



Building STEM career pathways and workforce diversity to address Australia's future challenges

The Australian Academy of Technology and Engineering (ATSE) is pleased to provide input to the Australian Government in determining its budget priorities for 2021-2022. This budget will be critical as Australia begins to recover from the effects of the COVID-19 pandemic, and in the face of increasing impacts of climate change.

As a Learned Academy of over 900 of Australia's leaders in applied science, technology and engineering, ATSE provides independent, objective advice and information to help Australians understand and use technology to solve complex problems. Our unique convening power brings together an extraordinary volunteer network of Australia's top experts across private, public and academic sectors.

ATSE urges the Government to take action on the urgent priority of mitigating and adapting to climate change, and to prioritise science, technology, engineering and mathematics (STEM) education, career pathways, and workforce diversity to ensure we have the capacity to drive innovation in Australia's recovery from COVID-19 and address future challenges.

Recommendations:

Climate change mitigation and adaptation

- Long term, bipartisan policies and programs to support mitigation and adaptation
- Set a national mission, such as net zero by 2050, supported by interim targets
- Continued rapid deployment of solar and wind-generated electricity infrastructure.
- Design and construction of material additions to the transmission network
- Development of zero carbon, large-scale storage such as pumped hydro
- Accelerated electrification across industry sectors (for example transport, heating), powered by renewable electricity.
- Investment in R&D and demonstration of all technologies with potential to facilitate Australia's low-carbon energy transition and reduce industry's emissions footprint.

STEM education and career pathways

- Increased use of inquiry- and problem-based pedagogies, taking advantage of industry partnerships, and introduction of new educational technologies
- Invest in skilled teachers, particularly in coding and other specific STEM disciplines
- A national approach to overcome the factors that discourage girls and women from studying STEM, and limit their opportunities to pursue careers in STEM-underpinned organisations and industries

Research translation and commercialisation

- Strategic public investment in research commercialisation to grow Australian industries and jobs
- Twenty per cent public-private collaboration premium in the R&D tax incentive
- A national industry innovation strategy to provide a long-term blueprint for industry innovation, scientific research, technology development and science, technology, engineering and maths education, supported by effective linkages and incentives

Climate Change mitigation and adaptation

Firstly, and most importantly to ATSE's Fellowship, Australia must take urgent action on climate change mitigation and adaptation. The science and lived experience of climate change is unequivocal. Greenhouse gas emissions have already altered the global climate system and will continue to do so well into the future, irrespective of any mitigation efforts.

Australia is being, and will continue to be, damaged by the effects of climate change. The horrific bushfires in the summer of 2019-20 affected millions of Australians. The costs to human life and health were immense. The direct economic cost may exceed \$5 billion, with reduced economic growth in the order of 0.2-0.5%.¹ The projected total cost to Australia's economy is in the order of \$70 billion, including costs associated with fighting fires, reconstruction, and loss of tourism.² The severity and extent of the impact of climate change across Australia's entire economy, environment and society is unknown, but ABS data indicates that the most vulnerable sectors include water, agriculture, biodiversity, coastal settlements and human health.³

Just as the Government accepted and followed the advice and evidence of experts during the COVID-19 pandemic, so must we listen to the experts on climate change. Climate change is an accelerating threat to Australia's infrastructure, agriculture, tourism, biodiversity and natural environment. Australia must adopt long-term, bipartisan policies and programs to support rapid and intensive deployment of technologies and measures to mitigate greenhouse gas emissions and adapt to the impacts of climate change.

We need a common mission – such as net zero emissions by 2050 – as a basis for co-ordinated national action, to create certainty for investment in climate change mitigation and adaptation, and to underpin a leadership position for Australia in international advocacy on emissions reduction. Net zero emissions by 2050 is very achievable, in fact perhaps even earlier. Oil, gas and coal produce 85% of Australia's greenhouse gas emissions. Energy generation greenhouse emissions are falling because of solar & wind generation are displacing coal and gas. Renewable energy generation is tracking towards 50% of the National Electricity Market (NEM) by 2025. In 2019, for the first time, over half of net demand on the NEM was met by renewables.⁴ If we can double solar & wind deployment rates, Australia will be well on track towards zero emissions in 2050.

To achieve this target, the Government should focus on:

- Continued rapid deployment of solar and wind generated electricity.
- Design and construction of material additions to the transmission network, and the development of zero carbon, large-scale storage such as pumped hydro.
- Accelerated electrification (for example of transport, heating), powered by renewable electricity.
- R&D and demonstration of all technologies that could be used to facilitate Australia's low-carbon energy transition, including reducing industry's emissions footprint.

This is the Australian Government's opportunity to fast-track Australia's transformation to a clean energy economy. Supporting 'clean' industries could create over 75,000 jobs in the next three years, in economic sectors and regions hardest hit by the COVID-19 downturn.⁵

¹ Dangar C. Ongoing Economic and Socio-Economic Impacts of the Australian Bushfires. C&D Restructure and Taxation Advisory. Published February 5, 2020. <https://cdrta.com.au/2020/02/05/the-wider-economic-and-socio-economic-impacts-of-the-australian-bushfires/>

² FXCM Australia. Financial Impact Of 2019-20 Australian Bushfires. FXCM Australia. <https://www.fxcm.com/au/insights/financial-impact-of-2019-20-australian-bushfires/>

³ Australian Bureau of Statistics. 4613.0 - Australia's Environment: Issues and Trends, Jan 2010. Australian Bureau of Statistics. <https://www.abs.gov.au/ausstats/abs@.nsf/lookup/4613.0feature+article1jan+2010>

⁴ Parkinson, G. Australia's main grid reaches 50 per cent renewables for first time. Reneweconomy. Published 6 November 2019. <https://reneweconomy.com.au/australias-main-grid-reaches-50-per-cent-renewables-for-first-time-17935/>

⁵ AlphaBeta. Clean Jobs Plan: How 76,000 new jobs for Australians can help rebuild our economy now and tackle climate change. <https://alphabeta.com/our-research/clean-jobs-plan/>

STEM education and career pathways

Sustainable economic growth, environmental sustainability and social wellbeing, now and in the future, will be driven by science and technology. Australia's future prosperity will rely on the quality and reach of STEM education, and ongoing capability development for a diverse innovative, knowledge-based workforce.

Demand for STEM skills in Australia is clear, presenting an opportunity to grow high-skilled Australian jobs; 75 per cent of the fastest-growing occupations require significant STEM skills and knowledge. STEM-based employment is projected to grow at almost twice the pace of other occupations. Yet recent ABS statistics show employers are still having difficulty recruiting STEM-skilled professionals, particularly in mining, manufacturing and electricity, gas water and waste services.⁶

ATSE commends the Australian Government's commitment to ensuring industry-relevant higher education and job-ready graduates, but this work must begin earlier, when Australia's future innovators are in primary school. As a nation, we are failing to encourage sufficient school students to take the senior secondary subjects that underpin further studies, or employment in areas that depend on STEM. School education must equip more children to gain core STEM knowledge and skills through the compulsory years of schooling, and the confidence and interest to pursue STEM subjects in senior school. We must excite tomorrow's innovators to pursue careers in STEM, developing Australia's capacity and capability to meet the challenges of the future. Australia's enviable existing STEM capability has seen us address the challenges of the COVID-19 pandemic head on and with world-leading success – we must continue to grow this capacity if we want to remain a globally competitive nation.

Increasing the use of inquiry-based and problem-based pedagogies within STEM and other subjects, taking advantage of industry partnerships where appropriate, and exploring the use of new educational technologies will significantly improve the quality of education in Australia. It is also critical that teachers are trained to be skilled and confident in STEM subject matter.

ATSE also urges the Government and the education sector to increase efforts towards achieving gender equity in Australia's STEM-qualified workforce. Australia's STEM Workforce Report 2020 showed that the gender gap persists despite significant progress.⁷ Diversity is a key driver of innovation and has been consistently linked to improved organisational performance. If Australia is to realise its innovation potential, we need every STEM-skilled worker and a diversity of perspectives and skill sets in our workforce.

ATSE advocates for a coordinated, national policy to overcome the various factors that discourage girls and women from studying STEM, and that limit their opportunities to pursue careers in STEM-underpinned organisations. ATSE partnered with the Australian Academy of Science to develop the Women in STEM Decadal Plan, and we have developed a number of programs that aim to improve quality, participation and gender equity in STEM sectors and STEM education, which include:

- **STELR (Science and Technology Education Leveraging Relevance)**, a program that has supported science in secondary schools since 2007 with authentic, inquiry-based and problem-based pedagogies
- **Science in Australia Gender Equity (SAGE)**, which aims to improve gender equity and diversity in STEM in Australia's higher education and research sector.
- **Industry Mentoring Network in STEM (IMNIS)**, which provides STEM PhD students the opportunity to engage with industry, extend their professional network, and obtain advice from influential industry mentors. Ninety per cent of IMNIS alumni are considering or actively pursuing careers in industry – compared to only about 30 per cent of PhD graduates not participating in the program.

⁶ Australian Bureau of Statistics. Business Indicators, Business Impacts of COVID-19.

<https://www.abs.gov.au/statistics/economy/business-indicators/business-indicators-business-impacts-covid-19/dec-2020>

⁷ Australia's Chief Scientist. 2020 Australia's STEM Workforce Report.

<https://www.chiefscientist.gov.au/news-and-media/2020-australias-stem-workforce-report>

In 2021, ATSE will build on the success of IMNIS with an integrated industry internship program to support advanced degree students and graduates to find pathways to employment in industries that will benefit from increased capability. This ATSE-led industry internships program will directly support career pathways for highly qualified researchers, as well as facilitating industry-research collaboration and innovation. ATSE welcomes government support for, and partnership in, this and our other initiatives.

Research translation and commercialisation

Collaboration between Australia's research workforce and industry sector underpins innovation in our economy, and will be critical to support growth in onshore jobs during and following the COVID-19 pandemic. While Australia has a world-class research base, our performance in translating publicly funded research outputs into economic benefits is poor. Australia needs to rethink the way public money is applied to research through a renewed focus on research commercialisation into high technology, high-value industries that drive economic and jobs growth by producing high quality products and services. The Government must also ensure public investment in research is leveraged toward public benefit, incentivising private sector investment in this research through a 20 percent collaboration premium in the R&D tax incentive.

Diversification of Australia's industry mix is also essential to ensure that our export base is less dependent on the resources sector. An overarching National Industry Innovation Strategy will provide a long-term blueprint for industry innovation, scientific research, technology development and science, technology, engineering and maths education, supported by effective linkages and incentives.