

SUBMISSION

Submission to the Productivity Commission

5 Pillars Productivity Inquiries:

Building a skilled and adaptable workforce

Harnessing data and digital technology

Investing in cheaper, cleaner energy and the net zero transformation

6 June 2025

The Australian Academy of Technological Sciences and Engineering (ATSE) is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia's leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

Australia's productivity growth has halved over the last two decades - the average annual productivity growth rate has fallen from 1.8% in 2003-04 to just 0.9% in 2022-23¹ (Australian Bureau of Statistics 2023). Given that high productivity is associated with higher wages, lower prices and stronger economic growth (Reserve Bank of Australia n.d.), the decline in productivity over the last two decades poses a clear risk to Australia's future economic prosperity. Technology and innovation are core drivers of productivity growth, with widespread adoption of new technologies and techniques leading to improved efficiency and higher growth. Australia's comparative advantages, including sovereign datasets and abundant clean energy, can be leveraged to enhance productivity growth across the economy.

This submission draws on the expertise of Australia's leading engineers, applied scientists, and technologists to provide evidence-based recommendations across three critical pillars: building a skilled and adaptable workforce, harnessing data and digital technologies, and enabling cleaner energy and the net zero transition. In building the skilled workforce required for Australia's productive future, ATSE highlights the importance of curriculum reform for inquiry-based learning, addressing education system inequities, and integrating vocational and university education systems. ATSE suggests also strengthening Australia's sovereign Artificial Intelligence (AI) and data capabilities, and ensuring rural and remote Australians benefit from the AI boom. Finally, ATSE advises opportunities for reforms to support the energy transition, including policy certainty, improving project approval timelines, and enhancing efficiency of the energy grid including through demand-side management. By invigorating these interconnected areas with appropriate policy reforms, Australia can unlock innovation-led productivity growth.

To improve Australia's productivity, ATSE recommends the following actions:

Recommendation 1: Establish an evidence-based, high-quality, and centralised directory of STEM learning resources accessible to teachers, learners, and organisations.

Recommendation 2: Increase equity by better supporting regional schools and improving training and support for teachers to achieve the best possible outcomes for students, including neurodiverse students.

Recommendation 3: Support greater integration between universities and vocational education for a system responsive to workforce needs.

Recommendation 4: Invest in increasing Australia's sovereign AI capability, including through infrastructure and skilled workforce development.

Recommendation 5: Encourage domestic AI technology development and collaboration through government procurement processes.

Recommendation 6: Develop coordinated national infrastructure for storing Australian datasets.

Recommendation 7: Embed data governance and sovereignty principles in the management and application of nationally significant datasets.

Recommendation 8: Expand digital access and literacy for regional, rural and remote Australia.

Recommendation 9: Reduce perceived investment risks through a clear, long-term vision for Australia's clean energy future.

Recommendation 10: Accelerate new energy projects through streamlined approvals processes, while engaging with communities to develop social licence.

Recommendation 11: Increase adoption of technologies and policies that allow for energy supply and demand to be better managed, improving energy system efficiency.

Building a skilled and adaptable workforce

Curriculum reform to improve educational outcomes

With rapid technological changes shaping society, skills such as critical thinking, creativity, collaboration, media literacy, and digital literacy are more essential than ever to support an innovative workforce. These

¹ 20-year average annual growth rate

are uniquely human capabilities that current technologies cannot replicate, and which are vital to navigate the changing world and meet future skilled workforce needs.

To address this need, ATSE recommends improving teachers' access to curriculum and lesson-planning resources as well as training using evidence-based teaching practices. This would support teachers to deliver high-quality, impactful and engaging education, enabling students to develop skills and apply them across different contexts. A more integrated curriculum would teach skills across disciplines, fostering deeper learning. This approach is pioneered by the University of Sydney's STEM Teacher Enrichment Academy, which develops teachers' capacity to integrate STEM skills into different subject areas. This also more closely resembles the thinking styles needed for many applied STEM careers. Similarly, ATSE's STELR program enables educators to deliver proven, hands-on, inquiry-based learning that teaches STEM concepts in real-world contexts.

ATSE agrees with the Productivity Commission's suggestion to improve access to curriculum and lesson-planning resources. While many STEM resources exist, finding and assessing these resources is a challenge for time-poor teachers. ATSE's report *Our STEM Skilled Future* recommends the creation of a national centralised directory of evidence-based and high quality STEM training programs and resources to address this gap (ATSE 2022a). Resources should be kept up to date with emerging technologies, including Artificial Intelligence, to ensure that Australia's future workforce is well positioned to navigate emerging technologies.

Ensuring every student has an opportunity to succeed

Education in Australia is not equal. Students at regional, rural, and remote (RRR) schools do not have access to the same resources, opportunities, infrastructure, and specialised teaching as their metropolitan peers. This is reflected in national statistics, where 10.7% of remote students and 35% of very remote students scored below the minimum standard in mathematics, compared with 3.8% of metropolitan students (Australian Mathematical Sciences Institute 2020). Due to the limited teaching workforce in RRR areas, often these schools have a single qualified mathematics teacher, with remote schools having higher rates of out-of-field mathematics teaching for years seven to ten (Australian Mathematical Sciences Institute 2020; Shah et al. 2020). The few teachers available are backed by insufficient infrastructure, equipment and professional development opportunities that fall well below the standard accessed by metropolitan teachers. There is an urgent need to train more in-field mathematics teachers in RRR areas and provide the same resources as their metropolitan peers. As recommended by ATSE's *Our Stem Skilled Future* report, along with increasing the number of in-field STEM teachers, improving resources, training and communities of practice would support RRR teachers – including out-of-field teachers – in delivering high-quality STEM education.

Even at metropolitan schools, some students are disadvantaged by the school system. Neurodiverse students face additional challenges, including behavioural issues, social challenges and managing executive functioning, that require support. Classroom environments are typically designed around the needs of neurotypical students and are not designed to support students with different information processing styles. Evolving our school system to better support neurodiverse students would facilitate greater equity and help improve outcomes.

Integrating the post-secondary education system

The skills that industry needs can change rapidly as new technologies emerge. The ability to rapidly retrain and upskill workers would support businesses to embrace new innovations. Australia's post-secondary education system is characterised by separate university and vocational education and training (VET) sectors. There is a status difference between these sectors - with 78% of students nominating university as their parents' preferred option for future study, compared with just 3% for VET alone (Year13 and YouthSense 2019). This is despite VET qualifications being essential to filling many of Australia's skill

shortages and the earning potential of many vocation qualifications being much higher than some university qualifications. Improving the perceived standing of VET will be critical to filling many of these shortages².

The relationship between universities and the VET sector would ideally be a two-way street, with students and life-long learners moving from one to the other seamlessly and receiving credit for prior learning. Better integration between the VET sector and universities, in the form of cross-accreditation and joint study pathways, would help to enable more flexible learning to support the skills needs of industry and allow learning pathways that can adapt more quickly to changing industry needs. It is also vital that these pathways are available to all students. Regional students often have limited study options or are travel long distances to undertake study. Improving access for RRR students to engage in post-secondary education and training is essential to building a stronger and more flexible workforce.

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Harnessing data and digital technology

Building a sovereign Artificial Intelligence (AI) capability

To unlock the productivity potential of AI, a significant domestic capability uplift will be required. Australian businesses have benefitted from imported AI innovations. However, Australia lacks sufficient AI research infrastructure. Developing sovereign AI capacity – bespoke to our national needs, strengths, and laws – can accelerate Australia's AI-driven productivity growth, while reducing exposure to the geopolitical risks of offshore providers. ATSE has proposed an AI research engine, which would include fundamental research and commercialisation hubs (ATSE 2022b). Creating this capability would elevate Australia from an AI consumer to an AI producer, realising economic and community benefits including in priority areas such as healthcare, climate change, and manufacturing. It could also help address some of the drawbacks of AI technology, such as power and water consumption by developing new efficient systems and building infrastructure in locations that can accommodate electricity and water needs. Applying the Future Made in Australia approach to AI development would engage the public and private sectors to build up this significant industry over the coming decades.

The public sector is actively pursuing efficiencies through AI adoption. Continued reliance on imported AI products in the public sector would represent a missed opportunity to foster sovereign technology development. A 2025 parliamentary inquiry revealed that 24 of 40 surveyed Commonwealth agencies were using generative AI tools such as Microsoft Copilot and ChatGPT (Joint Committee of Public Accounts and Audit 2025). A Microsoft Copilot trial provided proof-of-concept for productivity gains, though raised concerns including data misuse and vendor lock-in. AI efficiencies are also sought on a state level. The New South Wales Government, a leader in this space, published its Artificial Intelligence Strategy in 2020. Their strategy included reforms to procurement for AI-based technologies, to make it easier for businesses, including start-ups, to engage as suppliers. In May 2025, the Victorian state budget reduced the number of public servants, while allocating funding for AI programs to streamline bureaucratic processes. The uptake of AI technologies in the public sector raises both risks and opportunities. A sovereign AI capability, backed by an upskilled public sector workforce and robust regulatory frameworks to safeguard data and outcomes, would enable Australian governments to manage these risks directly. Public sector AI initiatives could

² For more information, see ATSE's [Submission to the House Standing Committee on Employment Education and Training's inquiry into the perceptions and status of vocational education and training](#).

leverage procurement to grow the Australian AI industry while also mitigating national concerns such as algorithmic biases and ethical data use.

Strengthening data sovereignty and governance

Sovereign datasets are a key enabler for AI-powered advancements in Australia. Nationally significant datasets in areas such as health and the environment will be essential for training sovereign AI systems that accurately reflect the Australian population and context. Datasets and AI capability go hand-in-hand – and will require significant infrastructure, governance and workforce uplifts to position Australia as a leader.

There are numerous challenges in storing, managing and sharing datasets held by Australian institutions. Research data management remains fragmented, with a lack of access and sharing arrangements and standardisation (ACOLA 2022). Misuse of data without informed consent is an active concern, including in the context of Aboriginal and Torres Strait Islander data and intellectual property. Universalising adoption of the FAIR (findable, accessible, interoperable and reusable) and CARE (collective benefit, authority to control, responsibility and ethics) principles would enable researchers to find and use datasets in an ethical manner. The practice of AI models scraping datasets from the open internet raises further concerns about intellectual property rights and responsible data use. This underscores the importance of developing sovereign AI capabilities. Australian governments could implement FAIR and CARE principles domestically, but cannot compel overseas providers to adhere to these frameworks.

ACOLA's report also identifies the need for investment in data infrastructure, providing long-term certainty and enabling digitisation of collections. Investment in storage is already underway in the health sector, with the Research Data Infrastructure initiative to establish and extend infrastructure for critical health and medical data (Department of Health Disability and Ageing 2024). Expanding shared infrastructure for secure, standardised, and ethically governed data access would unlock productivity gains for data-enabled research, including collaboratively across disciplines and sectors. National coordination would provide opportunities to standardise metadata, enabling interoperability across sectors and jurisdictions. Coordination could also lead to data provenance tracking, improving transparency of how data is used.

Bridging the digital divide for regional, rural and remote Australia

To fully realise the productivity dividends of data and digital technology, there is a need to expand technology accessibility to Australia's RRR communities. Bridging the digital divide can be a catalyst for economic growth, job creation, and improved delivery of health, education, and government services across RRR Australia. Conversely, as emerging technologies including AI and Internet of Things become more prevalent, it is crucial to ensure that rural and remote communities are not left behind. Providing adequate telecommunications infrastructure and uplifting digital literacy will be essential to fostering effective and inclusive AI-human interaction, including as AI becomes more common for government services administration. ATSE encourages the Productivity Commission to consider the findings of the [First Nations Digital Inclusion Roadmap](#) and the [New South Wales Digital Inclusion Strategy](#). ATSE provided submissions to both consultations, highlighting the need for infrastructure development and maintenance, affordable access to devices, and digital literacy programs (ATSE 2024a, 2024b).

Australia's dependence on foreign-owned telecommunications satellites is an emerging concern. Vendor lock-in limits the Australian Government's flexibility to plan for and respond to risks. Disruptions to satellite internet access would heavily impact rural and remote Australian communities, where there is often no alternative for internet access. Other applications of satellites in agriculture and mining may also be at risk. This is a further consideration for planning and delivering telecommunications infrastructure in RRR areas.

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Investing in cheaper, cleaner energy and the net zero transformation

Policy certainty to drive investment

The climate wars of recent decades have resulted in significant uncertainty that makes investment in all energy systems more difficult and more expensive. Increased policy uncertainty has been shown to lower investment in green energy in particular (Burns 2019). In the previous term of the federal government, several policies were announced with long-term climate and energy ambitions in mind (including the setting of a legislated emissions reductions target) which have been positive developments. However, a lack of bipartisan support for energy policies introduces uncertainty for investors considering long term energy investments. Australia therefore needs a long-term, consistent, bipartisan climate and energy policy that sends clear signal to investors that their energy decarbonisation investments can deliver long-term returns. These signals could include larger-scale government investments into renewables and supporting infrastructure, or economic policy levers like a universal price on carbon³. They could also include greater engagement through international bodies and cooperation with international trade partners, especially to avoid carbon leakage through policies such as the Carbon Border Adjustment mechanism.

ATSE supports a technology-neutral approach, so that the energy transition can be navigated using the cheapest, most timely and efficient technologies available. This includes removing the legislated prohibition on nuclear power which, while not currently the cheapest low-emissions option to decarbonise the first 90% of the energy sector, may be a competitive option alongside other technologies (such as carbon capture and storage, and hydrogen gas turbines) to decarbonise the final 10% (Mai et al. 2022).

Improving the efficiency of green energy infrastructure approvals

Improving the speed of deployment of new green energy projects will not only lead to lower emissions sooner, but also lower prices for energy consumers. Delays in the project development pipeline leads to increased project costs, resulting in higher consumer prices as electricity prices recoup this extra cost once deployed. It also leads to higher emissions as Australia relies on more expensive coal and gas generation in the meantime. Delays are primarily caused by two factors: the time taken to receive government approvals and community objections to projects.

Almost three quarters (74%) of renewable energy capacity in the development pipeline has yet to receive planning approval, with projects facing delays of up to eight years (Johnston 21 May 2025). This is becoming a major barrier to investment as projects are left in limbo while they attempt to navigate a complex web of state, territory and federal approval processes. Applications in different states can have wildly different outcomes, with application fees in New South Wales up to 150 times those in Queensland, while New South Wales approvals take up to three time longer (Riley 2024). The system needs to be streamlined and unified across jurisdictions to ensure projects are deployed quickly and at the lowest possible cost.

Several large-scale green energy projects have been significantly delayed by community concern regarding the impacts of these projects. In particular, offshore wind projects across the country from the Hunter to the South West have had vocal opposition from community groups. Misinformation has spread in these communities, with unscientific claims of impacts on whale migrations and damage to marine life. This speaks to a need for genuine community consultation and efforts to debunk misinformation to build social licence. The Government could ensure that high-standard consultation processes are adopted across all renewable energy industry sectors to ensure that bad practice by individual actors does not compromise the opportunities for all players. Such practices need to consider local factors, including local industries, history and the Traditional Owners of the area. While considering the concerns of local communities is important, the process should not be so open-ended as to lead to inordinate delays. The adoption of the EU approach

³ Carbon pricing is widely regarded by economists as the most effective economic lever to reduce carbon emissions, with international carbon prices only becoming more effective over time (Döbbeling-Hildebrandt et al. 2024).

of restricting permitting approvals and objections to one year for projects of [Overriding Public Interest \(OPI\)](#) is one option for Australia.

Boosting the efficiency of the energy system

Alongside investment certainty and optimised approvals processes, demand side management is another lever to reduce emissions and stabilise energy costs. The more efficient the energy system, the less generation capacity will need to be deployed, minimising capital costs and consumer prices. The Australian Government has several avenues it can take to improve the efficiency of our energy network as we transition towards a net-zero economy. Better use of consumer energy resources, storage technologies, demand management and better urban planning can all reduce energy generation requirements in the short-to-medium term. This will require a range of technologies including in energy generation, storage and management. Similarly, preparing for a circular energy economy will lead to long-term reductions in energy prices.

Efficient energy networks require supply and demand for energy to be better aligned. With over a third of households now having rooftop solar, mid-day solar generation has caused significant difficulties for Australian electricity networks as supply outstrips demand, requiring network managers to switch off consumer solar panels to maintain grid stability. This represents a major inefficiency where installed generation resources are not being utilised to their fullest extent. ATSE's [Power to the People: Demand Side Management Explained](#) explores a range of options to help manage this issue. Greater investment in energy storage is key, allowing this excess energy from the middle of the day to be stored and used when demand is higher (e.g. in the evenings). Options for this include household batteries and large-scale or community batteries for shorter term storage and pumped hydro for longer term storage. Electric vehicles with the ability to transfer electricity from the vehicle to grid (V2G) or vehicle to home (V2H) can also play an important role. AI may also help to manage energy systems more efficiently, detect problems more rapidly and better predict and model future energy needs.

Beyond the energy network, economy and society-wide changes can help to improve the energy grid's efficiency by reducing demand and future generation costs. These can include urban design which prioritises green canopy coverage and active transport friendly cities. Increasing canopy coverage, especially in city-centres helps to moderate temperatures resulting in reduced energy demand (Department of Planning Lands and Heritage et al. 2018). As electric vehicles become the standard vehicle for most households, cities designed for active transport can encourage motorists to take alternative options, reducing charging requirements and grid demand. Developing a circular economy will also allow the energy sector to reduce costs as green energy generation infrastructure reaches the end of its lifespan and needs to be replaced.

Recommendation 9: Reduce perceived investment risks through a clear, long-term vision for Australia's clean energy future.

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ATSE thanks the Productivity Commission for the opportunity to respond to inquiries into building a skilled and adaptable workforce, harnessing data and digital technology, and investing in cheaper, cleaner energy and the net zero transformation. For further information, please contact academypolicyteam@atse.org.au.

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