than having meaningful action undermined by fragmentation of knowledge and responsibility.

In the context of the efforts of The Royal Society of Victoria, our fourth strategic pillar focuses on addressing The Rise of Misinformation (and disinformation). A central part of that is supporting and facilitating the communication of science by scientists and science communicators, maintaining our scientific journal with a focus on understanding Victoria (*The Proceedings of the Royal Society of Victoria*), and advocating for evidence-based decision making at all levels, on all topics.

As always, we are keen to hear your informed views on this and other scientific topics. Have you got an example of how you have addressed this fragmented/siloed decision making to achieve an effective, evidence-based outcome? You can write to our editor at editor@sciencevictoria.org.au.

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Photograph: Simon Maisch via Unsplash.



Photograph: Karl Heidin via Unsplash.

Science Victoria STEM Photography Prize

Win \$300 and celebrate the world of STEM.

We are excited to announce the first annual *Science Victoria* Photography Prize!

In 2023, we introduced the 'Snapshots of STEM' section to our magazine, as a way to connect the images of everyday science with a general audience.

This year, the images published each month will form a shortlist, from which a winner will be selected at the end of the year.

Applications for the 2024 round are open until 15 November (the deadline for the December edition), and a winner announced in the February 2025 edition of *Science Victoria*.

The winner will receive a \$300 prize, and a certificate.

Images must be original photographs that capture your day-to-day work in STEM. These are not stock photos or overly posed images. Instead, they show what working and studying in a STEM field is actually like.

PRIZE:
\$300 prize, and a certificate.

RESOLUTION:
All photographs must be of sufficient size and quality for printing – as a rough guide, aim for >1.3 MB in file size.

SUBMISSIONS:
Submissions can be made until 15 November 2024 by emailing editor@ScienceVictoria.org.au.

ENQUIRIES:
For any questions about submissions for the *Science Victoria* STEM Photography Prize, please contact editor@ScienceVictoria.org.au.



As part of National Science Week (supported by the Inspiring Victoria program), attendees to Castlemaine and Bendigo Libraries were invited to contribute to an art piece depicting local threatened species. Photograph: Goldfields Libraries



As part of National Science Week (supported by the Inspiring Victoria program) at Phoenix Park Library, children were introduced to robotics. Photograph: Stonnington Libraries.

Photograph: Priscilla Du Preez via Unsplash.



Preventing Psychotic Illnesses: Advances, Challenges, and Debates

Schizophrenia and other psychotic illnesses often begin with a prodromal phase, marked by sleep disturbances, mood changes, and subtle psychotic symptoms like hearing whispers or feeling mild paranoia. Thirty years ago, Professor Alison Yung began researching whether identifying and treating this phase could delay or prevent psychosis. While global research shows promise, uncertainties remain about the best ways to detect at-risk individuals, effective treatments, and whether focusing on high-risk groups is the best strategy. This presentation – the 2024 Beattie Smith Public Lecture – will cover the field’s progress, challenges, and ongoing debates.

DATE/TIME:

Wednesday 13 November 2024, 5pm - 6pm

PRICE:

Free

LOCATION:

The University of Melbourne
Barry St,
Carlton, VIC 3053

BOOKING LINK:

events.unimelb.edu.au/event/42783-beattie-smith-public-lecture-preventing



Photograph: Zbyněk Burival via Unsplash.



Soil Biodiversity: Monitoring to Manipulating for Improved Soil Health

Soil Science Australia, Victoria and The University of Melbourne invite you for the 33rd annual GW Leeper Memorial Lecture presented by Brajesh Singh, a Distinguished Professor of Soil Biology, at Hawkesbury Institute for the Environment, Western Sydney University.

DATE/TIME:

Friday 22 November 2024, 6pm - 7pm

PRICE:

Free

LOCATION:

The University of Melbourne
Grattan St,
Parkville, VIC 3010

BOOKING LINK:

events.unimelb.edu.au/event/43331-soil-biodiversity-monitoring-to-manipulating-for



Innovation Synergy Series: Bridging Minds and Markets

The first Innovation Synergy session will be uncovering all things agricultural technology (AgTech) and agricultural business (AgBusiness). Learn more about the intersection of technology and business in agriculture, and the capabilities required to lead in this field and shape the future of farming and food production in Australia.

Gain insights into cutting-edge AgTech and AgBusiness innovations like precision agriculture, IoT, robotics, and AI, and learn how these technologies integrate into business to enhance productivity, sustainability, and profitability.

DATE/TIME:

Tuesday 26 November 2024, 4pm - 5pm

PRICE:

Free

LOCATION:

Digital Innovation Hub,
La Trobe University
Kingsbury Drive,
Bundoora, VIC 3086

BOOKING LINK:

innovation-synergy-1.eventbrite.com.au



RSV Events

The RSV hosts many STEM-related events, public lectures, and meetings throughout the year. These are held at the RSV Building at 8 La Trobe St, Melbourne (unless otherwise indicated), and simulcast online.

Our public lectures comprise the "Scientists in Focus" component of the *Inspiring Victoria* program in 2024.

Missed an RSV event?

You can catch-up on presentations from world-leading minds at youtube.com/@RoyalSocietyVic

Don't have time to watch a full presentation? Try one of the summary videos to catch the highlights.

youtu.be/CDE446enrt0

Holocene Climatic Fluctuations in the Australian Region

youtu.be/OdSsdcsUO0o

Reimagining Humanity in the Age of Generative AI

Awards & Prizes

The Prime Minister's Prizes for Science 2025

APPLICATIONS CLOSE

Tuesday 17 December 2024

Nominations are now invited for the 2025 Prime Minister's Prizes for Science.

The Prime Minister's Prizes for Science are Australia's most prestigious and highly regarded awards for demonstrated achievements in:

- ▶ scientific research
- ▶ research-based innovation
- ▶ excellence in science teaching

Category: Science Prizes

The prizes will award up to \$1.15 million each year for demonstrated achievements.

- ▶ There are 5 science prizes for science and innovation:
- ▶ Prime Minister's Prize for Science (\$250,000)
- ▶ Prime Minister's Prize for Innovation (\$250,000)
- ▶ Malcolm McIntosh Prize for Physical Scientist of the Year (\$50,000)
- ▶ Frank Fenner Prize for Life Scientist of the Year (\$50,000)
- ▶ Prize for New Innovators (\$50,000)

For more information, and to nominate a scientist, visit business.gov.au/pmprizesscience

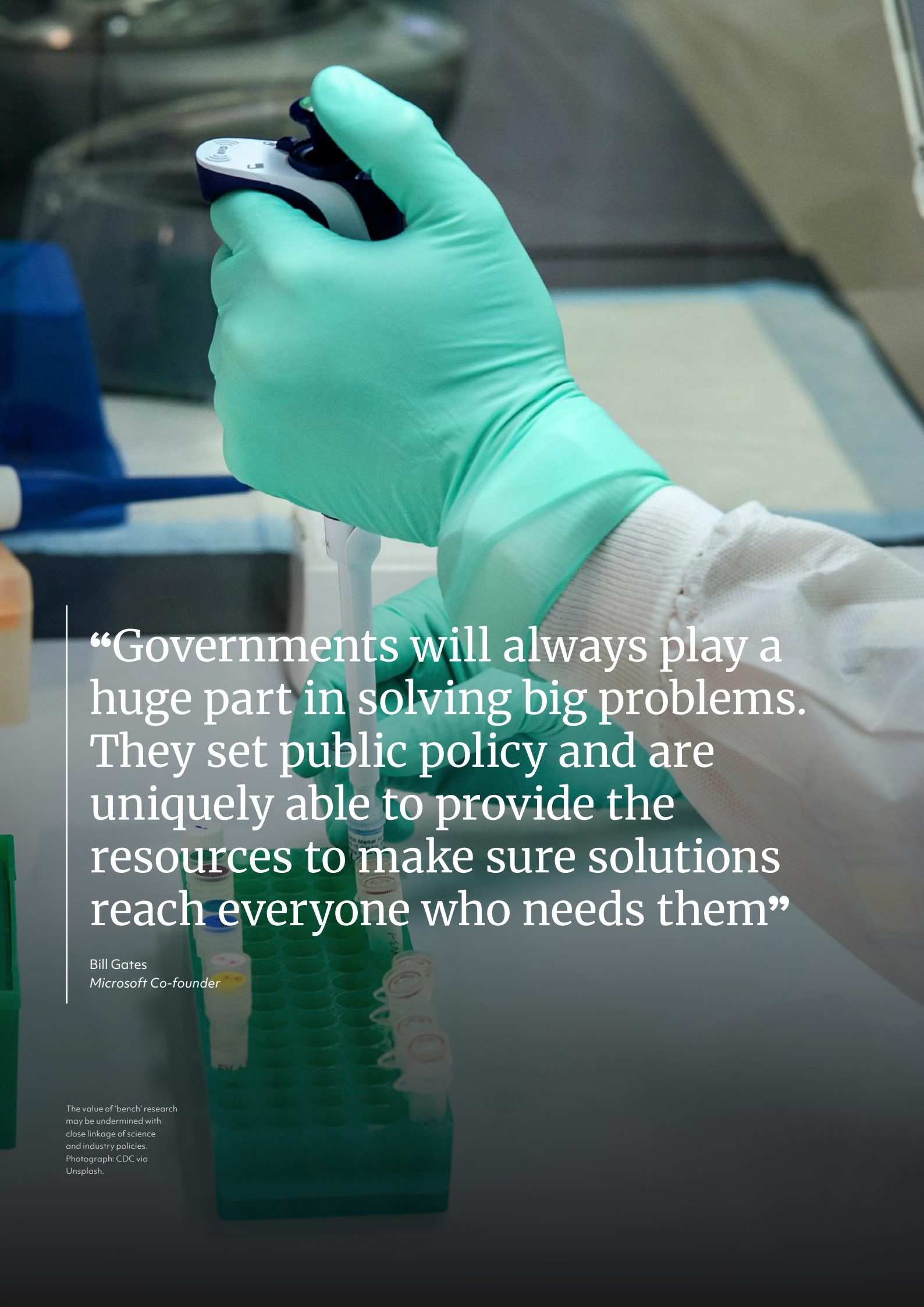
Category: Science Teaching Prizes

The Science Teaching Prizes recognise Australian science educators for excellence in the teaching of science, technology, engineering, or mathematics.

There are 2 science teaching prizes:

- ▶ Prime Minister's Prize for Excellence in Science Teaching in Primary Schools (\$250,000)
- ▶ Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools (\$250,000)

For more information, and to nominate a science teacher, visit business.gov.au/pmprizesteaching



“Governments will always play a huge part in solving big problems. They set public policy and are uniquely able to provide the resources to make sure solutions reach everyone who needs them”

Bill Gates
Microsoft Co-founder

The value of 'bench' research may be undermined with close linkage of science and industry policies.
Photograph: CDC via Unsplash.

Australia’s National Science Statement

Clear Roadmap or Chimera?

DR DON WILLIAMS MRSV

The Australian government recently released a new National Science Statement, which has the sweeping ambition of shaping “science policy and leadership across governments, in our labs, in research institutions and in boardrooms”.¹

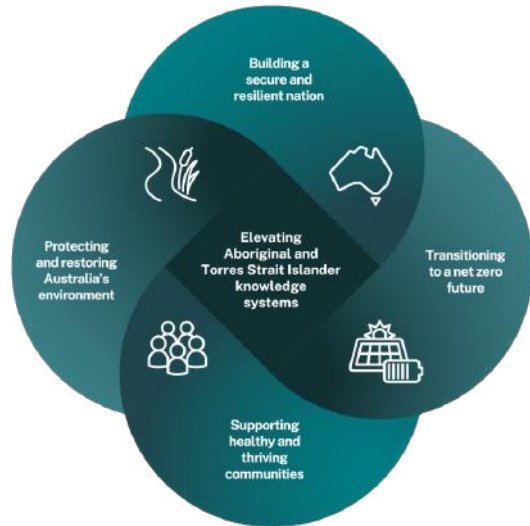
Put simply, the Statement describes how the government intends to support Australian science across the public and private sectors, including research and educational institutions. The Statement is accompanied by five ‘imperatives’, and a set of research priorities.²

An examination of the Statement, including the imperatives and research priorities, identifies both positive elements and potential risks. This article critically assesses the Statement, examines its links to the government’s broader policy agenda, and notes that government policies announced with considerable fanfare must be matched with action to have any real impact.

The New National Science Statement

The previous National Science Statement (NSS) was issued in 2017 by a previous government – and pre-COVID-19 – so the release of a revised version is timely. The new NSS was released in August 2024, following consultation led by Chief Scientist Cathy Foley. It boldly refers to:

“A future made in Australia: Through science and innovation, Australia will develop new industries that drive a dynamic economy, provide well paid jobs, improve our quality of life, preserve our unique environment and build a future made in Australia.”



The overlapping nature of the National Science and Research Priorities. Image: Copyright Commonwealth of Australia 2024 (CC BY 4.0).

The intent of the NSS is clarified by five accompanying imperatives or broad goals, intended to “shape the national science system and national science policy, and their influence on Australia’s transformation, over the next 10 years”. These imperatives are:¹

1. Australian scientists, science institutions, and infrastructure shaping Australia’s science future
2. Science at the centre of Australian industry
3. A diverse, skilled workforce to underpin the translation of science into new industries
4. Embracing science to drive Australia’s regional and global interests
5. A science system prepared for future challenges.

As these imperatives do not identify specific priorities for research, the NSS is also accompanied by a set of National Science and Research Priorities, which “will guide Australian science and research efforts”.² The research priorities are:

- ▶ transitioning to a net zero future
- ▶ supporting healthy and thriving communities
- ▶ elevating Aboriginal and Torres Strait Islanders knowledge systems
- ▶ protecting and restoring Australia’s environment
- ▶ building a secure and resilient nation.

Linking Science and Industry

The most important feature of the NSS and the imperatives is their explicit, strong connection with the government's industry policy. Tellingly, the Minister for Science Ed Husic MP is also the Minister for Industry. He stated that:

“The Albanese Government wants our world-class science and research sector to help build a Future Made in Australia. We have today released Australia’s new National Science Statement and National Science and Research Priorities placing science at the forefront of our industrial transformation...We want science to drive industry growth, creating stronger businesses and more secure, well-paid jobs for Australians.”³

Linking science policy with the government's broader policy agenda is consistent with contemporary theories of public administration, which condemn 'silo' thinking and claim that more integrated, whole-of-government policies produce better outcomes for the community.^{4,5,6}

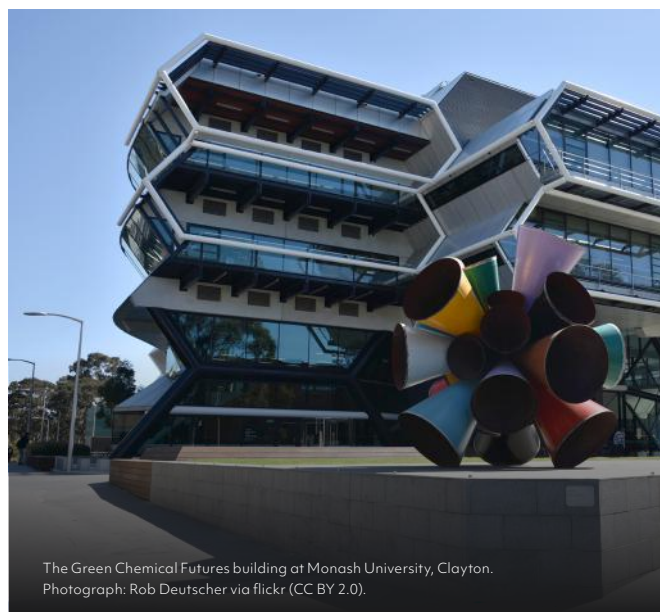
Pragmatically, explicitly linking science with another key government policy should provide welcome support for scientific research during the competition for attention and funding that is inevitable at senior levels of government and the bureaucracy.

The allocation of very substantial funding to industry policy should ensure that funds are available for industry-related scientific research.⁷

That said, there are risks associated with this whole-of-government approach. One of these is that a marked change of direction by a future government could 'strand' initiatives taken to support the current government's industry policy. The 'Made in Australia' industry policy is already a subject of political debate and criticism.^{8,9}

Sharp changes in policy directions are not unusual in Australia's political history, as highlighted by the divergent positions on addressing climate change adopted by governments over the past 30 years. This type of political risk is hard to mitigate, but the scientific community should be aware of it and accept the need to adapt to changed government priorities, if they arise.

A potential risk of closely linking industry and science policies is that it could lead to "science" being perceived at senior political levels as a technical input that facilitates industrial development but does not provide other value. In other



words, it would be judged largely on its industrial/commercial outputs, and would not recognise the benefits associated with fundamental scientific research. Advocates for pure science may struggle to be heard.

This possibility was recognised by the Group of Eight (representing Australia's leading research-intensive universities) in its feedback on the draft research priorities, which included a recommendation that "The Priorities should also include an explicit call for support for basic research – in itself a national Priority – given its critical importance".¹⁰

The research priorities, and the NSS more generally, do not recognise the importance of basic research in the way recommended by the Group of Eight.

And What About Science Education?

The Royal Society of Victoria contributed to a submission during the consultation phase of the NSS as the Victorian member of the Inspiring Australia Network, calling for additional recognition and support for science teaching. The submission also argued for enhanced community engagement with science. The submission endorsed:¹¹

“...the position presented by...the Inspiring Australia Network in relation to support for science teachers and community science engagement...there is significant need for improvement in staffing numbers...A significant improvement in conditions and facilities for science teaching staff is required...together with a general elevation of the value of science teaching in our culture.

Further, a more robust and strategic commitment to resourcing the Inspiring Australia community science engagement program is needed to fulfil Australia's commitment to UNESCO's recommendation on Open Science.”

Recognition of these issues in the NSS is limited. The explanatory text that accompanies the imperatives indicates that the government will “Celebrate and invest in science professionals in every sector, from our science teachers in primary and high school classrooms...to our scientists making world-leading discoveries”.

The Australian government does provide some support for resources and professional development to support STEM teaching, but the level of funding is modest. For example, the 2024/5 budget allocated \$34.6 million over four years to continue the delivery of several national STEM teaching resource hubs – an amount that is unlikely to be transformational.¹²

The text supporting the imperatives also states that the government will “Modernise our science agency systems and decision-making mechanisms, including to better support open science and cross disciplinary and cross institution collaborations”.

The brief references to science teaching and open science in the NSS imperatives do provide glimmers of hope. However, this hope should be tempered by the very strong efforts to link science and industry policy that pervade the NSS and the imperatives. In the political domain, the attention of high-level government decision makers will inevitably focus on making, and being seen to make, this science/industry nexus succeed. Support for science teaching and open science will be at risk of being relegated to second-tier status

Support for Science Education: Commonwealth or State?

Science advocates need to take all possible opportunities to support science teaching, including via the NSS. That said, the potential impact of the NSS on science teaching is tempered by the reality that “Under the Australian Constitution, education in Australia is largely the responsibility of the State and Territory Governments”.¹³ Material improvements in STEM teaching at primary and secondary levels will not occur without real recognition of the issue, and the provision of corresponding funding, by state/territory governments.

Fortunately, the Victorian government has introduced some initiatives to enhance STEM teaching, including offering courses to improve the STEM skills of secondary teachers and training primary school teachers to become specialists in either science or mathematics.^{14,15} These welcome initiatives suggest

there is some recognition at the state level of the need to improve STEM teaching. Advocates should call for additional support from the Victorian government to build on these initiatives.

Conclusions

The release of a new NSS is timely. The NSS, and the accompanying imperatives and research priorities, closely align the Australian government’s science and industry policies. This should ensure that science is highly visible in government policy debates and is well placed in the inevitable competition for funding. However, potential risks should not be ignored. These include the possibility of future changes to industry policy, which could affect the implementation of science policy, and the potential for government decision makers to perceive science as little more than a technical input that facilitates industrial development.

The NSS does include some recognition of the need to improve science education and open science, but this may be overshadowed by the Statement’s very strong emphasis on linking science and industry policies. Also, education is largely a state responsibility, and advocates should ensure their interventions reflect this reality.

Ultimately, the real value of the NSS will only be measured when government initiatives to, for example, “Celebrate and invest in science professionals in every sector” have (or have not!) been implemented. While the risks presented warrant some attention, the Statement’s rhetoric appears to point in the right direction. However, it goes without saying that this means nothing if corresponding action, particularly the allocation of realistic funding, does not occur.

► *Don Williams MRSV worked for 30 years in the water quality management, wastewater regulation and water efficiency fields. Don then completed a PhD examining how planning laws influence the adoption of sustainable urban water practices. Don has a long-standing interest in how scientific knowledge informs the development of public policy.*

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Hazelwood Power Station (1964-2017), a brown coal-fired power station located in Victoria's Latrobe Valley. Photograph: Beyond Coal and Gas via flickr (CC BY 2.0)

Science Without Action

What creates the gap between evidence-based research and government policy?

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The devastation caused by climate change needs no introduction. It seems like each year we record the “hottest summer on record”, and there always seem to be unprecedented natural disasters unfolding somewhere around the world.

There is a virtually unanimous agreement among scientists that modern climate change is caused by humans. In fact, it was almost 100 years ago that a link was found between the increase in carbon dioxide emissions due to the rise of industry and the warming global temperatures.¹ Scientists have been calling on governments for decades, desperately trying to encourage policies to align with their research findings, but governments have been in no rush to respond.

Unfortunately, climate change is not the only example of this. So why, despite scientific evidence, does little translate into policy and action?

Mo' money, mo' problems: the economic interests

Money makes the world go round. It's no surprise that economic factors are a major consideration when it comes to implementing new policies. Australia was the fourth largest fossil fuel exporter in 2019, which contributed \$115.5 billion to our national gross value.² In addition, fossil fuel industries provide jobs, which grants income to employees and to the government through employee taxes. This may be why last

year there were 116 new coal, oil, and gas projects planned to start, which would bring in billions more dollars – and output billions of tonnes of greenhouse gases.³

Yet the addition of fossil fuel projects simply doesn't align with the target of net zero greenhouse gas emissions by 2050.

Of course, there is nuance to the situation. There would be a significant impact on the Australian economy to suddenly cease all operations. It would lead to job loss for thousands of people and introduce instability to the economy given how much the sector contributes to our GDP.² Additionally, we do not yet have the resources for our infrastructure to completely rely on clean energy, so energy shortages would occur if we were to immediately stop all fossil fuel projects.

Does this mean the government should be supporting more projects? Of course not. However, there is a balance to transitioning away so that the economy, and therefore our population, are not negatively affected, and not prioritising profits. The latter seems to still be part of the equation.

Best interests in mind: industry pressure

Unfortunately, industries do influence policies - or lack thereof. A great illustration of this is the tobacco industry, which undermined scientific evidence about the detrimental health effects of tobacco while lobbying for their own interests.

One of the main ways they successfully did this was the "revolving door" approach, where the industry recruits former government officials so that they can use their knowledge of the policymaking process to influence it.⁴ In this case, these officials would use their connections to lobby for policies in favour of the tobacco industry.⁴

The revolving door approach is still used by the alcohol, food, and gambling industries. As with the tobacco industry, these sectors offer financial incentives and use strategic messaging to have the public and politicians in their favour.⁵ This raises many ethical and moral questions about the bias in policymaking and the balance between evidence-based research and industry influence on decisions for policy.

In Victoria alone, there is a strong perception that gambling is harmful and a public health risk,⁶ yet it is impossible to turn on free-to-air television or browse the internet without seeing an advertisement promoting gambling. Despite public opinion and an abundance of research illustrating the harm of this sector, little has been done to change the situation.

Your opinion matters: social factors

Public opinion matters. We've seen the significant influence it has when it comes to implementing policies, such as those created for gender equality and marriage equality. However, it also plays a role in the lack of policy, even when weighed up against evidence-based research.

Any Victorian that resided in the state between 2020-2022 will be very familiar with the "mask mandate" and lockdowns. Public opinion on mask mandates was quite divided, with some people understanding the importance of wearing them to decrease transmission, while others feeling it imposed on their freedom.

The government was aware of the public stance on masks, which is one of the reasons why health advice was ignored and the government stopped driving the mask mandate despite the arrival of the Omicron variant of COVID-19.⁷ This was also part of the reason behind the cessation of lockdowns, even though Omicron delivered the highest COVID-19 case numbers yet. Of course, there were also economic factors – small businesses were struggling and travel was virtually non-existent. But the public voice was loud, and played a significant part in the policy going against health advice.



Face masks remain a common sight in Melbourne. Photograph: Jane Slack-Smith via Unsplash.

Lessons on the matter

The great divide between evidence-based research and government policy is complex. It is evident that several factors are at play (including others not discussed). There is nuance here that needs to be considered, but above all else, policies need to be implemented with the best interests of the population in mind, not of those creating the policies. We're already seeing the impact of waiting too long to make significant changes with climate change, this cannot continue. We cannot wait until it's too late.

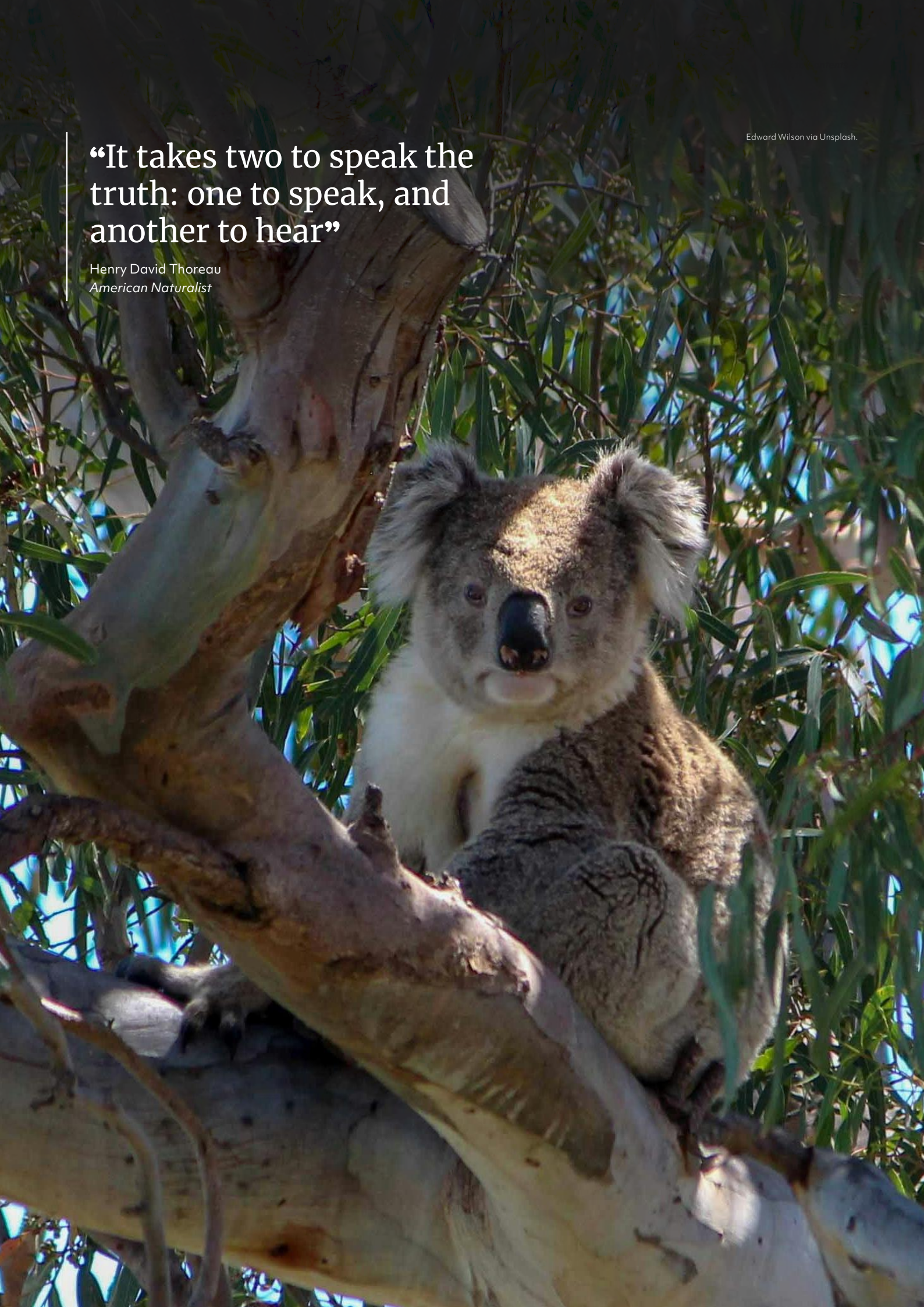
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“It takes two to speak the truth: one to speak, and another to hear”

Henry David Thoreau
American Naturalist



Saving Australia's Biodiversity Means Ending the Lies

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If we are to have any hope of protecting and restoring Australia's wildlife and the ecosystems they call home – with which our own survival and wellbeing are inextricably linked – what's needed more than anything is honesty.¹ Like the child stating the obvious about the Emperor's lack of clothes, collectively we must stop accepting, settling for and perpetuating the patently absurd regarding the conservation of nature. We need honesty from our governments and political leaders, institutions, industry, and ourselves.

Let's dispel some of the most common and oft perpetuated dis- and mis-information relating to the environment and biodiversity.

Lie 1. Australia's government can't afford to fund the majority of environmental protection and repair

Australia is a sovereign nation, and can therefore fund whatever it deems an important priority.² There are currently more than 2,000 threatened species and ecological communities in Australia, and this number is rapidly rising.³ The federal government has classified 110 species and 20 places as *priorities*.⁴ Funding that supports the environment *does not* come at the cost of other priorities, in fact it benefits them.⁵

For perspective, the federal government is planning to spend a minimum of > \$360 billion on AUKUS (the security partnership between Australia, the UK, and the USA), and the Biodiversity Council estimates the government also spends more than \$26 billion annually on subsidies likely to harm biodiversity.⁶

The Wentworth Group of Concerned Scientists has calculated that for ~\$7.3 billion per year over 30 years (\$219 billion total) we could take massive strides towards achieving far greater environmental protection and recovery.⁷

It is therefore frankly nonsensical that the federal government suggests we need a much-criticised and highly dubious nature repair market to finance conservation.⁸ Are we really to believe that capitalism and markets – that created the very issues we confront – will also now be our saviours and the solution? This obfuscation and absolution of responsibility by government is truly shameful, especially when we consider what's at stake and how little time we have to turn things around.

We are fortunate to have many world-leading environmental and climate experts and more than enough knowledge and expertise in Australia to address the problems we face. What we continue to lack, and severely so, is sufficient government ambition and financial support.

Lie 2. We can continue harmful actions and simultaneously sustain a biodiverse, nature positive world

Minister for the Environment and Water, Tanya Plibersek, claimed at the Global Nature Positive Summit '*We're doing everything we can to protect our extraordinary oceans and marine life*'.⁹ This statement is quite hollow, given that the very same Minister has:

1. Recently approved the expansion of three coal mines which will contribute further greenhouse gas emissions, driving increased warming and negative impacts on the Great Southern and Great Barrier reefs, which are already under severe pressure.^{10,11}
2. Permitted industrial fishing to continue within deep waters of a marine sanctuary in the vicinity of Heard and McDonald Islands,¹² placing marine biodiversity at risk.
3. Failed to rapidly and sufficiently curtail the impacts of the salmon industry and other threats, driving the Maugean skate to the very brink of extinction in the wild.¹³

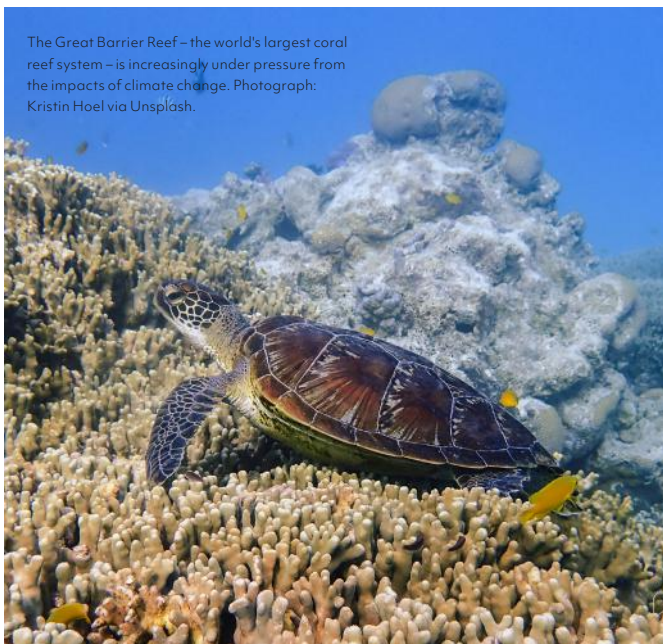
On land, the picture is no brighter. Forest homes of threatened greater gliders were destroyed *during* the nature 'positive' summit.¹⁴ Endangered koala habitat was recently cleared, allegedly unlawfully, for coal mining.¹⁵ The Victorian government has chosen to extend and geographically expand the Unprotection Order and killing of dingoes in eastern Victoria,¹⁶ despite dingoes being a listed threatened species and this decision being deemed culturally harmful and strongly against the concerns of many First Nations peoples.¹⁷

Likewise, First Nations peoples and local communities have had their concerns ignored on Larrakia Country (Darwin), where the development of a defence housing project has already destroyed habitat at Lee Point (Binybara), home to several threatened species and an extraordinarily rich diversity of other wildlife.¹⁸ Further works have been paused as there are allegations some of the habitat destruction that occurred was unlawful.¹⁹

We live on a finite planet, where life has evolved to exist within certain conditions and boundaries. No amount of politics, greenwashing, and sleight of hand (see carbon and biodiversity offsetting)^{20,21} can escape from the fact that habitat destruction, in all its forms, inevitably drives biodiversity decline and extinction.

“The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for destruction.”

— Rachel Carson



The Great Barrier Reef – the world's largest coral reef system – is increasingly under pressure from the impacts of climate change. Photograph: Kristin Hoel via Unsplash.

Lie 3. Increased environmental protection risks jobs and economic growth

One of the most well-worn and defeatist tropes is ‘it’s jobs and economic growth versus environmental protection and sustainability’. Such a deception is regularly perpetuated by many media outlets, and manifests in multiple ways. Minister Plibersek’s ministerial appointment was labelled a ‘demotion’ by many,²² but how can this be so? The environment literally keep us alive, it brings us great joy and is essential for our wellbeing, it drives our economy,²³ and has enormous cultural and social values. Sounds important to me!

The great tragedy here is that many politicians, industry and organisation leaders, journalists, and others lack ambition, imagination, and fail to see Australia has an enormous opportunity,²⁴ one that is the envy of others across the globe. Environmental protections and repairs are not a cost, they are a very shrewd *investment*.²⁵ We only need look at Costa Rica to see what’s possible when government and society truly seize a bold, sustainable future with nature at its core in their commitment to decarbonise their economy.²⁶ By investing in the conservation and repair of nature, Australia could reap benefits across society.²⁷

Lie 4. We can achieve and sustain a biodiverse world without far stronger environmental laws and enforcement

Following the arrival of Europeans, Australia’s environmental demise has been rapid and severe.²⁸ It’s not merely an historical tragedy – our environment is continuing to deteriorate at

an alarming rate. The harms inflicted are well documented and have occurred under local, state, territory and federal governments of varied political persuasions.²⁹ Despite attempts to make this a partisan issue, it’s very much a shared failure.³⁰

Let’s not forget, both the current and previous federal Environment Ministers (Labor and Liberal, respectively) have argued that they do not have to consider the environmental harm that emissions from fossil fuel projects may cause.³¹ Perhaps this is why the current government is also refusing to install a “climate trigger” that would consider the impacts of development proposals on emissions.³² Political expediency cannot defeat fundamental laws of physics and chemistry. If we continue to fill the atmosphere with greenhouse gases, the world will continue to warm, extreme weather and fire events will disturbingly become increasingly normal, and humans and other life will suffer, greatly.^{33,34,36}

Despite the scathing independent review of the performance of Australia’s environmental laws (EPBC Act),³⁶ led by Professor Graeme Samuel AC, and a commitment by the current government to end ten years of neglect,³⁷ the full reform package has not been delivered, and no time has been set for when this will occur,³⁸ if this occurs. There is now a genuine risk of environmental laws and the associated Environment Protection Australia agency being watered down,³⁹ and hence rendered inadequate and ineffective, against the comprehensive recommendations of the Samuel review and scores of environmental experts. Environmental laws and protections are also under severe pressure at state and territory levels, including in Western Australia and the Northern Territory.^{40,41}

There are many key ingredients for progress towards achieving genuine social and environmental justice and better outcomes for the conservation of nature. Media diversity and ownership, and laws related to political donations, whistleblowing, and anti-corruption are vital. But I will leave these to be discussed by others far more expert on these topics than I.

Importantly, we must own our individual choices and impacts. What we eat, wear, how often and by what means we travel, and whom we vote for...all of these things matter. The privileged minority causing the vast majority of environmental harm must be accountable.⁴² It is all too easy to fall back on another trope, that environmental decline is largely a function of too many people. Yes, population size is an issue that must be addressed in a thoughtful way, but wildly contrasting rates of consumption and social and cultural equity must also be central to discussions.⁴³ None of this will be easy, but it is vital.

More than ever, we need to summon, support, and celebrate courage, the courage to speak truth to power, out loud, and wherever possible, in public. We must be honest with ourselves and others, and stop perpetuating lies.

“There is a price to pay for speaking the truth. There is a bigger price for living a lie.”

— Cornel West

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Photograph: Gary Yim via Shutterstock.

Science, Media, and the Law

Lessons from the Kathleen Folbigg Case

DR CATRIONA NGUYEN-ROBERTSON MRSV

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Sometimes it might feel like the world is stacked against you. In the case of Kathleen Folbigg, the entire judicial process was stacked against her.

She was wrongfully convicted in 2003 of murdering her four infant children over a ten-year period. She spent decades behind bars, accused of harming the children that she so tragically lost, and labelled as Australia's worst female serial killer.

The system was against her from the beginning. Her father was a criminal, murderer, and savage of the underworld. She was portrayed as her "father's daughter".

At the time of her trial, Kathleen had little chance of a 'not guilty' verdict. Scientific and medical evidence suggesting that Kathleen's daughters died of natural causes was dismissed, and her words were taken out of context.

"Team Folbigg" faced many barriers to getting complex science considered as robust legal evidence in the Australian judicial system. But after a 20-year legal battle, her name was cleared. She was pardoned and released from prison in June 2023, and exonerated — her convictions finally quashed — in December.

Why was she convicted in the first place?

Kathleen had her first child in 1989, who passed away 19 days later. Neither of her next two children survived beyond a year. The deaths of her three infants were attributed to sudden infant death syndrome, or SIDs, an umbrella term encompassing sudden, unexplained deaths of seemingly healthy babies.

Kathleen's fourth child, Laura, passed away at almost 19 months old. Even Laura's death was initially determined to

be medical at first...until the autopsy doctor learned of the deaths of Laura's siblings. He notified the police, believing that smothering was a possibility.

Instead of being allowed to mourn the loss of her fourth child in a decade, Kathleen faced the full brunt of the NSW police, the judicial system, and a hostile Attorney General.

The conviction relied on Meadow's law: that "one infant death is a tragedy, two is suspicious, and three is murder". Ironically, the year after Kathleen's conviction, the reputation of retired paediatrician Roy Meadow, who first stated this, was severely damaged after it came to light that his role as an expert witness led to the wrongful conviction of several mothers who had been accused of killing their babies.¹

In the case of the four Folbigg children, Meadow's law suggested that someone was to blame. Responsibility was placed solely on Kathleen, as she had been the only one in the presence of each child when they died, or had been the one to find them deceased. All evidence was circumstantial, and almost no scientific evidence was asked for or considered.

The science that set Kathleen free

Immunologist Professor Carola Vinuesa was pulled into the Folbigg case in 2018. She read the medical files of the deceased children and saw signs of underlying illnesses in all four, such as respiratory infections. Just one month earlier, she and colleagues had identified a rare genetic mutation that appeared to explain four mysterious infant deaths in a family in Macedonia.²

More than one-third of sudden deaths in children can be explained by genetic conditions.² Furthermore, studies over the years have shown that siblings of infants who have died of

SIDS have a fourfold greater risk of dying suddenly.³ Carola therefore became quickly convinced of Kathleen's innocence.

Carola's team collected a DNA sample from Kathleen. The sample revealed a mutation in a gene, *CALM2*, that encodes the calmodulin protein, whose malfunction has been implicated in heart disorders and infant deaths. After testing existing blood samples from the Folbigg children, it was clear that the children had indeed inherited the mutation.

This was a new area of research. At the time of the first judicial inquiry into Kathleen's convictions, there was no definitive experimental evidence. Carola presented the prediction that the mutation *likely* caused the children's deaths, but there was still a level of uncertainty.

Instead, the evidence that was used to make a decision at the hearing were Kathleen's journals. Kathleen had been journaling since her teens, and continued as a grieving mother to process her trauma. The journals were analysed by a legal team – never a psychologist or psychiatrist – and the entries were viewed as evidence to admissions of guilt and used to seal Kathleen's fate for another few years.

Carola then reached out to cardiologists, and one, Professor Peter Schwartz, had overseen a case that mirrored this situation: a healthy mother with a similar calmodulin mutation had two children suffer heart attacks and one dying.²

Carola, Peter, and other scientists continued their investigations. They compiled scientific evidence, including publishing studies suggesting the *CALM2* mutation was indeed detrimental to cardiac health and data showing that both Kathleen's sons had mutations in another gene known to cause lethal epilepsy in mice.⁴

The tide began to turn.



Tegan Taylor (health and science reporter for the ABC) chaired the session at the RSV. Photograph: Dr Catriona Nguyen-Robertson.

Changing Kathleen's "fate"

While ultimately successful, the voice of scientific expertise was difficult to establish in the emotionally charged, challenging case. It required a sustained campaign by a team of Kathleen's close friends, philanthropists, scientists and legal professionals championing the cause.

The team of scientists had to work tirelessly to amass genetic evidence that explained the children's deaths – and ensure that this evidence was listened to.

Having clear scientific evidence now published in peer-reviewed journals supporting Kathleen's innocence, 100 eminent scientists from around the world, medical practitioners, and other prominent Australians signed a petition calling for Kathleen's immediate pardon. The Australian Academy of Sciences also backed the plea.

While more and more high-profile and influential people were being drawn to the case, the team waited months without a decision from the Attorney General.

If taxpayer money was to be spent on a second inquiry, the Team Folbigg needed to change the narrative around Kathleen from "murderer" to a mother wrongly incarcerated.

With public opinion overwhelmingly shaped by the media, they launched a massive media campaign. Kathleen's story was all over main news coverage both internationally and locally. This eventually applied enough pressure on the Attorney General and Director of Public Prosecutions to open the doors again for another inquiry.

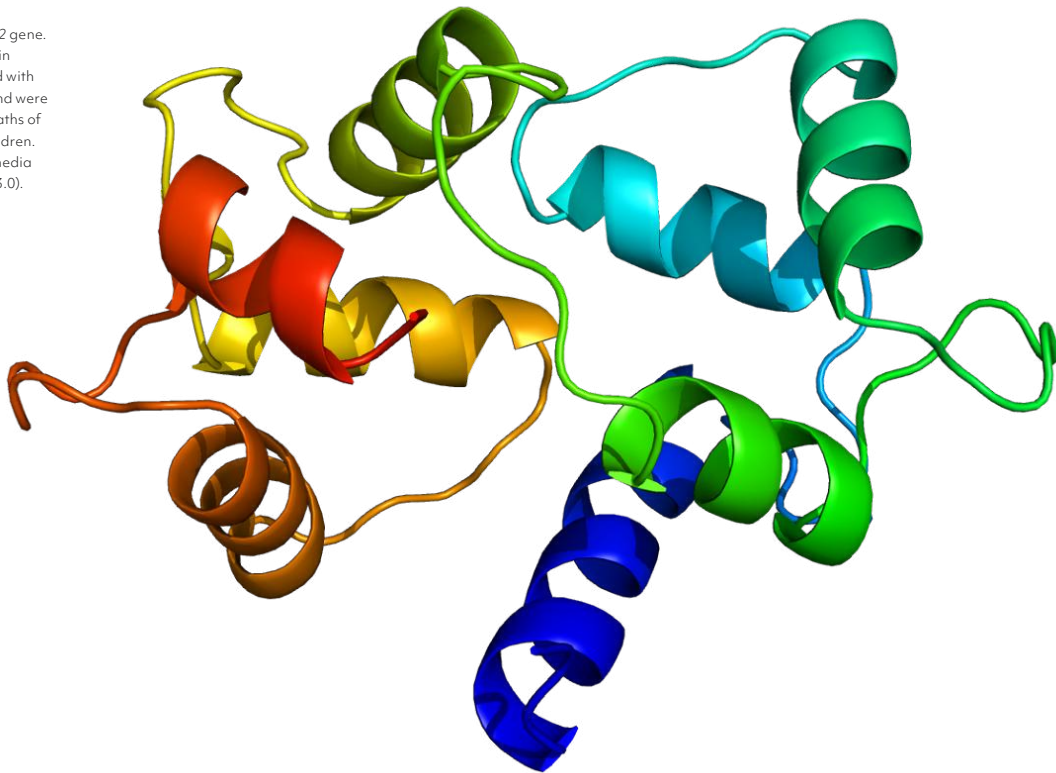
One of Kathleen's high-profile supporters was businessman Peter Yates, who helped raise around \$200,000 from the business community to finance transport and accommodation for the legal team and scientific expert witnesses. The Academy of Sciences assisted with recruiting the right experts from around the world, and Peter wanted to ensure that they could make the inquiry in-person to do Kathleen's story – and the science – justice.

The scientist experts at Kathleen's second inquiry in 2022 were put through six hours of questioning. Unlike in the first inquiry, the questioning was not hostile and dismissive. According to Anna-Maria Arabia, Chief Executive at the Australian Academy of Science, their answers were "just great scicomm". The science was heard, and there was now reasonable doubt that Kathleen had killed her children.



Tegan Taylor, Peter Yates, Tracy Chapman, Anna-Maria Arabia, and Professor David Balding at the National Science Week panel. Photograph: Dr Catriona Nguyen-Robertson.

The structure of the protein Calmodulin 2/CALM2, encoded by the CALM2 gene. Hereditary mutations in CALM2 are associated with cardiac arrhythmias, and were responsible for the deaths of Kathleen Folbigg's children. Image: Emw via Wikimedia Commons (CC BY-SA 3.0).



Creating a more science-sensitive legal system

To this day, there are hundreds of mothers in court cases, accused of inflicting harm to their children, when the cause is most likely rare genetic disorders that we do not yet know much about. Some have even sought Carola's help after this case.

Science can now play a greater role in explaining sudden deaths that seem suspicious. There may be other genetic diagnoses that may have been missed. There needs to be more collaboration between the scientific world and the legal profession.

According to Anna-Maria, the problems in Kathleen's case present three opportunities for law reform:

1. A reliability standard for evidence presented. Not anything can be presented as "evidence" – especially the diaries of a grieving mother that were not even looked at by a psychologist or psychiatrist.
2. A way to select independent and reliable experts – the role that the Australian Academy of Sciences played in this case.
3. Mechanisms to review appeals so that new scientific evidence can be heard in cases as it emerges. Two decades ago, we did not know of the calmodulin mutations that likely led to the deaths of Kathleen's children – but there is no question that it should have been considered when it did come to light.

It is also important for experts to be briefed or trained in science communication so that they can present complex scientific evidence to judges and juries – and the wider community, who form public opinion. For science to have influence in court proceedings, it needs to be understood.

Kathleen should have never been charged. There had been no evidence to implicate her. There had been reports of her infants' poor health. To put a grieving mother on trial for the murder of her children was unjust.

Her story is one of science and scientists fighting to be heard in a legal system that is not equipped to keep up with the pace of research. Australia needs to ensure that this doesn't happen again to others.

► *This article follows a presentation by Peter Yates (Board Chair in Financial Stewardship, Science Engagement and Not-for-Profit), Anna-Maria Arabia (CEO, Australian Academy of Science), Professor David Balding (Statistical Geneticist), and Tracy Chapman (Friend and Advocate to Kathleen Folbigg). Presented as part of National Science Week and co-hosted by the Australian Academy of Technological Sciences and Engineering (ATSE), Royal Society of Victoria and the Australian Academy of Science. Watch the full discussion here: [youtube.com/watch?v=7MgOKHon6RU](https://www.youtube.com/watch?v=7MgOKHon6RU)*

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The once-familiar landscape of the municipal 'tip.' Photograph: Andromeda stock via Shutterstock

Solid Waste in Victoria

Past, Present, and Future

DR JOE PICKIN

Director, Blue Environment

Waste is an upside-down material transaction. Usually, exchanges of money and materials are in opposite directions – I give you money, you give me stuff. But when you pay a waste company to provide their service, they take both the money and the materials. There are obvious risks with this transaction, which increase significantly with scale.

Price is a key consideration in choosing a provider, but waste transactions might be cheap because the waste will be badly managed or dumped. Poorly constructed landfills can leak, stink, burn, and support pest animals. Promised recycling may not occur.¹ Criminal gangs sometimes hire a warehouse, put out the word of a cheap recycling option, then disappear when the warehouse is full of tyres or demolition waste.^{2,3} Naivety or bad luck can also lead to orphaned stockpiles, when markets for recovered products fail, or equipment works worse than promised.

Waste management is quintessentially collective, and the potential for private benefit at public cost justifies government intervention. Protecting the environment from waste needs laws, regulations, engineering specifications, standards,

licences, monitoring, outreach programs, investigators, scientists, and lawyers. State environment protection authorities do much of it.

As well as direct environmental protection, there are strategic aims needed when managing waste flows. The 'waste hierarchy' is the best recognised articulation – it preferences reducing and reusing waste, then recycling and energy recovery, and lastly disposal. The modern policy concept is the 'circular economy', which aims to keep products and materials in circulation and at their highest and best use for as long as possible, with contributions through better design, maintenance, reuse, refurbishment, remanufacture, recycling, and composting.⁴ This needs targets, financial incentives, grants, markets, advocacy, innovation, data and public education. Several states – including Victoria – have established separate organisations for this agenda.

This article focuses on the application of this strategic aim, beginning with how Victoria's recent waste history has led to the circular economy has become a guiding principle for our state's waste management.



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Waste in Victoria – a history

At the end of the 1960s, most Victorian local governments ran their own tip, typically in an old and unlined quarry, and restricted to locals. This resource was supplemented by backyard and industrial incinerators – quite literally, burn your rubbish at home. There was little control or knowledge of what or how much went where.

During the following decade, the politics of pollution made major inroads. In 1971 Victoria was the second jurisdiction in the world to form an Environment Protection Authority (EPA). *The Environment Protection Act 1970* centralised the regulation of industrial discharges. The waste hierarchy became popularised.

Around this time, beverage companies stopped wanting their empty bottles back to wash and refill them, as it was no longer cost-effective. This went down badly in the community, and there were calls for container deposits. Inquiries followed, and deals were done. Recycling targets were negotiated with paper and packaging companies. Industry pushed for an ‘integrated solution’ to recycling through local government, and helped set up the first formal municipal recycling collections. Municipal recycling went mainstream in the 1980s, but industry battled against tightened targets and the cost of recycling was increasingly borne by ratepayers. Volatility in prices paid for collected materials was a major challenge, and led to stockpiles and periodic bailouts.

A landfill levy of \$3/tonne was imposed on metropolitan commercial waste in 1992. The increased price of the alternative helped make recycling more attractive, and funds could be used for strategic support for recycling. It proved a successful approach, and the rate and the revenue climbed over the subsequent decades. In July 2025, the metropolitan levy will increase to \$167.90/tonne.

The increasing complexity and demands of waste management saw major changes in its delivery. Local earth-moving contractors mostly withdrew or sold up, and specialist national and international operators became prominent. Local governments also began to withdraw from direct waste management. Most contracted out the collection processes

and, in the cities at least, sold their landfills. The big waste companies developed large-scale engineered landfills and invested in recycling. The support from the landfill levy saw construction and demolition waste recycling take off, substituting for quarry materials. Composting grew in size and scope.

Piecemeal deals with the packaging and paper industries gave way to the 1999 *National Packaging Covenant*. Signatories were required to develop a public action plan, submit annual reports, and contribute to funding recycling. Business flocked to sign, but in those early days many action plans focused more on reducing their own waste than stewardship of their products. Some simply copied the action plan of their industry association. The \$11 million transitional funding from industry was less than 2% of the cost of municipal recycling costs over the initial Covenant period.⁵

Product stewardship of oil was introduced in 2000. This was the first and is still the most successful mandatory product stewardship program – where sellers of a product take a voluntary or mandatory role in its end-of-life management. A levy on oil purchases funds a collection program so that the cheapest option for auto mechanics is collection for re-refining.

Life cycle assessments in the 2000s compared the greenhouse gas emission implications across the whole product chain of “virgin manufacture and discard to landfill” with recycling.^{6,7,8} Recycling was shown to be better in almost all cases. The increasing political difficulty in establishing new landfills gave additional force to these arguments.

Victoria’s first waste strategy *Towards Zero Waste* foresaw an overall waste recovery rate (defined as (waste recycled + waste to energy recovery)/waste generated) of 75% by mid-2014.⁹ It relied on education, industry partnerships, product stewardship, grants, and buy-recycled programs. There was optimism about landfill alternatives – either new generation thermal technologies or factories that separated the recyclables, pulled out the nasties, and composted the remainder. NSW businesses pioneered these approaches, investing \$0.5b during the 2000s only for them to perform poorly or fail outright. In Victoria, recycling inched forward without them, and the target wasn’t met.



Fuel conveyor: municipal solid waste on its way to a boiler for combustion. Photograph: Martin Mecnarowski via Shutterstock

Landfill prices continued to rise with the levy and increasingly strict engineering requirements. Recycling prices followed. The community slowly got used to much higher costs for waste management.

The global commodification of recycling led to a concentration of demand from China, the global centre of manufacturing. Victorian domestic recyclables were sorted only roughly, then exported for finishing. By 2018, the Chinese government was fed up with the environmental implications of receiving the world's semi-sorted recyclables and imposed bans. Markets for recovered paper and plastic jammed up all over the world. Victoria had a major bankruptcy, large stockpiles, and fires.

The Australian Government intervened. It placed matching bans on exporting waste-derived products unless they were ready for direct use, and co-funded replacement technology. It cemented and expanded its stake in the waste sector by working with the states on a new set of targets, including an 80% recovery rate by 2030. This was matched by Victoria.

Waste in Victoria – the status

The most up-to-date Victorian data puts the recovery rate at 66% in the 2022-23 financial year. The municipal recovery rate lifted to 55%, as separate collection of organic waste, including food, becomes more common. About 84% of construction and demolition waste was recovered, mostly to make road base and other civil engineering materials. Commercial and industrial waste recovery rates have been declining slightly in recent years and sat at 55%.¹⁰

Compared with other states and developed countries, our recovery rate is not particularly high or low. Victoria's bipartisan effort and success has been matched by others. But while we might recover most waste, CSIRO estimates that only 4% of Australia's material throughput is derived from recovered materials.¹¹

Clearly, the journey to circularity will be long.

Waste in Victoria – how do we get (more) circular?

As the financial, regulatory, and other incentives to recycle grow, it is obvious that the easiest materials will be dealt with first. That means that the portion not recovered in 2022-23 will be harder to tackle. So how should we deal with it?

Firstly, it is worth looking up the hierarchy at options to reduce, repair, and reuse. Governments like to push these options, typically by promotion and education. But they battle the tide – over the scale of centuries, the price of 'stuff' relative to the price of labour has fallen strongly.¹² This tends to boost waste as new materials and products outcompete human effort.

A hundred years ago, a worn shirt would get patched, a blunt saw sharpened, a bottle refilled, a nappy washed, a razor blade changed. Now, prices push us towards disposal and replacement. In addition, for every dollar a government can spend promoting material frugality, advertisers can spend a thousand to convince us to buy more.

Nevertheless, apart from waste generated by major infrastructure developments, the total mass of waste is stabilising, as digitisation replaces print and we learn to make products from lighter materials.^{13,14}

There are also a few things in the pipeline to improve recovery of waste materials:

- ▶ Victoria's four-bin municipal waste standard will generate clean streams of glass and other recyclables that attract more interest from potential users.
- ▶ Diversion of domestic food waste to the organics stream

will reduce the impact of landfills and improve the nutrient value of composts – so long as we can manage awful contamination problems in some areas.

- ▶ The Victorian Government has also flagged an interest in requiring diversion of food waste from larger commercial generators such as restaurants, cafes, and institutions such as universities, hospitals, and prisons.
- ▶ Waste to energy is on its way, and within 10 years facilities in Laverton, Dandenong, and the Latrobe Valley are likely to be manufacturing electricity and steam from mostly municipal waste.

Collecting and processing materials for recycling is only half the story – unless someone wants to buy the materials, it's a wasted effort. Governments can do a lot more in this area, particularly as they expend more than one in three of every dollar spent in Australia.¹⁵

But waste management remains a largely marginalised industry, expected to deal with whatever comes its way. That can include:

- ▶ lithium ion batteries that set fire to waste infrastructure;
- ▶ toxic PFAS (per- and polyfluoroalkyl substances), for which we set maximum levels for compost but not for lipstick;
- ▶ packaging that is made from layers of different plastics and capped with another different material;
- ▶ electronic goods with multiple different screws and glues that increase the cost of repair and dismantling; or,
- ▶ fake 'compostable' materials sold openly in supermarkets.

Governments are getting better at these things – for example, many problematic single-use plastics have been banned – but progress is glacial.

The key to becoming more circular is to strengthen the links between the 'outputs' and 'inputs' to the economy. We need to shape inputs through reference to the outputs. We need to oblige those who sell products into the economy to have some level of financial or logistical responsibility for their end-of-life management.

Ideally, we would have a default trigger that places obligations on any product that cannot be readily managed to a standard acceptable to the community standards using existing waste management processes. This would shape design, reduce end-of-life costs for consumers and improve markets for recovered materials.

But Australia seems to find product stewardship terribly hard. I speculate the following reasons:

- ▶ Waste is primarily a state responsibility, and they get all the levy funds, but regulating inputs to the economy requires the Commonwealth.
- ▶ There is a general reluctance to regulate. Governments seem happy to give industry years to flounder with voluntary methods before losing patience. Mandatory product stewardship for TVs and computers was held up for years by Commonwealth economists who saw no net benefit in the proposed program, despite enthusiasm from the community and major brands.
- ▶ There is a fear of administrative burden. Typically, product stewardship is supported by big brands with sophisticated administration but harder for smaller brands and no-name imports. Big brands won't do much unless their competitors

are forced to. This requires the government to navigate the anti-cartel rules, identify all the players, drag them into the fold, educate, make the deal, monitor progress and enforce. There's a 'we're busy already' attitude.

- ▶ Regulating inputs will often mean putting a recycling levy on products. There is a reluctance to add to price pressures during a cost-of-living crisis. It is apparently preferable to have local and state government land managers collect 300,000 illegally dumped tyres per year at \$22 per tyre rather than impose a purchase levy of \$5 per tyre to make recycling the cheapest option.¹⁶
- ▶ It will get easier in the future. The European Union is typically the pioneer in this area. To some extent, we can ride on its coattails.

Although we're rubbish at it, product stewardship is where we need to go to improve our waste management and improve the circularity of the economy. It is most likely where we will go, at a slow and lurching pace.

- ▶ *Dr Joe Pickin is a director of Blue Environment strategic environmental consultants. He has 25 years of experience as a waste and resource recovery specialist and a PhD on the environmental economics of waste. He has particular expertise on data, modelling and greenhouse issues in relation to waste. Joe was the primary author of the Australian Government's biennial National Waste Reports from 2016 to 2024 and an advisor to the ABC's War on Waste series.*

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The Atomisation of Accountability – and Knowledge

The legacy of neoliberal policy failure in Victoria

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The miasma of diesel fumes enveloping Spencer Street railway station (now Southern Cross Station) was immediately obvious when I first entered the precinct after its roofing in 2004.

It is remarkable that it is only a workers' compensation claim from one individual some 20 years later that is forcing those responsible to face up to the medical lemon that has been suffered by Melburnians ever since.¹

But who are “those responsible”?

Who is actually responsible for the health and comfort of patrons and employees at this major transport interchange? Is it the station operator, Civic Nexus, or its contractor Infranexus? Their owner, IFM Investors, a finance company? Is it V/Line, who run the non-electrified diesel hydraulic train sets and parks them under the canopy, belching smoke for hours?

Or is it Public Transport Victoria? The Department of Transport and Planning? The Minister? Of course, under our system of government, the Minister is accountable for everything in their portfolio, but that is a non-answer, when there is a network of contractors, corporatised entities, and commercial firms sharing powers and hand-balling accountability to each other.

Silos in academia and government

The dispersal of responsibility for Southern Cross Station is a signature consequence of the economic rationalist (~neoliberal) restructures imposed on Australia's public institutions by both major political parties since 1983.

The core neoliberal processes of deregulation, outsourcing, and privatisation have been derived from single-minded economic theory, inadequately informed by multidisciplinary knowledge – notably scientific knowledge.

Central to mainstream economic theory is the principle that free competition between rational, self-interested contenders

in a market will deliver the most *efficient* outcome – with ‘efficiency’ in economic jargon measured by price. Through this, competition is engineered. However, complex networked systems like public transport, telecommunications, and electricity necessarily require cooperation towards a shared purpose, not competition.

The foundational concepts of these economic ‘reforms’ are shallow in contrast to the depth of insights that science provides. Current knowledge of ‘systems’ phenomena – such as thresholds, feedback loops, nodes/links, and necessary/sufficient conditions – can offer valuable insights into public affairs. Further insights are provided by medicine and psychology, which explain that human behaviour is not always self-interested and not always rational, as modelling in economics assumes.

We can't expect administrators of public authorities to be experts in emerging specialist branches of science. But even a basic application of the scientific method would require policy officials to consult widely across professional disciplines, jurisdictional boundaries, and with civil society. This is not only to tap into their distinctive knowledge banks, but to model interactions and potential scenarios.

Throughout Australia, decades of budget cuts and downsizing have depleted expertise within government departments, with outsourcing being both a cause and a consequence. Given the post-Whitlam Government (1972-1975) prevalence of tertiary education, peak expertise on any conceivable subject is now as likely to lie with the public as with the relevant departments.

In particular, learned societies can muster impressive fields of content-rich experts, but they are depressingly rarely called upon to advise governments on complex public affairs.

Given that much scientific knowledge is curiosity-led and publicly funded, there is an intrinsic mismatch with a policy agenda focused on reducing financial costs through commercial forces. However, ignoring scientific information in commercial entities is just one of the negative consequences of competition.

Fragmentation, increased complexity, and the atomisation of accountability are common consequences of introducing competition to previously unified systems. Southern Cross Station is undoubtedly an example of a complex system, but



V/Line diesel-powered trains under the canopy of Melbourne's Southern Cross train station. Photograph: Phillip Mallis via flickr (CC BY-SA 2.0).

one hesitates to argue that it is unusually complex. Nearly every significant public enterprise these days is beset with complex interactions and these require strong central coordination to operate successfully.

Dispersing the levers of government

Take telecommunications, for example. The current Minister for Communications, Michelle Rowland, has recently written: *“Crucially, the sale [of Telstra] also deprived the government of strategic levers to drive the investment necessary for Australians to fully access reliable high-speed broadband...”*²

What strategic levers, exactly? The primary role of a government is to coordinate, and the strength of their authority to do so comes from the consent of the people they govern. This coordination allows governments to use various resources effectively, including:

- ▶ Legal powers, such as the ability to regulate and collect taxes;
- ▶ Tenure powers, which involve creating, owning, and transferring property;
- ▶ Contract powers, including spending money and carrying out projects; and
- ▶ Suasion (the ability to persuade others), which relies on their status as ‘government’, and their ability to gather scientific and other knowledge.

The power of tenure (ownership) is direct and simple, when compared with the power to regulate (to restrict some other body’s ownership). Outsourcing and privatisation surrender the power of ownership.

The hidden costs of Victoria’s energy privatisation

If a panel of economists was asked to provide an example of a successful privatisation in Australia, they would likely nominate the breakup and sale of parts of Victoria’s electricity system in 1994. It earned that reputation because of the unexpectedly high price received by the Kennett Coalition government for the sale at the time. Now, 30 years later, it’s easy to conclude on several grounds that the fragmentation was a colossal mistake.

Dissipation of proceeds

The proceeds from disbanding the former State Electricity Commission (SEC) have long been spent. Whatever financial benefits were gained by selling public assets have been minuscule given the scale of the Victorian government’s capital and recurrent expenditure ever since. The perceived value of the proceeds should also be offset by the cost of subsequent industry adjustments in the Latrobe Valley, that come as a consequence of the closure of coal-fired power stations – which should have been foreseeable.

Economics’ short-sightedness on scarcity

Most basic economics textbooks define the discipline as the study of how to allocate scarce resources. But ‘scarcity’ has an idiosyncratic meaning, confined to the arena being modelled. The natural resources of the planet – which include the capacity to absorb CO₂ waste – are assumed to be unlimited until commodified. Science textbooks however explain that the laws of thermodynamics reign supreme. The scene is set for a policy regime based upon market forces, such as the national electricity regime, to fail to manage decarbonisation successfully.



Loss of system coherence

Economics textbooks emphasise how markets coordinate buyers and sellers, but this ability is overstated. Markets can balance the competing needs of buyers and sellers throughout supply chains of specific goods or services. However, they cannot effectively coordinate at a societal scale – between governments, academia, business, and civil society. It's a common feature of privatisation: relying upon piecemeal markets to resolve complex, fuzzy, evolving, and conflicting policy objectives. Markets are simply not equal to that role.

Impediment to the carbon transition

Splitting a function between corporate providers and residual public authorities makes steering collective efforts towards a common future more difficult. The architects of privatisation in the early 1990s should not be forgiven for focusing on 'potential sale price', and failing to foresee that coal-fired generation was on borrowed time, given the scientific modelling of climate change that was coming to light.

Complexity can increase in unexpected ways. For example, the selling of a core utility to private corporations inevitably invokes the national foreign investment regime, which for a long time has been free-for-all. The alignment of the interests of a foreign profit-seeking investor with the public interest of Victorians in decarbonising electricity supply is likely to be tenuous. Further, the leaching of dividends, franchise fees and untaxed profits overseas erodes the claimed economic benefits of the sale.

Contracts with private providers that spread over a decade or more ossify the worldview of the government of the day for the length of the contract. This contrasts with the flexibility that a government has to change its own policy as circumstances change.

Under government ownership, coal-fired power stations could be phased down and something better phased in with a minimum of fuss. It is difficult for governments to force the write-down of assets owned by influential private investors who paid top money and will find willing supporters in the political opposition and the conservative press. It is plausible to argue that privatisation has impeded the transition by a decade or two, with huge opportunity costs and no end of painful disruption.

Implications for public policy

In a perceptive opinion piece in 2016,³ Professor Emma Johnston argued that four characteristics of scientists are essential skills for making a difference in our changing world: vision, a love of structure – “processes of experimentation, observation and testing”, ability to form cooperative teams across disciplinary boundaries, and systems-based thinking – which is “problem solving and decision making based on analyses of the data, not hasty conclusions based on values or beliefs”. Yes, an understanding of causation and a capacity to trace cause and consequence would seem to be a skill essential for politicians and policy analysts.

She argued that more people trained in science, technology, engineering, mathematics and medicine should aspire to positions of leadership in society — certainly a worthy objective, but one that butts up against atomisation in academe (reductionism). Policy leadership would oblige aspiring scientist-leaders to pursue further education in the arts of leadership, including public administration, corporate governance, comparative economics or law. It would probably be better to include a compulsory course in policy analysis in every science degree at undergraduate level.

However, there must surely also be a parallel obligation upon politicians, analysts and commentators in the policy community to become more scientifically literate. It's not as though scientific knowledge is concealed in scholarly journals: there are many competent brokers and translators such as the ABC, let alone the environmental movement.⁴ The scientific evidence that numerous current policy settings are un conducive to a sustainable, peaceful, and prosperous Australian society is overwhelming and in plain view.

▶ *Dr Geoff Edwards is Policy Coordinator of the Royal Society of Queensland and Adjunct Professor in the School of Government and International Relations at Griffith University. He was educated in science at Monash University.*



LEFT: Trainees at the SEC Linesmen's School in Oakleigh, Victoria, in 1946. Photograph: via Museums Victoria (photographer unknown) (Public Domain).

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The Art of Policy Upcycling

DR NATASHA ABRAHAMS

Strategy and Government Relations Manager, Australian Academy of Technological Sciences & Engineering (ATSE)



Photograph: Cristina Gottardi via Unsplash.

In the op-shop of science policy, one can hunt through the bins for a bargain or a treasure. Some ideas may need a simple repair or a refresh to become fashionable again, while others have been discarded for a reason.

As a policy professional at the Australian Academy of Technological Sciences and Engineering (ATSE), I rely on the work and wisdom of both my peers and those who have come before me. Due to the cyclical nature of policy, those who work in this space become adept at remixing the ideas that have come before into new solutions for current issues.

I was struck by this when sorting through ATSE's physical archive of submissions, reports and conference programs. Although these publications dated back decades, many could be submitted to recent inquiries with little more than a date change on the cover sheet.

ATSE's submission to a 2009 inquiry into the Australian Research Council called for a greater focus on interdisciplinary collaboration, noting that research questions of the future will need an interdisciplinary approach, but funding structures do not accommodate this.¹ The need for research funding to support and incentivise interdisciplinary research remains a staple of science policy circles today, and I am sure it was not a revolutionary idea fifteen years ago either.

A qualified success

The challenge for science policy professionals is how to present these ideas – often very good ideas that have been floating around the sector for a long time – in a way that is compelling and timely for today's decision-makers.

This can be difficult when there is no good reason that an idea was not adopted, and its political moment has passed. For instance, and much to the chagrin of many in the education policy space, the Australian Qualifications Framework (AQF) review recommendations have never been implemented.² The AQF Review final report, developed by an expert panel chaired by the late Prof Peter Noonan, was the result of considerable consultation with the education sector.

The final report laid out a framework for modernising and simplifying the AQF, aligning qualifications from different types of education providers, and dealing with the then-thorny issue of micro-credentialing. This Grand Unified Framework would have been a favourable solution to some of the challenges plaguing the education sector. Of course, implementation is never without some pain, but there was broad agreement that it had to happen.

Unfortunately, timing was not in the AQF Review's favour, with the final report being released in late 2019 and left to languish as other issues became more urgent. Recently, leading policy minds of the higher education sector have furthered the debate through the book *Rethinking Tertiary Education*.³ Now, five years after the publication of the AQF Review, the Universities Accord has attempted to revive it, recommending that its proposals be progressed through engagement with industry, unions and governments.

With 47 recommendations formally outlined in the Universities Accord, and the Federal Government approaching these reforms in tranches, it is hard to see when or if revamping the AQF will be on the agenda. By the time the AQF is revisited, it may even be necessary to conduct a new review, taking stock of the changes to the system since 2019, as well as considering the evolving needs of learners and employers.

Policy professionals and sector leaders will dust off old submissions, and the cycle continues.

Burning issues from history

As those in policy spaces will be aware, the best ideas often fail to gain traction because they are difficult, expensive, or both. Flicking through ATSE's archives, I saw how this was the case for climate change policy, arguably the defining problem of our time. Decades-old publications and conference proceedings documented concerns from leading thinkers on how climate change might affect Australia in the future, and policy interventions for this great challenge.

Proceedings from a 1999 joint Academies' seminar on bushfires – enthusiastically (perhaps insensitively) named 'FIRE! The Australian Experience' – outline the possibility of increased bushfires due to climate change.⁴ One chapter discusses predictive modelling for bushfire management, briefly mentioning its niche application of modelling the likely effects of climate change on fire occurrence.

The detailed exposition for each of these chapters indicates that we now have a higher level of presumed knowledge for topics like climate change and information technology. However, the concerns remain similar – and we have reached the imagined tomorrow that experts and policy advisors warned about. The solutions are often still politically difficult and invariably still expensive. If decision-makers had heeded the advice back then, we could be more advanced in climate change mitigation by now.

Review of policy recommendations from 1999 shows that we have reached the imagined tomorrow regarding the impact of climate change and bushfires. Photograph: European Space Agency via flickr (CC BY-SA 2.0).

Learning from the past to shape tomorrow

While I may wish that experts and policy professionals had been more strident and convincing about their warnings decades ago, somehow overcoming the limitations of the political ecosystem, I can't say we aren't repeating those patterns now.

I consider it a great privilege to be working in this exciting area, translating old and new ideas from bright thinkers into digestible solutions. It is gratifying when this work makes an impact, however modest. Nevertheless, a future-me writing this article might feel frustrated over missed opportunities in today's policy debates, big and small.

Today's niche policy issues, such as quantum ethics, may become more salient in the future. Researcher Dr Tara Roberson has identified that little is known about the societal risks of quantum technologies, yet now is the ideal time to build the sector in a way that minimises these issues.⁵

Future policy professionals may lament the decisions knowingly made today. For current major policy issues, such as critically low research expenditure, in a few years from now we might wonder how such predictable outcomes were allowed to occur. Finding solutions will become more urgent. The silver lining will be that policy professionals need only look through the archives to find inspiration for ideas whose time has come.

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1875

A River Retrenched

SCOTT REDDIEX MRSV

Editor-in-Chief, Science Victoria

The Port Phillip Bay of 1875 was not the same Port Phillip Bay of 1850, and definitely not the same as the one in 1700. By this time, the city of Melbourne was rapidly growing in size, population, and wealth.

Consequently, its citizens were reshaping the land to best suit their priorities of the day. Having built a city in an area prone to flooding, next to swampland, at the top of a bay, and between the mouths of two major rivers (and several smaller creeks), a primary concern was managing the water they had built next to.

On the 13th of December 1875, T. E. Rawlinson presented his paper to the Society, *“On the Past and Present of the Port of Melbourne, and Proposed Works for its Improvement”*.

Rawlinson highlighted the differences between the river and the bay in 1853 and 1875, with a focus on how earlier works had caused some of the problems they were now facing.

“The great evil of the past has been that marine works in and about the river have been carried on apparently as matters of temporary expediency, and on no definite or comprehensive plan, by which each portion however small should be part of a complete whole.”

“It is impossible that merely shortening the river bends can be of much avail whilst we retain the narrow channel of the river, bound in as it is with buildings and wharves, to the obstruction of trade and shipping; and I submit that it is useless to incur the expense of further deepening the river, unless we are prepared to widen it”.

With the river and port unsuitable for the growing city's needs, Rawlinson proposed some solutions, including widening the river and cutting a new channel, removing several wharves and stone dykes, building retaining walls, and ongoing dredging.

This would be accompanied by land reclamation, using the material recovered from dredging and widening projects. Rawlinson suggested that doing this in the swamps of West Melbourne and other low-lying areas would yield highly valuable land – *“land which at present is but a noxious swamp”* would become *“worth from five to six thousand pounds per acre.”*

The sale and/or leasing of this land would then offset the cost of both the initial works and ongoing maintenance, while also providing more usable space surrounding the city. He supported his arguments by providing costing estimates, showing a net surplus of £1,595,000 if this work were to be undertaken.

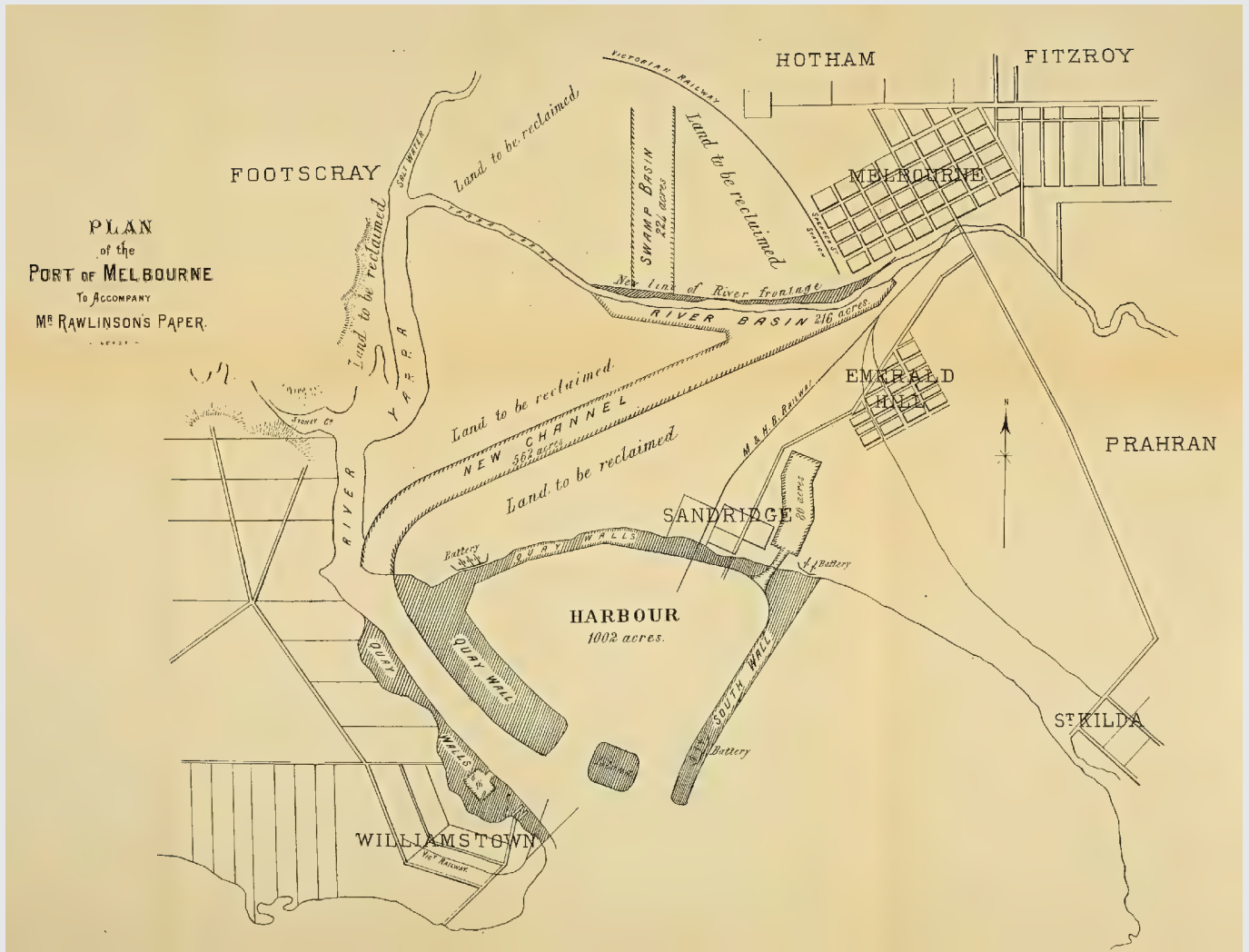
Rawlinson ends his article with a final, strong call to action: *“I cannot conclude without the expression of a hope that my hearers will consider I have established the position assumed at the beginning of this paper, of showing the past of the port, its condition in the present, and of what it is capable in the future.”*

FROM:

Transactions and Proceedings of the Royal Society of Victoria, Volume XII, 1875. Ant. XXIII. – On the Past and Present of the Port of Melbourne, and Proposed Works for its Improvement. By T. E. Rawlinson, Esq.

OPPOSITE:

Plan of the Port of Melbourne to accompany Mr Rawlinson's paper, noting the areas of Footscray, Williamstown, Sandridge (Port Melbourne), Emerald Hill (South Melbourne), Hotham (North Melbourne), Fitzroy, Prahran, and St Kilda. Image: *Transactions and Proceedings of the Royal Society of Victoria*, Volume XII, 1875.



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Vape e-liquids contain a wide-ranging amount of nicotine and other chemicals like acetonitrile, cadmium, chlorine, xylene, arsenic, and benzene. Photograph: Ernst-Günther Krause (NID) via Unsplash.



Evidence-based Action on Vaping and Tobacco

Report from the Inquiry into Vaping and Tobacco Controls

BILL BAINBRIDGE
Senior Communications Adviser, Parliament of Victoria.

There is now a significant (and growing) body of evidence that relates to the health effects of vaping.

Vapes, or e-cigarettes, vary widely in the chemical cocktail they contain.¹ While the presence of nicotine (at wide-ranging levels) is a major health concern, its absence from a vape by no means removes the risk – and 60% of vape liquids labelled as “nicotine-free” were found to contain nicotine.^{1,2}

Evidence provided to the Victorian Parliament’s recent *Inquiry into Vaping and Tobacco Controls* found a “wide range of substances and heavy chemicals ... in e-cigarettes, that are poisonous if inhaled including chemicals found in car batteries, disinfectants, fuel products and poisons”.³

The Public Accounts and Estimates Committee received 115 submissions, and heard from a wide range of experts in public health.⁴

Significant impacts on individuals and communities

Tobacco smoking is the leading preventable cause of death and disease in Victoria, and a key driver of social inequalities in health.² Every year smoking costs the Victorian community 4,000 lives and \$5 billion.⁵

The Committee found that tobacco use has declined in Victoria over the last 20 years.⁶ However there has been a rapid growth in vaping since 2018, particularly by young people including children.⁷

“We know now that one in three young people across Australia have vaped. We have gone from 3% of 18-year-olds or older vaping in 2018 to almost 18% by 2022, and we know that young people who vape are three times more likely to go on to smoke cigarettes,” Dr Sandro Demaio, the CEO of VicHealth told the inquiry.

Additionally, he notes that the unregulated nature of the market means many vapes contain dangerous substances.

“We know that e-cigarettes contain more than 200 toxic chemicals,” Dr Demaio said. “This plume is breathed deep into the lungs and into the lung tissue of increasing numbers of young people.”

Those chemicals include acetonitrile (found in car exhaust fumes), cadmium (found in batteries), benzene (found in petrol), chlorine (found in bleach), glyoxal (found in disinfectant), xylene (found in paint stripper), arsenic (found in rat poison) and many others. One 2019 study published by the Commonwealth Department of Health identified some 243 chemicals in total.^{1,8}

Many submissions to the Committee claimed that e-cigarette use is healthier than smoking cigarettes, but the evidence provided to the Committee did not support that conclusion.

Evidence-based policy required

Stricter regulation at the state and federal level is likely to reduce the number of illicit vapes available and therefore the number of toxic chemicals present in vapes. But e-cigarettes containing nicotine may still pose a health risk.

Dr William Cross of the Goulburn Valley Public Health Unit told the Committee that the “consumption of no nicotine is always preferable” but he added that better regulating products would be better than the current environment.

“We would also consider that regulated products are likely to be less harmful than unregulated products, as the latter can give an undisclosed amount of nicotine and may also contain a broader range of potentially harmful chemicals,” he said.

Nonetheless, the Committee heard that regardless of the presence of other harmful chemicals, nicotine is inherently addictive, and can increase the risk of serious health conditions.





E-cigarettes/vapes undergoing laboratory testing at the CDC. Photograph: CDC via Unsplash.

Even the tobacco companies that appeared before the Committee agreed “the science is clearly established that nicotine is addictive”, with British American Tobacco Australia telling the Committee its position is that “if you do not use these products, do not start”.⁹

One submission to the inquiry from alcohol and drug consultancy 360Edge pointed out that, unlike other nicotine replacement therapies such as lozenges or nasal sprays, nicotine delivered via a vape can reach the brain in just 20 seconds.¹⁰

Some single disposable e-cigarettes for sale in Australia at the moment contain as much nicotine as 20 packets of cigarettes.¹¹

VicHealth’s Dr Sandro Demaio told the Committee that addiction has an enormous impact on the social, educational and interpersonal development of young people.

“It also influences the developing brain and particularly the frontal lobe, which is responsible for decision-making and higher order thinking,” he said.

Victoria’s Chief Health Officer, Dr Clare Looker, told the Committee that research on the health impacts of e-cigarettes is still an evolving area but a number of health effects are already established.

“We know there is conclusive evidence that the use of e-cigarettes can cause E-cigarette or Vaping-Associated Lung Injury, or EVALI. There is also conclusive evidence about the risks of acute nicotine toxicity, including, as we know, a number of tragic deaths in young children who have accidentally consumed liquid nicotine,” she told the Committee.

“There is also conclusive evidence of burn injuries from exploding batteries. There is emerging evidence of links between e-cigarettes and cardiovascular impacts, impaired lung function, low birth weight in babies of women who have smoked during pregnancy and links between carcinogens found in many e-cigarettes and cancer.”

The Committee’s final report was tabled in the Legislative Assembly in August and makes 27 recommendations across a range of policy areas that aim to reduce the significant harms of tobacco and the emerging harms of e cigarettes.³

The government, which has already flagged its intention to introduce new legislation this year to better regulate e-cigarettes, has until February to respond to the report.

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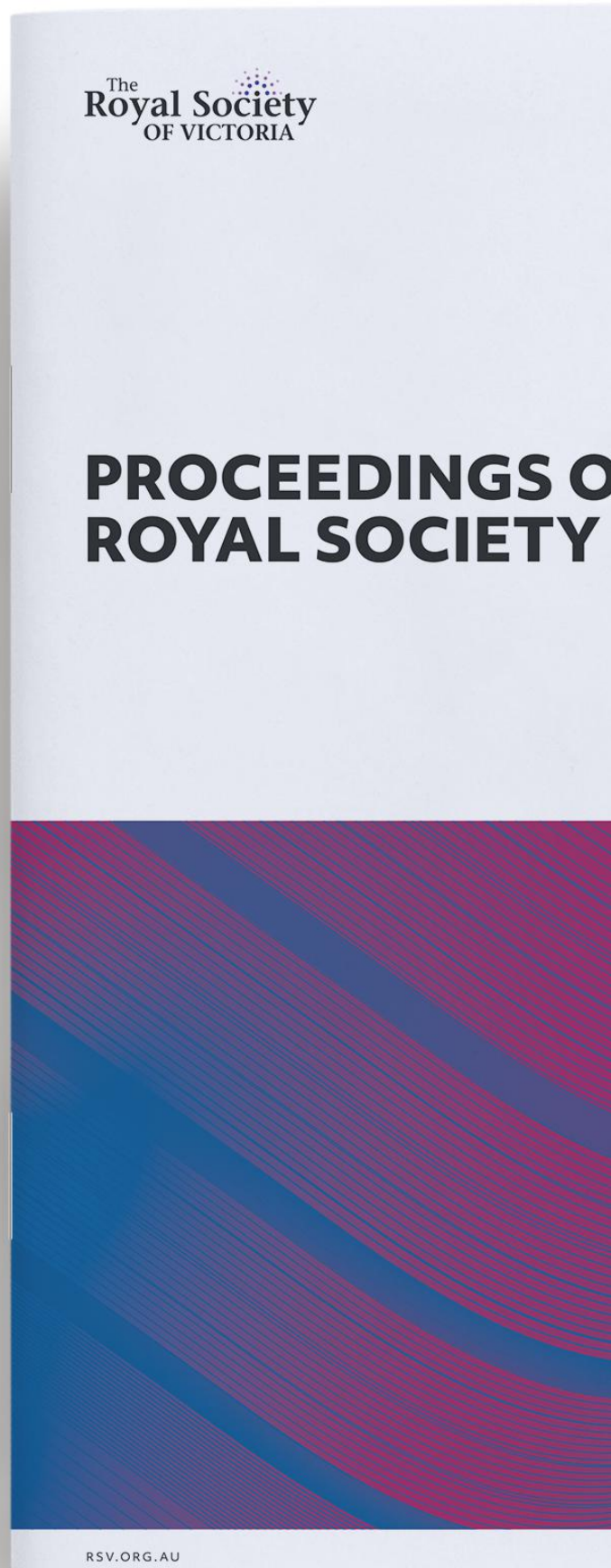
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The Outer Barrier of the Gippsland Lakes, Ninety Mile Beach, looking across to Raymond Island on the Lakes' side.
Source: Shutterstock



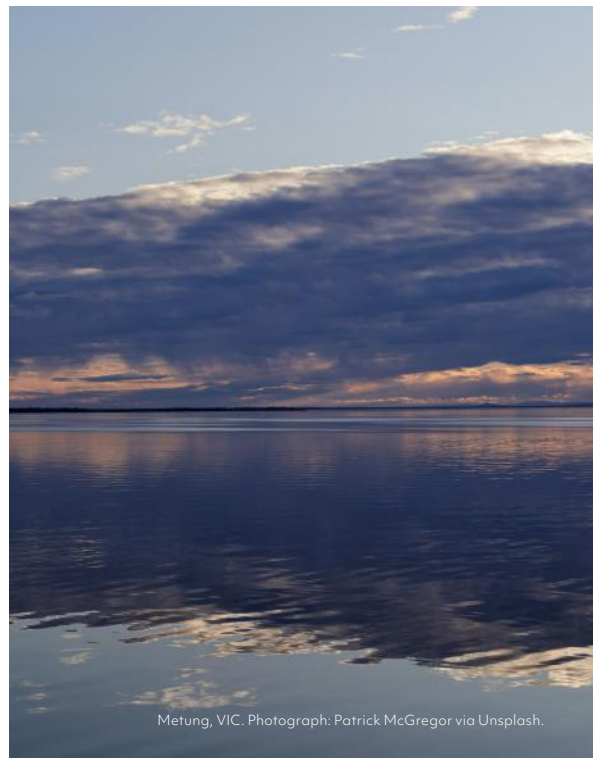
The Future of the Gippsland Lakes

PROCEEDINGS OF THE ROYAL SOCIETY OF VICTORIA, VOLUME 136

The first papers from Volume 136 of the *Proceedings of the Royal Society of Victoria* are now available online, open access from CSIRO Publishing, hosted at publish.csiro.au/rs/collection/12070. This volume is the first to be released under CSIRO Publishing's new 'publish-as-you-go' model, progressively collecting the volume over the course of the year.

This collection on the Gippsland Lakes compiles papers commissioned following the roundtable held at the Royal Society of Victoria on 26 May 2023, involving research expertise along with First Nations (Gunaikurnai) representation. It summarises the geomorphological character of the Lakes system, the current state of estuarine health, and anticipates the impacts of intensified human activities, a drying regional climate and rising sea levels on the interaction of the marine and freshwater ecological conditions.

The Society's report from the roundtable, titled 'Securing the Future of the Gippsland Lakes,' is also available at rsv.org.au/gippsland-lakes.



Metung, VIC. Photograph: Patrick McGregor via Unsplash.

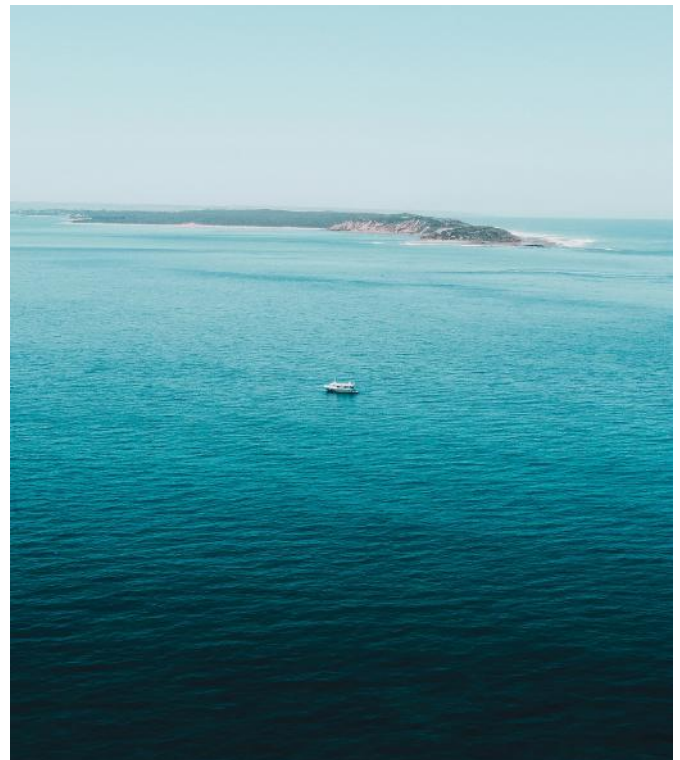
Papers from Volume 136

Effects of varying levels of nutrient inputs to coastal marine systems: a case study of a semi-enclosed bay influenced by a large urban population

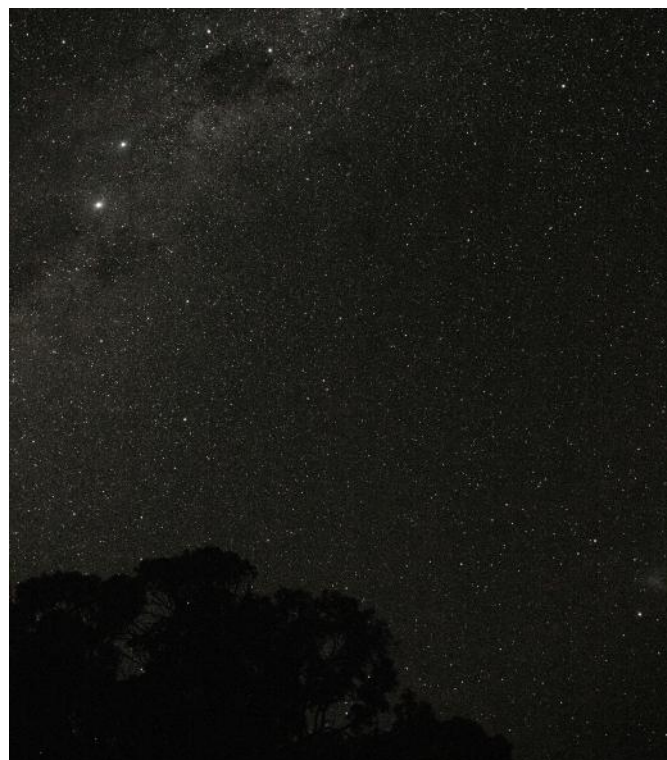
BY GREGORY P. JENKINS, KERRY P. BLACK, AND PERRAN L. M. COOK

The input of nutrients is a major issue for the health of coastal environments around the world. This review shows that the environmental health of Port Phillip Bay, Australia, can be affected by both excessively high and low nutrient inputs. Coastal managers have traditionally focused on the effects of high nutrients; however, this review shows that low nutrient inputs also need to be considered.

► You can read this open access paper in the *Proceedings of the Royal Society of Victoria* via CSIRO Publishing at publish.csiro.au/RS/RS24006.



The entrance to Port Phillip Bay. Photograph: Pat Whelen via Unsplash.



The night sky from Wilsons Promontory National Park. Photograph: Nao Takabayashi via Unsplash.

A sustainable world requires darkness at night

BY JOHN B. HEARNshaw

Multiple environmental challenges face today's world. One of the most damaging but least widely recognized arises from artificial light at night (ALAN). Light pollution is now known to be harmful to human health, mainly through disruption of hormone production and of human circadian rhythm, which causes sleepless nights, depression, anxiety, hypertension, and more. ALAN is also bad for the environment: almost all species of animals and plants are adversely impacted by light pollution, and not just nocturnal animals. Light pollution also wastes large amounts of energy, and as much as 35% of exterior lighting energy costs could be saved by better lighting.

► You can read this open access paper in the *Proceedings of the Royal Society of Victoria* via CSIRO Publishing at publish.csiro.au/RS/RS23009.



Current Government Consultations of Interest to Victoria’s Science Community

Projects open for consultation from engage.vic.gov.au/project



Dominik Vanyi via Unsplash

CONSULTATION CLOSES 8 NOVEMBER 2024

Strategic Extractive Resource Areas in Cardinia, Hume, and Baw Baw

Share your thoughts on draft planning controls to secure strategic extractive resources near Lang Lang, Oaklands Junction and Trafalgar.

engage.vic.gov.au/sera-langlang-oaklandsjunction-trafalgar



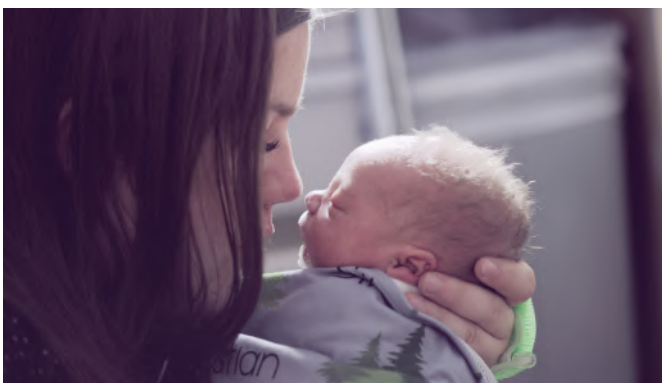
Pat Whelen via Unsplash

CONSULTATION CLOSES 15 NOVEMBER 2024

Albert Park pit building redevelopments

Public feedback is invited on the planned redevelopment of the Albert Park pit building and how the community uses Albert Park.

engage.vic.gov.au/share-your-thoughts-on-albert-park-pit-building-redevelopment-planning-scheme-amendment



Alexander Grey via Unsplash

CONSULTATION CLOSES 1 DECEMBER 2024

Have your say on Maternal and Child Health Services

Parents, carers and families, tell us how your Maternal and Child Health Service can better support your family and your child’s needs.

engage.vic.gov.au/have-your-say-on-maternal-and-child-health-services



Jeremy Buckingham via flickr (CC BY 2.0)

CONSULTATION CLOSES 15 DECEMBER 2024

Potential water access for Latrobe mine rehabilitation

Proposed amendments to existing water entitlements and to grant new water entitlements for mine rehabilitation in the Latrobe Valley river system.

engage.vic.gov.au/potential-water-access-for-latrobe-mine-rehabilitation



Submission Guidelines

Pitch it to us!



*Have an idea for an article?
We want to hear from you!*

Briefly outline your key message, why it should be shared in *Science Victoria*, and the proposed article type. Pitches can be submitted at any time, but check submission deadlines if you're interested in publishing in a particular edition.

All pieces will be reviewed prior to publishing, and may be edited for length and clarity (although we will not alter the message or context of your work).

Send pitches and any questions to editor@ScienceVictoria.org.au.

We welcome your pitches relating to current scientific research in Victoria, recent scientific discoveries, social and policy issues, technical innovations, and overviews of impactful research.

Science Victoria's articles are written in plain, non-academic language, and thoroughly referenced (see: References). This is not a platform for scientific journal articles or media pieces. For more information on what we're looking for, see below.

Style Guide

All pieces should have readability in mind. A good litmus test is knowing that most people have read a piece or been to a presentation that managed to make the most interesting topics incredibly boring and/or confusing. This is what you want to avoid.

A general guide for readability is that it should be understood by an educated 16-year-old – or ask a friend or family member to proofread!

Feature Articles

Recommended length: 600 - 1,800 words

Feature articles are more in-depth pieces on a specific topic related to STEMM. A key aspect of feature articles is the narrative – this isn't a journal article, so think about the story that your article is trying to tell.

Avoid using jargon, as it will quickly alienate anyone who isn't an expert in that field. Explaining one or two otherwise irreplaceable terms is fine.

Use of sub-headings and figures to break up longer pieces is strongly encouraged.

Not quite sure about the tone for your piece? Have a look at articles published in previous editions of *Science Victoria*, or in other scientific publications for a general audience, like *The Conversation*, *Cosmos*, *New Scientist*, or *Scientific American*.

Opinion Articles

Recommended length: 600 - 1,800 words

In contrast to a feature article, an opinion piece conveys your informed opinion on, or experiences with, a particular topic. Clearly state your argument, outlining the details of the problem you are addressing, and build to a strong conclusion.

For greatest impact, your choice of topic should be one that is broadly relevant to STEM-related fields in Victoria. Examples of possible topics include how to address a climate-change related problem in Victoria; successes and failures common to STEM engagement initiatives; ethical problems related to scientific projects or careers in STEM; your experiences of a career in STEM and thoughts on how to better support the next generation of researchers; existing STEM-related studies or approaches that you believe could be applied in Victoria.

We welcome well-informed opinion articles from all authors, particularly from those with significant expertise in a given area. Articles may reference your own work; however, these are not promotional fluff pieces.

Letters

Recommended length: 200 – 1,000 words

Letters have minimal restrictions on style, structure, or subject matter. You are encouraged to submit your thoughts/questions/comments that broadly relate to STEM in Victoria. Potential subject areas include responses to articles in previous editions of *Science Victoria*, seminars at scientific events, science-related issues and policies, or topics you'd like to see in future editions.

Letters are also the best format to share current or recent news relating to science, with an emphasis on science in Victoria or news that impacts Victoria's scientific community. News could relate to funding announcements/grant outcomes, new STEM-related projects, high-impact publications relevant to Victoria, successes of Victorian scientists, or relevant STEM-related policy news.

Where a specific question is asked, we will try to have the appropriate person respond to your letter.

What I've Been Reading

Recommended length: 600 - 1,800 words

This is a column for you to tell us about a book broadly relating to STEM that you've read. These pieces typically include a summary of the book and its ideas, as well as your interpretations or conclusions. Possible questions to consider: Do you think the author was correct in any assumptions? Was the author's style of writing approachable? Did they do the subject matter justice? Who would you recommend this particular book to? What did it mean to you? What did you learn?

Images and Figures

Images are strongly encouraged, however please only provide files that are either completely original, in the Public Domain, or covered by an appropriate Creative Commons license. Images must include details of the source, license, and any relevant descriptions.

If suitable images are not provided, we may include relevant Public Domain/Creative Commons images.

All images must be of sufficient size and quality – as a rough guide, aim for >1.3 MB in file size.

References

Please reference primary sources/journal articles for any non-trivial scientific claims, or for publications that prompted your writing of the article. If references aren't provided, we will request them for specific statements.

References for all articles should use a modified APA 7th edition format: reference list in author-year format, with numbered in-text citations. Refer to articles in previous editions for examples. Please do not submit pieces that use MS Word's References/Footnote/Endnotes feature, as it forces us to manually re-write your references.

Submission Deadlines

MARCH 2024 <i>Victoria's Fauna</i> Everything <i>Animalia</i> in Victoria, particularly native fauna.	DUE DATE 16 February
APRIL 2024 <i>The Four Planetary Crises</i> Biodiversity Loss, Climate Change, Pollution & Waste, and The Rise of Misinformation	DUE DATE 15 March
MAY 2024 <i>Accessibility & Inclusion in STEM</i> Supporting the education, employment, and engagement of everyone in STEM.	DUE DATE 19 April
JUNE 2024 <i>Victoria & Climate Change</i> The impacts of, research on, and responses to climate change in Victoria.	DUE DATE 17 May
JULY 2024 <i>Building Scientific Competency</i> Empowering individuals and communities to understand the scientific method.	DUE DATE 14 June
AUGUST 2024 <i>STEM Throughout Victoria</i> The opportunities for learning and engaging with STEM across the state.	DUE DATE 19 July
SEPTEMBER 2024 <i>Pollution in Victoria</i> The different pollutants, sources, impacts, and responses required.	DUE DATE 16 August
OCTOBER 2024 <i>Victoria's Ecosystems</i> The many and varied ecological niches across Victoria	DUE DATE 13 September
NOVEMBER 2024 <i>Science & Policy</i> From lab bench to front bench: how scientific understanding can positively influence policy.	DUE DATE 18 October
DECEMBER 2023 <i>Science & Business</i> Creating a sustainable industry, start-ups, med-tech, patents, and ethics.	DUE DATE 15 November

Hold Your Next Event at the Royal Society of Victoria

The RSV engages communities with scientific knowledge through aligned partnerships, events, festivals, conferences, and education programs.

Services Available

We also provide a number of services to ensure your event is a success. Some of the services we provide are:

- ▶ Event management
- ▶ Meeting venues
- ▶ Grants and awards administration
- ▶ Social media campaign management
- ▶ Broadcasting and video production
- ▶ Recruitment of scientific panels
- ▶ Convening community engagement and deliberation processes where scientific work contributes to social, environmental, and economic impacts and benefits.

The Facilities

The RSV's facilities are available for hire to organisations, companies, or private groups.

Audio-visual and seminar equipment is available for use, including videoconferencing facilities for hybrid Zoom/MS Teams meetings.

There is a commercial kitchen on the ground floor, suitable for your own use or by a caterer. Limited parking is available on-site, and a commercial parking operator is adjacent on La Trobe Street.

Take a Virtual Tour

Take a Virtual Tour of the building at: matterport.com/discover/space/royal-society-victoria



The Burke and Wills Room

The beginning and end of the ill-fated Victorian Exploring Expedition of 1860-61 is a beautiful, multi-function space with an adjoining kitchen, suitable for a range of events.

SUITABLE FOR

Workshops, roundtables, luncheons, dinners, seminars, and functions.

CAPACITY

Workshops	≤30 people
Dinners	≤60 people
Catered Functions	≤80 people



The Ellery Lecture Theatre

First-floor lecture theatre, with raked seating, speaker's podium, and audio/visual equipment. Perfect for lectures, presentations, and conferences.

SUITABLE FOR

Presentations, seminars, lectures.

CAPACITY

Any Booking	≤90 people
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Book online for your meeting, conference, or a larger event.

Just visit rsv.org.au/facility-hire to explore our rooms, check availability, and secure the perfect space for your needs. Book now to ensure your date!



The Cudmore Library

The Cudmore Library A picturesque room with videoconferencing and projection equipment. Great for larger meetings and seminars, with in-person or hybrid attendees.

SUITABLE FOR

Meetings, seminars, and videoconferencing.

CAPACITY

Any Booking ≤15 people



The Von Mueller Room

A light-filled room on the first floor, perfect for smaller meetings and seminars, or group/individual work.

SUITABLE FOR

Meetings, seminars, and videoconferencing.

CAPACITY

Any Booking ≤15 people

Support Victoria's Science Society in 2024 and help us to engage individuals and communities with STEMM

WHO WE ARE

Founded in 1854, the Royal Society of Victoria (RSV) is our state's science society.

We are a membership based, non-government organisation, advocating for the importance of science, technology, innovation, and building the skills for Victoria's future industries, governments, community leaders, and research superstars.

WHAT WE DO

We manage the Inspiring Australia program in Victoria (inspiringvictoria.org.au), meaningfully engaging communities with science.

We encourage, profile, and celebrate the achievements of Victorian scientists through public lectures, awards, and prizes, which are supported by the donations and bequests to the RSV Science Foundation.

WHERE YOUR DONATIONS GO

Your donations allow us to continue the work we have been doing for Victoria for more than 160 years. This includes hosting organising/hosting/running STEMM events, running a public lecture series (in-person and online), producing the magazine *Science Victoria*, celebrating Victorian scientists through awards and prizes, publishing Victorian science in our academic journal (the Proceedings of the Royal Society of Victoria), and empowering the next generation of scientists.

HOW TO SUPPORT

We also support a number of smaller organisations, which are listed at rsv.org.au.

You can donate online now at rsv.org.au/support-the-rsv, or alternatively contact us at rsv@rsv.org.au for information about other payment methods.



Become a Member of the RSV

We bring together an independent community of science practitioners, educators, industrialists, and enthusiasts to promote an understanding and utilisation of scientific knowledge for the benefit of the state of Victoria.

	STUDENT \$40 PER YEAR	FULL \$120 PER YEAR	ORG. \$1000 PER YEAR	SCHOOL \$1000 PER YEAR	AFFILIATE \$500 PER YEAR
Special Membership rates at RSV and affiliate events.	✓	✓			
Networking opportunities – national and local.	✓	✓	✓	✓	✓
Recognition of membership through use of post-nominal affix	MRSV	MRSV			
<i>Science Victoria</i> Digital Edition (Printed copy available for an additional fee).	✓	✓	✓	✓	✓
Free monthly printed copies of <i>Science Victoria</i> for school libraries.				✓	
Recognition of achievements through awards programs.	✓	✓			
Discounted advertising in <i>Science Victoria</i>			✓	✓	✓
Discounted facility hire at 8 La Trobe Street, Melbourne.			✓	✓	✓
Discounted membership rate for eligible full-time students.	✓				
Discount on purchases from CSIRO Publishing	✓	✓			
'Schools Supporting Schools' Membership Program*				✓	
Listing of membership on the RSV.org.au website.			✓	✓	✓

Call for Nominations

Nominations for four Council Officers and up to five Ordinary Members of the Royal Society of Victoria's governing Council for 2025 and 2026 are sought. If required due to more nominations being received than places are available, all nominees will be elected by postal ballot during February 2025.

Newly elected Officers and Councillors of the Society will take up tenure from the Annual General Meeting to be held in May 2025 – all current Ordinary Councillors of the Society

appointed for the 2023-24 term will continue until that date. All current 2024-25 Councillors continue until the AGM to be held in May 2026.

Please download the nomination form for more information: rsv.org.au/rsv-council-nomination-form-2025-26

The form must be returned to the Society, attention to the Returning Officer, along with the nominee's 200-word statement by **3.30 pm, Monday, 16th December 2024**.

Valete

The Council of the Royal Society of Victoria records with sadness the passing of the following members during the course of 2024:



MR IAN ENDERSBY

MRSV FLS (1941 – 2024) – a member since 1977

Ian was a skilled zoologist, elected as a Fellow of the Linnean Society. His life's work was notably focused on entomology, particularly the study of dragonflies and damselflies (Odonata), both living and in the fossil record.



MS HEATHER (HEATHERBELL) EVANS

MRSV (1953 – 2024) – a member since 1989

Heather was a committed social historian and librarian with a strong interest in how science is being applied to mitigate climate change and habitat loss, and for humanitarian purposes.

We mourn the loss of Ian and Heather from our science community and convey our condolences to families, friends and colleagues.

Individual Members

MISS COURTNEY VENN

Mathematics Postgraduate Student, University of New England

MR ALEXANDER ZADNIK

Business Manager, MetraWeather Australia

MR THOMAS LAIRD

Educator

MR STEVEN SAN GILL

Computer Technician, Computers on the Move

PROFESSOR JOHN LONG

Strategic Professor in Palaeontology, Flinders University

MR JAMES TALBETT

Project Firefighter, Melbourne Water

MR JOHN HARDIE AM FRSN

President, Royal Societies of Australia

How to Join

For more information: rsv.org.au/how-to-join

* The 'Schools Supporting Schools' membership program allows a school to sponsor the membership of one or more schools at a discounted rate of \$750/year, allowing less-resourced schools the same benefits and opportunities of RSV membership.



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LA VIRUELA

Science Victoria
The Royal Society of Victoria
Wurundjeri Country
8 La Trobe Street, Melbourne, VIC 3000

View the Digital Edition
Scan the QR Code or go to:
rsv.org.au/news/science-victoria



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