2025-26 Pre-Budget Submission

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Australian Academy of Science 2025-26 Pre-Budget Submission

Australia faces increasing challenges and opportunities that demand strategic investment in science and innovation—to secure supply chains, maintain defence and cybersecurity, drive the energy transition and decarbonisation, adopt new technologies and support citizens' wellbeing.

While the government's strategic examination of research and development will identify strategies to improve the science system and efficiencies in how we fund and benefit from science, there are clear capabilities the government can invest in *now* to build Australia's resilience and competitive edge.

The most urgent priority is building next-generation high performance computing capabilities and coordinating the earth system science that enables robust climate intelligence. These urgent priorities are required to secure the government's existing investments to grow and transform Australia's industry and economy, creating new jobs and opportunities.

The Australian Academy of Science (the Academy) recommends that the Australian Government's 2025-26 Budget include investments to:

- Set out a long-term national strategy and roadmap—across government, the private sector and science sector—to secure and supercharge Australia's high-performance computing and data capabilities.

- Establish an Australian Institute for Earth System Science to provide the coordination and scientific underpinnings—observations, process-based understanding, and advances in predictive models—necessary for government bodies and industry to generate actionable climate intelligence and inform decision-making.

- Support 'Teaching Towards 2030', the Academy's plan to scale its proven education programs to equip teachers to boost school STEM engagement.

- Sponsor Australia's membership in the Belmont Forum and participation in the oceans collaborative research action in 2025, to lead and shape global research efforts on challenges presented by climate and environmental change.

Bringing Australia's supercomputing up to speed

The Australian Academy of Science calls for ambitious strategic planning and targeted investment in next-generation high-performance computing and data infrastructure, including exascale computing, to maintain Australia's sovereign capability as our economy becomes increasingly reliant on computing and data, and to address national and regional priorities.

In the 21st century, high-performance computing and data (HPCD) (also known as supercomputers) are becoming increasingly important. Advanced economies invest in HPCD to gain and maintain industrial competitiveness and scientific leadership, address societal challenges, ensure national security, accelerate digital transformation and ensure the capacity to participate in the artificial intelligence and machine learning revolution.

Supercomputers are vital to Australians' everyday lives. They support accurate weather forecasting, improve agricultural productivity, accelerate drug discovery, support cybersecurity and drive the development of new technologies including artificial intelligence (AI) that create jobs and fuel economic growth. Soon, we will rely on HPCD for the operations behind our food and healthcare systems.

HPCD is evolving quickly to meet the demands of increasingly complex scientific, industrial and societal challenges. Australia's existing supercomputers are oversubscribed and rapidly reaching the end of their lifespan, and there is no plan for the next generation of computing, or to replace the HPCD infrastructure Australia relies on.

As datasets grow larger and simulations become more complex, existing petascale supercomputing systems are no longer sufficient. Exascale computing has emerged as the new benchmark for global competitiveness—1,000 times faster than Australia's existing petascale supercomputers. This leap in capability enables unprecedented precision in climate modelling, AI development and advanced research, making exascale infrastructure essential for nations to address critical challenges and maintain technological leadership.

Recommendation & investment

The Australian Government should commit to a decadal program to secure, coordinate, and expand Australia's HPCD capabilities—across government, the private sector and science sector. This decadal program would necessitate investments of up to **$2 billion over ten years**. This investment would support sector coordination and planning, deliver upgrades to current Tier-1 and 2 facilities and co-locate data and compute, and drive coordination and co-investment in a Tier-0 facility.

The Academy calls for the Australian Government to set out a long-term national HPCD strategy and roadmap to build national capacity, with targeted investment in next-generation HPCD infrastructure. This strategy and investment would be directed towards:

- **Upgrading and expanding national (Tier-1) and institutional (Tier-2) facilities**, ensuring they are equipped to meet the growing demands of advanced research and societal needs.

- **Coordination and co-investment in a regional (Tier-0) supercomputing facility** to acquire, deploy and operate next-generation exascale infrastructure.
- **Sector coordination, collaboration and planning across industries and institutions**, to improve integration of data and computing resources, ensuring co-location of data storage and processing, which will reduce latency and optimise efficiency.
- **HPC-powered emerging technologies**, including AI and quantum computing, to accelerate scientific development and breakthroughs.
- **Developing international partnerships** for AI and exascale high performance computing with like-minded countries.

Without a national strategy to acquire and sustain next-generation HPCD for our science sector, Australia risks falling behind on global advancements, limiting our ability to innovate and tackle emerging societal challenges and putting our future prosperity and security at risk.

Investment in next-generation HPCD infrastructure, including exascale, would deliver benefits including:

- **Enabling more reliable climate models**, better representation of extreme weather events, and finer spatial detail. This reduces uncertainty in climate projections, enhancing disaster response strategies, **enabling targeted climate adaptation and saving lives and resources**.
- Allowing geoscientists to fully realise the potential of geophysical datasets, producing 3D volumetric continental-scale high-resolution models of Australia's subsurface and Earth's interior. This will **improve our understanding of valuable mineral resources and natural hazards**, such as seismic activity and groundwater contamination, critical for a sustainable, resilient future.
- Allowing chemists and drug producers to run larger, longer simulations of molecular systems, **accelerating drug discovery** and driving economic, social, and environmental benefits.
- **Enabling energy grid optimisation**, efficiently integrating new energy technologies like renewables to **lower energy bills**.
- **Improving agricultural productivity** by optimising planting schedules and resource allocation, leading to **higher yields and lower food prices**.
- Australia realising its ambition to become a **global quantum industry hub** is only possible with the requisite HPCD infrastructure to support research and development. Without HPCD, quantum technology development in Australia will stall.
- Positioning Australia as a **scientific and technological leader in the Pacific region**, promoting regional collaboration and providing access to advanced computational resources and addressing shared challenges such as climate change and disaster management.

Further information
- The future computing needs of the Australian science sector

A national institute to coordinate the earth system science Australia needs

The Australian Academy of Science proposes establishing an Australian Institute for Earth System Science to support and co-ordinate the development of the underpinning earth system science Australian needs.

Australia's ability to adapt to and mitigate climate change depends on climate intelligence that is founded on our understanding of earth system science processes.

Over the past two decades, funding has focused on applied research to develop tools and advice, neglecting the fundamental earth system science needed to advance climate intelligence. This has led to fragmented efforts, uncoordinated data systems, and critical knowledge gaps. Many climate models and projections rely on decade-old research, increasing the risk of maladaptation and poor policy decisions.

Without better coordination and investment in fundamental science, adaptation efforts may fail due to unreliable data and models. The increasing demand for higher-resolution climate models requires a deeper understanding of earth system processes, a need that existing organisations are not meeting. Critical gaps in understanding atmospheric, ocean, and land processes will persist, and Australia's capacity to provide reliable climate intelligence for national and regional security will be compromised.

Australia's previous investments have enabled us to build capability through organisations and research programs, including CSIRO, the Bureau of Meteorology (BOM), universities and the Australian Climate Service. It is now time to secure that investment by ensuring that the system does not ignore the underpinning science.

Earth system science integrates various scientific disciplines to provide the underpinning and fundamental science that informs solutions to complex issues like climate change and extreme weather. It combines global and local data to inform risk management strategies in Australia and supports our geopolitical partners, making it unique in the Southern Hemisphere.

Australia's earth system science capability underpins:

- **Accurate climate projections**, helping Australians prepare for and adapt to extreme weather events like floods, droughts, and heatwaves.

- **Agriculture adaptation** by helping farmers decide where to plant crops, graze livestock, and build drought-resilient infrastructure, ensuring food security and lower food costs.

- Insights into **urban climate impacts**, enabling **better planning** for rising temperatures, improved air quality, and reduced risks from extreme weather.

- **Reliable climate intelligence** that informs businesses and governments to manage risks, safeguard investments, and support regional stability.

- **Australia's global leadership**—our earth systems science capability is crucial for the Pacific region as a leading country in the southern hemisphere with unique ecosystems and climate challenges. It positions Australia as a strategic partner in addressing global climate issues and fostering regional stability and collaboration.

Recommendation & investment

An Australian Institute for Earth System Science must be established to provide the coordination and scientific underpinnings—observations, process-based understanding, and advances in predictive models—necessary for other government bodies and industry to generate actionable climate intelligence and inform decision-making for decades to come.

This institute will serve as a central hub for long-term, collaborative, and cutting-edge climate science, ensuring reliable and up-to-date knowledge underpins national and regional decision-making.

The institute could be established and operated for around **$20 million annually**. Additional funding would be required to support its long-term strategic research agenda. Government-led consultation and a scoping study are required to determine the institute's budget and governance model.

The institute will:

- **Operate independently with an advisory board** that includes members from universities, the CSIRO, BOM, business and government.

- **Facilitate collaboration** among existing organisations like CSIRO, BOM, and universities to **enhance national capacity**.

- Combine fragmented climate science activities under a **unified strategy** to eliminate duplication, address critical gaps, and align efforts with national priorities.

- **Coordinate long-term, strategic research** on critical earth system processes.

- **Develop the models and datasets that will inform policy**, adaptation strategies, climate services and investments for decades to come, ensuring Australia's responses to climate change are robust and evidence-based.

- **Represent Australia in global climate programs**, such as the Coupled Model Intercomparison Project (CMIP) and the World Climate Research Program (WCRP) and align national efforts with global priorities.

- **Establish a centralised system to manage, curate, and integrate climate observations**, ensuring they meet FAIR principles (Findable, Accessible, Interoperable, Reusable) and are accessible for cutting-edge research and modelling.

- Provide a focused environment to coalesce the **scientific workforce** required to address Australia's big earth system science questions.

Further information

- *A Decadal Plan for Australian Earth System Science 2024-2033*

Teaching Towards 2030: Academy teaching resources and professional learning

The Teaching Towards 2030 project scales the Academy's proven system of professional learning and innovative teaching resources across Australia. The project will expand the successful Primary Connections, reSolve Maths and Science Connections programs.

Science, technology, engineering and mathematics (STEM) are at the heart of almost everything we do and how we advance as a nation and a globe, from solving major global problems to creating new businesses and jobs we haven't yet imagined.

STEM skills are vital for navigating the complex and evolving landscape of the 21st century. Participation in STEM, from early years to the professional level, is an important means by which Australians can develop these skills and be equipped to navigate life, lead change, and shape a sustainable and prosperous future.

Reports on schooling in Australia continue to emphasise the need to improve student participation and performance in school STEM subjects.

Investing in teacher capability and confidence in teaching STEM is a significant factor in boosting student engagement, knowledge and accomplishment in STEM at each stage of their schooling. Access to high-quality teaching resources, coupled with sustained professional learning for educators, significantly contributes to improved STEM school education outcomes.

The Academy has an established track record in developing and delivering Australian Government-funded science and mathematics education programs. Over the last twenty years, successive independent evaluations have demonstrated that programs that build teacher capability succeed in increasing student engagement in science and mathematics.

The Academy of Science Education pre-budget submission, 'Australian Academy of Science Education, Teaching Towards 2030' provides a detailed proposal to expand the Academy's offerings, including baseline, midline and highline levels of investment. The proposal leverages current activities and momentum to consolidate, deepen and extend the programs, and to innovate in key areas of new impact.

Australian membership in the Belmont Forum

The Australian Academy of Science calls for the Australian Government to support membership and the Oceans 2 collaborative research action in the Belmont Forum through Future Earth Australia.

Many of Australia's scientific and research priorities are affected by global environmental change. A safe climate and healthy environment are foundational to economic prosperity and social well-being.

Many challenges presented by climate and environmental change are collective and therefore addressed through international collaborations. Australian input into global agendas and research strengthen the applicability of these efforts to our national and regional contexts, while our absence means Australian priorities are not even considered.

The Belmont Forum is a well-respected part of the multilateral system. It facilitates international cooperation in environmental research, builds global research capacity, influences policy, and enhances data sharing and open science practices.

Belmont Forum actions support the generation of the scientific knowledge and data that the Intergovernmental Panel on Climate Change and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services rely on to conduct its assessments and provide evidence-based recommendations for global climate and biodiversity policy.

The Belmont Forum opens new collaborative research actions each year on different themes, put forward and sponsored by governments and national agencies.

Current opportunities in the Belmont Forum

The Belmont Forum will open a call for Oceans Research (Oceans 2) in June 2025 at the UN Oceans Conference. The call's themes currently include biodiversity conservation, socio-ecosystems reliant on oceans, and adaptation to climate change. Australia should leverage its significant expertise in oceanic research to bear and lead this call.

Participating and funding Australia's involvement presents an opportunity for the Australian Government to:

- amplify Australia's distinguished track record in marine research

- directly aid implementation of our Nature Positive Plan commitments and draft Sustainable Oceans Plan priorities and enablers

- demonstrate leadership for Oceania in an area of regional significance

Contributing to this call brings direct benefits to Australia. It enables Australia to establish new partnerships globally and, in our region, to develop a better understanding of the impacts on, and resilience to, climate change on the ocean. We can shape global science efforts to find implementation pathways for the draft Sustainable Oceans Plan and Kunming-Montreal commitments (30x30 targets). This process can leverage Australian expertise to achieve the government's ocean policy objectives while accessing and benefiting from international efforts.

Australia's support for this effort would be materially helpful in building regional trust and partnerships, with the aim of hosting the UNFCCC COP31 jointly with the Pacific. It would also offer a chance to lead by example in an area of strength for Australia.

Recommendation & investment

The Australian Academy of Science calls for financial sponsorship of Future Earth Australia as a Belmont Forum member. An **ongoing investment of $75,000 per annum** would secure membership to and administration of the Belmont Forum for Australia.

Future Earth Australia adds value by finding, aligning and disseminating opportunities in the Belmont Forum, and supporting Australian stakeholders to enable global research action.

The Academy recommends that the Australian Government invest **$2 million in the Oceans 2 collaborative research actions** to reflect our national capabilities and interests. Funds can be annexed to support Australian and Pacific scientists, ensuring Australian dollars support Australian interests.

Contribution to the Belmont Forum will demonstrate Australia as a globally responsible nation through engagement with international projects on par with other comparable countries. The Australian Government has invested in four collaborative research actions to date via former Belmont member organisation, CSIRO. Based on previous experience, the Australian Government can expect up to $10 million in benefits from other partners for funded projects (data to 2019) from its investment of $2 million.

Contact

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