

Australia's Research Priorities 2023



ENGINEERS
AUSTRALIA



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About Engineers Australia

Engineers Australia is the peak body of the engineering profession representing the collective voice of more than 115,000 individual members. Constituted by Royal Charter, our mission is to advance the science and practice of engineering for the benefit of the community.

Engineers and engineering are indispensable contributors to Australian prosperity and lifestyles. Engineering services are embodied in almost every good or service consumed, used or traded by Australians, now and in the future. Engineers are the enablers of productivity growth because they convert 'brilliant ideas' into new commercial products, processes and services. Engineers also ensure society gets the most out of existing facilities by optimising their operations and maintenance.

As Australia's signatory to the International Engineering Alliance, Engineers Australia maintains national professional standards benchmarked against international norms. This includes accreditation of undergraduate university engineering programs.

Under the Migration Regulations 1994, Engineers Australia is the designated assessing authority to assess potential migrant engineering professionals' skills, qualifications, and work experience to ensure they meet the occupational standards needed for employment in Australia.

Engineers are passionate participants in public discourse, contributing to meaningful community and policy discussions that impact the economy and society. Engineers Australia formulates its policy positions through engagement with members and non-member engineers, industry, educators, government officials, and other experts across Australia and internationally. By synthesising these diverse perspectives, we develop evidence-based policy aligned with the highest professional standards.

Engineers Australia is a strong supporter of developing new industries that can grow the workforce, increase trade, strengthen domestic fuel security, reduce emissions, and foster innovation across Australia's scientific and engineering landscape.

We welcome the opportunity to provide input as part of the public consultation on *Australia's Research Priorities* discussion paper including previous consultations and workshops.

Ongoing engagement and contact

Engineers Australia stands ready to participate in future opportunities to discuss any of the issues and recommendations raised in this submission. Please do not hesitate to reach out if you would like clarification or to discuss anything further.

You can contact Simon Koger, Senior Policy Adviser - Climate Change at skoger@engineersaustralia.org.au

Consultation question responses

Question 1: The draft priorities intend to identify specific challenges facing the country that will require multidisciplinary and multisector efforts to address. Do they achieve this objective? How can we improve them?

Engineers Australia notes that the four priorities broadly reflect the pillars of Australia – our environment, our economy, our communities, and the resilience of each pillar as a cross cutting theme.

We support the specific objectives contained therein, and throughout this submission we provide detailed commentary including further research and collaboration opportunities across sectors to achieve the best outcomes for Australia.

Question 2: Feedback stressed the need to work in partnership with First Nations people to embed First Nations knowledge and knowledge systems in the way we address national challenges. How might governments and the science and research sector best work with First Nations people to achieve this objective?

Engineers Australia notes that the Indigenous population of Australia represents 3.2 per cent of the overall population, yet only 0.27 per cent of university qualified engineers. In light of this and in partnership with our Indigenous Engineers Group and Engineers Without Borders, we have developed our first Indigenous-led outreach program that focusses on engaging Aboriginal and Torres Strait Islander students in engineering for Country.

This program is vitally important for young Indigenous Australians to better represent and serve their communities but also provides essential community development work in creating opportunities and educational programs in regional and remote Aboriginal and Torres Strait Islander communities.

Engineers Australia recommends the Commonwealth Government support, by all available means, our Indigenous-led outreach program from pilot to a national program in all States and Territories.

Question 3: The draft priorities provide a range of critical research paths. How could we refine these research paths, for example, to address immediate challenges?

Opportunities for further research have been outlined below.

Priority 1: Ensuring a net zero future and protecting Australia's biodiversity:

- Greater research to improve our understanding of climate impacts, including tipping points, as well as the compounding effects of multiple stressors at global warming of 2°C or more.
- Design and construction of infrastructure including transport systems will be critical to achieving net zero. Specific opportunities for research and development include:
 - Materials: provenance, substitution, avoidance, resilience etc.
 - Design innovation.
 - Embodied carbon, with particular attention to Scope 3 emissions.
 - Electrification.
 - Transport technology and systems.
- Emissions reduction technologies: There are a number of high priority research and development challenges:
 - Energy storage that is cost effective, designed for circularity, and safe (e.g., battery chemistries that are not vulnerable to thermal runaway; and safety features/fire suppression methods for existing battery chemistries).
 - Green metals production and low emissions materials: develop low carbon methods for refining ores to metals.
 - Green hydrogen: Research the most cost-effective generation method for use as an industrial feedstock and energy storage. Storage methods also require research to overcome longevity problems of pipes and storage vessels such as from hydrogen embrittlement of steel.
 - Soil carbon methodologies that are not subject to or are more resilient from the impacts of climate change itself.
 - Renewable energy: low-cost energy production from diverse renewable sources and technologies to enhance grid stability.
 - Recycling: develop replacement materials suited to recycling and develop low energy/low carbon recycling methods.

- Plastics:
 - Plastic consuming organisms and fungi as a means of both removing environmental plastics or reforming it from polymer to monomer via hydrolysis, enabling repurposing and reuse.
 - The removal of plastics within our environment, both aquatic and terrestrial.
 - The production of plastics to be consistent so as to allow environmentally friendly disposal or recycling.
 - The ongoing impacts of plastics to human health, and our environment
- Understanding competing interactions between natural systems and human introduced systems such as the built environment, infrastructure, and agricultural systems, as a means of ensuring co-existence.

Priority 2: Supporting healthy and thriving communities:

- Education research:
 - STEM learning and teaching.
 - Education systems.
- Research to increase diversity, inclusion, belonging and equity within our communities to foster better physical and mental health outcomes.

Priority 3: Enabling a productive and innovative economy:

- Research into Australia's resources value chain as a means of value adding and supporting local manufacturing, especially in green technologies such as critical minerals, and green fuels such as biofuel & green hydrogen production.
- Workforce research:
 - Workforce productivity.
 - Skills shortages and acquisition, particularly engineering.
 - Workforce diversity.
 - The future of work.
- Streamlined pathways from research to commercialisation as a means of fast-tracking innovation and new technologies in the marketplace. Please refer this link for Engineers Australia's [Commercialisation of Engineering Innovation](#) paper, for reference.

Priority 4: Building a stronger, more resilient nation.

Climate resilience across our built environment requires engineered designs to cater for more extreme and more frequent natural disasters. Further research is required into the potential impacts of floods, severe weather events, drought and fire will inform design parameters for future infrastructure as well as retrofitting existing infrastructure.

Question 4: How would you implement the priorities in your organisation or setting? What mechanisms would support implementation?

Engineers Australia is able to muster skilled engineering expertise regarding all the priorities and most of the objectives. We welcome support and collaboration in this regard and are ready to work with all levels of government to continue to foster continued research and development.

Further, appointing a Commonwealth based Chief Engineer within the Department of Industry, Science and Resources would support implementation of the research priorities and provide a focal point for interactions on engineering matters.

Question 5. The National Science Statement will explain the role our science systems will play in delivering the priorities and maximising the benefits from science for Australia. How can the following best support the priorities:

- a. Science agencies: Appointing a Chief Engineer role would provide much needed government-based advice and support.
- b. Science infrastructure: Ensure adequate funding is available for new and existing research facilities.
- c. Australian government science programs: Ensure pathways to commercialisation are established as part of critical research programs to better enable market realisation, with a focus on promoting Australian developments.
- d. Domestic and international science relationships: Continue to foster international dialogue, peer review and research placements to increase our knowledge base.



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