

Engineers Australia's Employment White Paper
Submission
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ENGINEERS
AUSTRALIA

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Engineers Australia's Employment White Paper Submission

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Executive Summary

The engineering profession has a direct influence on national productivity and employment. Engineers create the systems, products and services that enable people in almost all occupations to be more productive and create more jobs. They allow people to do more with less effort, time, materials, energy, health risks and environmental disturbance. Engineers also help people to use systems, products and services more effectively, creating more value hence new job opportunities. Therefore, the engineering profession is critical to employment in Australia.

The roadmap the Federal Government intends to draw which will shape productivity and employment growth in the future, will rely on the skills and experience of engineers. From advancements in the use of technology and data in the growing services sector, to improving digital infrastructure and transitioning Australia to a decarbonised economy, an engineer's ability to think critically and solve complex problems will be highly sought after. The expectations on engineers are growing. As well as having technical expertise, the modern engineer is expected to work in complex multidisciplinary teams, be digitally savvy, have good interpersonal skills and understand the social context of their work. In addition, engineers are expected to help develop social licence (trust), improve sustainability, and engage directly with a broad range of stakeholders.

Governments at all levels have committed to a significant number of infrastructure projects at various stages of development. The certainty of climate change and the need to radically reduce emissions, coupled with the need to enhance the resilience of physical energy assets and systems, drives the urgency of the transformation process facing Australia. For all these priorities, engineers are essential. It is therefore paramount that current and future challenges in the supply of engineers are addressed.

The current acute skills shortage is partly due to an increase in demand for engineering skills, at a time when international border closures have hindered skilled migrants arriving in Australia. However, the explanation for the skills shortage is more complex and multi-faceted. There are structural reasons that explain why the engineering workforce supply channels are not keeping pace with demand.

Shortages are present in almost all professions. Priority should be given to engineering because engineers play a critically important role in all sectors of the economy. Prioritising the supply of experienced engineers would reduce project costs and timelines, as well as the cost of rework. This would have an overall positive domino effect on Australia's productivity.

Resolving the engineering workforce challenges requires collaboration between all levels of government, industry, the tertiary education sector, and professional associations. The time to commence some focused initiatives is now.

This submission outlines the factors influencing the number of practising engineers in Australia and offers suggestions on how to resolve them in the short, medium and long term. It highlights the imperative to sustain the current infrastructure pipeline as well as the current and future needs to achieve the global transition to clean energy and adaptation to climate change. It addresses the clear gaps in diversity and the opportunities for better inclusion in Australia. It points out the importance of collaboration to drive innovation through STEM commercialisation. It emphasises the need for building domestic skills and capabilities to move to a more sustainable, productive and resilient future, focusing on the accuracy of our demand forecast. It also outlines the need to preserve the integrity of engineering practice, using existing and upcoming state mandatory engineering registration schemes, without hindering its mobility.

There are clear opportunities for the engineering profession to be Australia's main driver of productivity and employment, but it calls for more to be done to address the shortage of critical engineering skills hindering the industry's full potential.

Engineers Australia puts forward a series of recommendations of impactful initiatives to strengthen the engineering workforce in Australia and invites feedback and collaboration with the Federal Government on how to best pursue the development and implementation of these initiatives

Summary of Key Recommendations

1.1.1 Shortage of skills affecting full employment in the engineering industry

- All levels of government should work together to increase Australia's teaching capability in STEM subjects, including offering programs to make it easier for mid-career STEM professionals to become maths, science or engineering studies teachers, increasing the number of maths and science teachers with relevant qualifications, and providing effective resources to out-of-field maths and science teachers to encourage more young Australians to choose to study maths and engineering studies.
- Establish senior engineering roles within government to oversee, guide and advise on important engineering work and to ensure the engineering perspective is incorporated into policy decisions and planning.
- Government should take a more active role in providing engineering experience to engineering students and graduates. Agencies and departments which have an engineering capability should offer more engineering internships and graduate programs, and contractors should be incentivised to provide similar opportunities to engineers through procurement processes.
- Offer incentives for students to undertake engineering associate (2-year) and engineering technologist (3-year) qualifications.

1.1.2 Increasing labour productivity growth.

- Governments must commit to long-term collaborative planning to mitigate the negative effects of short-term electoral cycles on infrastructure planning and delivery.
- Government and industry should develop an infrastructure industry best-practice guide mandating key policies to optimise benefits and minimise risk in infrastructure project management, delivery, and operations.
- Governments at all levels should reform their tendering processes to promote greater participation from SMEs.
- Engineers Australia recommends governments implement a consistent procurement framework across all levels and between all departments associated with interrelated infrastructure, applying the ISO 55000 series of standards for asset management for consistency across states and territories.
- Governments should avoid using non-standard contracts and provide visibility of contracts before tender, allowing sufficient time for review. Any required amendments to standard contracts must be subject to collaborative negotiation with industry stakeholders.

1.1.3 Increasing real wages growth.

- Engineers Australia recommends the implementation of recommendations made in 1.1.1 and 1.1.2 as they would help increase both the engineering talent pool and productivity. This would have a direct impact on Australia's capability to sustain the pipeline of projects, increase engineering companies' profitability and assist with the wages issue.

1.2.1 The energy transition and tackling climate change and emerging technologies.

- A comprehensive national transition strategy needs to be clearly defined by the government so that real tangible structural adjustments in the labour market can be made.

- Australia needs coherent and stable policy settings focused on community benefit and certainty for investors. Policy settings need to reflect how structural change will be managed equitably across industry sectors and geographies for a just transition.
- Governments have a critical role in setting expectations and facilitating new industries and training opportunities, particularly in regional areas that are transitioning from the carbon economy.

1.2.2 The transformation associated with digitalisation and emerging technologies.

- Engineers Australia recommends the establishment of a unit focused on Australia's digital infrastructure future to support agile development and the rollout of digital infrastructure tools.
- Governments must allocate funding for training and upskilling the labour force and subsidise programs to promote collaboration between industry and academia to encourage greater integration of current and emerging technologies.

1.2.3 Building resilient supply chains in a changing geopolitical landscape.

- Australia needs coherent and stable policy settings focused on community and integration of engineering solutions with political, economic and social concerns.
- Priority should be given to building strong manufacturing sovereign capability to reduce our dependence on imports. In the short term, implementing 'buy local' policies will help domestic suppliers in the procurement phase.

1.2.4 The adaptability of our workforce to meet the needs of emerging industries and areas of traditional economic strength.

- ANZSCO codes relating to engineering in the energy sector should be updated to reflect the modern engineering workforce
- Training incentives and programs need to be offered to businesses and the Australian workforce to ease the shift and ensure a safe and fair transition to the net zero / clean economy.

1.3 Job security, fair play and conditions, including the role of workplace relations

- Engineers Australia recommends government lead the way by implementing robust skills competency frameworks based on international benchmarks within all its departments and set it as standard for all industries to reach to promote a greater level of job security and conditions within the Australian labour market.

1.4 Pay equity, including the gender pay gap, equal opportunities for women and the benefits of a more inclusive workforce.

- Engineers Australia encourages more Australian companies to join initiatives such as the Champions of Change Coalition, which aims to change the status quo and disrupt the system on sexual harassment and promote a more diverse and equal workforce in Australia.
- More support from governments needs to be provided to raise awareness of these types of initiatives and promote a more just, diverse, equal and fair labour market in Australia.

1.5.1 Reducing barriers and disincentive to work, including the role of childcare, social security settings and employment services.

- Engineers Australia supports the government's announcements on extended parental leave for all and greater level of support subsidies for day care.
- We recommend further investments from the government on day care programs assisting working parents' return to full time work to lessen part-time arrangements' impact on engineering teamwork and deter them from leaving the industry for more flexible professions.

1.5.2 Improving labour market outcomes for those who face challenges in employment

- Government needs to include and promote the incorporation of Indigenous knowledge into any tenders released, as well as demonstration by bidders of their understanding and respect for Indigenous culture to set new standards within industries.
- Government should invest in programs to improve and provide culturally appropriate and engaging delivery of STEM education for Aboriginal and Torres Strait Islander students, particularly acknowledging Traditional knowledge, and including mathematics instruction 'in language'.
- Government needs to promote training on how to implement reasonable adjustments in the workplace and financial incentives to encourage disability employment
- Government needs to take the lead by implementing nonbinary gender and neurodiversity inclusion awareness programs and promoting the expansion of gender options in all Australian administrative systems.
- Government needs to integrate automatic recognition of ADF's training and cadetship programs with professional peak bodies and universities to ease veterans transition to the civilian workforce.
- Government needs to increase its investment in infrastructure, technology and teaching capabilities to disenclave RRR areas, and improve the chance of employment and retention in RRR communities.

1.5.3 Skills, education and training, upskilling and reskilling, including in transitioning sectors and regions.

- Government must allocate funding for training and upskilling the labour force, and subsidise programs to promote collaboration between industry and academia to encourage greater integration of current and emerging technologies.
- Government should work with industry peak bodies to establish simple industry standards for digital skills (e.g., cybersecurity, artificial intelligence, data analysis, etc) to enable the acknowledgement of skills acquired through diverse educational mechanisms such as microcredentialling (i.e., small, focused courses that rapidly upskill individuals), on-the-job training and vendor-provided training.
- Government must take leadership in the review of needs upskilling and reskilling training programs and coordinate them with necessary fundings with states and regions most affected by the energy transition to reduce the impact on local workforce and provide further employment opportunities and supply of critical skills needed.
- Engineers Australia recommends the government provide more funding to STEM programs in schools which have been proven to be effective like EA Junior Club, Engineering is Elementary, Khan Academy, Re-Engineering Australia Foundation, F1 in schools STEM challenge and Year 13.

- Government must provide support to these industry-led initiatives by collaborating with industry, professional peak bodies, unions and universities, reviewing these programs and coordinating the successful ones nationally to generate improved results.

1.5.4 Migration settings as a complement to the domestic workforce.

- Better support needs to be provided to migrants to improve employment outcomes which will increase the pipeline of 'experienced' engineers immediately. Continuing large scale intakes of qualified engineers will not significantly develop Australia's engineering capability and may start to harm Australia's reputation as a country with good employment prospects for migrant engineers.
- Better utilisation of the skills currently in Australia (both through migrants and those looking to re-enter the engineering workforce) should be sought in the short term. Action is needed to modify Australia's migration program to ensure a better fit for the policy objectives with more of a focus on employment outcomes
- State and territory governments should provide specialist programs to support skilled migrants to transition into occupations that align with their skills and qualifications, and should provide greater opportunities for them to engage in leadership roles across the sector. Where such programs exist, they should be subject to regular review to determine efficacy and allow for continuous improvement

1.6 The role of collaborative partnerships between governments, industry, unions, civil society groups and communities, including place-based approaches.

- For Australia to improve its capacity to commercialise STEM innovation, there are three core issues where a policy shift is required:
 - Improving models of collaboration and ecosystem development
 - Reforming grants processes and tendering for government contracts
 - Reducing regulation and incentivising investment in STEM start-ups in line with global best practice
- Australia further needs to develop students' awareness of career paths and opportunities gained through studying these subjects. Collaborating with peak bodies like Engineers Australia would bring additional support to existing programs. See list of current Engineers Australia programs in Appendix 1.
- Peak bodies, educators and government education departments should work to develop and support implementation of collaborative teaching practices. Strategies should leverage virtual mechanisms such as online synchronous teaching from subject matter experts for multiple classes that allows both the students and teachers to learn. They should also consider group/co-marking of student work, collaborative lesson planning, sharing of established lesson plans and team teaching. This cultural change needs to be championed by school leadership and departments of education.
- The Government education departments should develop and fund a targeted paid internship program for undergraduate tertiary mathematics students to expose them to RRR teaching career options that they may not have otherwise considered.
- Engineers Australia advocates for internships to be paid to support students who are working and studying as well as for youth allowance and scholarships to be increased.
- Industry-led collaborative partnerships require the government's support by allocating funding and incentives for employers.

- Engineers Australia supports the current government proposal to rethink the current system in place. We encourage the government to collaborate with industry, peak bodies and unions to implement a more efficient attractive and demand-driven system for Australian employers and much needed talents as a complement to the domestic workforce.

1.7 Other relevant topics and approaches.

Occupational Licensing & Mutual recognition schemes

- Now that more states have or are about to have a statutory registration for engineers, the need for a coherent approach is urgent to end discrepancies between the various schemes and to prevent further impacts on the uptake of engineering projects vital to the country.
- Government must provide an avenue to resolve the automatic deemed recognition issue to reduce the negative impact the various statutory registrations currently impose on occupational mobility and overall engineering industry productivity, by working with state governments to establish a system similar to what is in place for other licencing system such as driver licences.

Introduction

Engineering is a profession which influences the lives of every Australian every day. Engineers build the world around us. The innovations they bring enable all other professions to evolve and achieve what we thought was impossible. At Engineers Australia, we know that when engineering thrives, our civilisation thrives too. Therefore, the engineering profession is the cornerstone of our society, and it is paramount to ensure a strong supply of engineering workforce to ensure a bright future for Australia.

As the voice of the engineering profession, Engineers Australia's scope of response to these Terms of Reference will only be within the remit of the engineering industry.

About Engineers Australia

With more than 115,000 individual members, Engineers Australia is the profession's peak body. We are the voice of the profession and exist to advance society through great engineering. We support engineers in the pivotal role they play in shaping the future of Australia: creating safe, successful, and sustainable communities.

Engineers Australia takes an evidence-based approach that harnesses the collective technical and professional skills of engineering leaders in contributing to important decisions and debates.

As Australia's signatory to the International Engineering Alliance, Engineers Australia maintains national professional standards, benchmarked against international norms. Under the Migration Regulations 1994, we are the designated assessing authority to perform the assessment of potential migrant engineering professionals' skills, qualifications, and/or work experience to ensure they meet the occupational standards needed for employment in Australia

Contact for more information

Engineers Australia welcomes the opportunity to engage further with the Treasury to help shape Australia's roadmap to build a bigger, better-trained and more productive workforce – to boost incomes and living standards and create more opportunities for more Australians.

These are complex and contextual issues. Engineers Australia has significant expertise in our Learned Society Colleges and Technical Societies that can assist in addressing them. Please do not hesitate to reach out if you would like to discuss this further. You can contact us at policy@engineersaustralia.org.au.

1. Response to Terms of Reference

1.1. Full employment and increasing labour productivity growth and incomes, including approach to achieving these objectives.

1.1.1 Shortage of skills affecting full employment in the engineering industry

The engineering profession has been facing shortage of skills since the late 1980s in Australia, yet the country is experiencing perhaps its greatest-ever critical engineering skills shortage now as its scale and breadth is affecting nearly all disciplines of the profession.

Our research clearly indicates that this shortage is:

- Long-term (chronic/structural) – Australia has been relying on overseas-born engineers to provide capability over many decades resulting in a growing division between the number of qualified engineers in the country and those working in engineering occupations. There are now proportionally less of them in engineering occupations despite Australia having more qualified engineers than ever before ¹.
- Cyclical – Boom-bust cycles are a common trait in modern western economies, but skill shortages are presently even more acute due to a combination of border closure due to COVID-19, transition to renewable energy, digital transformation and current induced stimulatory spending is seeing the engineering demand at an all-time high.

Two main supply channels typically support Australia's engineering workforce - Australians choosing engineering for their tertiary education and career, and skilled migrant engineers. While supply for the latter is roaring back in action, the tertiary sector remains depressed and well below its 2019 peak. However, demand for engineers keeps growing, with new sectors like nuclear, digital and space adding to the need for critical engineering skills.

Engineers Australia has identified five major categories of factors that influence the engineering workforce²:

- Factors that influence the number of young Australians who choose to study engineering
- Factors that influence the engineering graduation rate
- Factors that influence retention in the engineering workforce
- Factors that influence the workforce the participation of skilled migrant engineers
- Demand forecasting

The development of an engineer begins early. Increasing the take-up of science, technology, engineering and maths (STEM) subjects early in a person's education is critical to boosting the pipeline of engineers. While domestic engineering student commencements peaked in 2014, both commencements and completions have declined ever since. Priority should be given to encouraging young Australians to choose prerequisite subjects for engineering study (science and maths) and inspiring more of them to study engineering for their tertiary education.

More needs to be done by the government to promote the community awareness of what engineering is and what engineers achieve to inspire younger generations. Greater level of support to initiative taken by peak bodies like Engineers Australia to promote the engineering profession needs to be put in place to

¹ Engineers Australia, *Australia's Engineering Capability: How The Last Ten Years Will Influence The Future*, 2019, p40

² Engineers Australia, *Strengthening The Engineering Workforce in Australia: Solutions To Address The Skills Shortage In The Short, Medium, And Long Term*, 2022, pp14-17

increase the take-up of STEM subjects and further the supply of engineering students if full employment in the engineering industry is to be achieved.

Once an individual has decided to undertake tertiary-education study in engineering, it is a decade-long process to bring them to a competent level to practice independently. The key to limiting the attrition rate is providing not only visibility on career opportunities, proving to engineering students that there is a bright future ahead of them, but also enabling that future through work experience via internship during studies and graduate programs once graduated. Attrition rate at student level is around 40 per cent currently while approximately half of all engineering bachelor graduates leaves the profession according to the 2016 census. Investing in internships and graduate engineers will help to keep more of this cohort in the profession and develop the skills of an 'experienced' engineer which are always in demand.

Greater investment in international students who graduate locally should also be made. Developing this pool of engineers and making it easier for them to transition to a permanent migration visa can further assist in boosting the supply of engineers in Australia. Currently, migrant engineers in Australia are much more likely than their Australian born counterparts to work in non-engineering roles. Continuing large scale intakes of qualified engineers will not significantly develop Australia's engineering capability and capacity unless better support systems are provided to help them secure engineering work when they are here.

Without accurate information we could contribute to the unintended adverse consequence of students being encouraged to study certain engineering qualifications then finding minimal employment opportunities after graduation. An example of an industry with strong future forecasting is the defence sector which has long term funding and priorities making recruitment forecasting and skills demand easier to ascertain. This level of quantification needs to be explored for all sectors to assist in lessening acute supply shortages and to help focus efforts on bolstering supply for more sought-after disciplines and skills. This data can then be used by the tertiary sector and schools to help students understand their opportunities in the context of future demand areas.

Engineers Australia has identified a series of immediate actions governments can take to assist in alleviating the current supply challenges and shore up the future supply of engineers³. These can be summarised as followed:

1. All levels of government should work together to increase Australia's teaching capability in STEM subjects, including offering programs to make it easier for mid-career STEM professionals to become maths, science or engineering studies teachers, increasing the number of maths and science teachers with relevant qualifications, and providing effective resources to out-of-field maths and science teachers to encourage more young Australians to choose to study maths and engineering studies.
2. Establish senior engineering roles within government to oversee, guide and advise on important engineering work and to ensure the engineering perspective is incorporated into policy decisions and planning.
3. Government should take a more active role in providing engineering experience to engineering students and graduates. Agencies and departments which have an engineering capability should offer more engineering internships and graduate programs, and contractors should be incentivised in providing similar opportunities to engineers through procurement processes.
4. Offer incentives for students to undertake engineering associate (2-year) and engineering technologist (3-year) qualifications.
5. Provide support for existing programs that assist engineers returning to the workforce after a career break (e.g., STEM Returners) and fund new programs to incentivise engineers working out of field to return to engineering.

³ Engineers Australia, *Strengthening The Engineering Workforce in Australia: Solutions To Address The Skills Shortage In The Short, Medium, And Long Term*, 2022, pp7-9

These possible immediate actions can only produce the desired impact should the government collaborate with industry, peak professional bodies and the tertiary sector to ensure consistency across the line.

1.1.2 Increasing labour productivity growth.

At the heart of increasing productivity in Australia is having the required skills. As noted in the Productivity Commission's interim report a highly skilled workforce with strong cognitive skills including problem solving will be needed in a rapidly changing service economy. This is further supported by the National Skills Commission which predicts cognitive ability to be highly sought after in the future.

The nature of engineering requires a strong cognitive ability making engineers sought by many employers in various industries, simply due to the value placed on the skills developed through an engineering education and an engineer's cognitive ability to think and to solve complex problems. Ensuring a strong pipeline of engineering skills is available is critical.

Engineers Australia's [Engineering Australia's Productivity submission](#) proposes 21 recommendations which, if implemented, will improve the sector. For this submission, we believe the key recommendations the government should focus on are the following:

- Governments must commit to long-term collaborative planning to mitigate the negative effects of short-term electoral cycles on infrastructure planning and delivery.
- Government and industry should develop an infrastructure industry best-practice guide mandating key policies to optimise benefits and minimise risk in infrastructure project management, delivery, and operations.
- Governments at all levels should reform their tendering processes to promote greater participation from SMEs.
- Engineers Australia recommends governments implement a consistent procurement framework across all levels and between all departments associated with interrelated infrastructure, applying the ISO 55000 series of standards for asset management for consistency across states and territories.
- Governments should avoid using non-standard contracts and provide visibility of contracts before tender, allowing sufficient time for review. Any required amendments to standard contracts must be subject to collaborative negotiation with industry stakeholders.

1.1.3 Increasing real wages growth.

Research from the Australia Institute⁴ indicates a zero increase in real hourly wages despite ten years of productivity gains. Real wages are now back at 2012 levels and more needs to be done to reverse this trend affecting people's ability to purchase items. An increase in productivity growth needs to be paired with real wages growth to sustain a healthy economy.

The engineering profession is no different to other professions and has seen a modest 2.4 per cent increase in 2020-21, with forecast expected of only 1.6 per cent in 2021-22⁵, far outpaced by inflation set to grow by 7.8 per cent by the end of the year⁶. This puts further stress on the attraction and retention of engineers and fuels a so called "war on talent" which not only affects engineering companies' profitability but also sees, in some cases, a disparity between new hires and existing staffs⁷.

The engineering industry has been greatly impacted by the "Great Reshuffle" with 49.2 per cent of engineers changing jobs to seek higher remunerations. Nearly half of the respondents believing their remuneration package did not reflect their level of work appropriately and 8.6 per cent considered leaving the profession permanently to take up a more lucrative trade⁸. More engineering firms are

⁴ The Australia Institute, *Ten Years Of Productivity Growth, But No Increase In Real Wages*, September 8, 2022

⁵ Professional Australia, *Professional Engineers Employment And Remuneration Report 2021/22*, 2021, p5

⁶ The Australia Institute, *Real Wages Plunge To 2012 Levels*, August 17, 2022

⁷ Human Resources Director, *New Hires Are Rocking The Australian Salary Boat*, October 6, 2022

⁸ Professional Australia, *Professional Engineers Employment And Remuneration Report 2021/22*, 2021, p6

resorting to ad hoc pay increases and share-based retention plans to retain their staff while being forced to be more selective on bidding for new projects⁹.

This further demonstrates the urgent need to increase the pool of talent to sustain the rising pipeline of complex infrastructure projects in Australia. Engineers Australia has listed a series of recommendations (see 1.1.2 & 1.1.3) to help increase both the engineering talent pool and productivity. This would have a direct impact on Australia's capability to sustain the pipeline of projects, increase engineering companies' profitability and assist the wages issue.

1.2. The future of work and labour market implications of structural change.

1.2.1 The energy transition and tackling climate change and emerging technologies.

A reliable and secure supply of electricity is a critical component of modern life and drives the Australian and global economies. Australia is undergoing an energy transformation at an unparalleled pace and scale.

The certainty of climate change and the need to radically reduce emissions, coupled with the need to enhance the resilience of physical energy assets and systems, drives the urgency of the transformation process facing Australia. Actions and investments taken between now and 2030 will determine how successful the transformation will be. Energy is the principal driver of economic prosperity and is essential to ensuring high living standards. Unfortunately, energy is a controversial policy area that has been overly politicised, to the detriment of the community, environment and economy.

A good illustration of the complexity of implementing the energy transition Australia needs and the labour market implications of the structural changes associated to it is the integration of distributed energy resources (DER) into our existing power grid¹⁰.

The complexity of the task is exacerbated by the fact that for a period we will have parallel paths: maintaining and augmenting the capabilities of the current system, while designing and implementing the future system. Moving to a smarter grid, and the attendant underpinning infrastructure with upstream and downstream services, will require new skills and necessitates a rethink of workforce and training needs for power system engineers, electrical engineers and telecommunication engineers. Energy engineering draws from the same labour pool as mining and big infrastructure projects. Australia needs to understand the current energy workforce to be able to plan and provide the training and development required to enable the energy transition.

A comprehensive national transition strategy needs to be clearly defined by the government so that real tangible structural adjustments in the labour market can be made.

Renewable energy will be a major source of employment, including in regional Australia, and it already employs more people than the domestic coal sector. However, not everyone in the fossil fuel industry can move into a clean energy job. Governments have a critical role in setting expectations and facilitating new industries and training opportunities, particularly in regional areas that are transitioning from the carbon economy. Adding complexity to the task is the fact that prolonging the life of declining industries may increase the environmental costs paid by all Australians, increase the financial costs of subsidies and retraining, and cause Australia to lag international competitors in taking advantage of clean energy business opportunities.

The trans- and multidisciplinary nature of modern power engineering requires an ongoing discussion around the balance between electrical, electronic, and systems engineering. A greater emphasis on the

⁹ Australian Financial Review, *Why Engineering Salaries Are Beating Inflation*, September 2, 2022

¹⁰ Engineers Australia, *Integrating Distributed Energy Resources In The Electricity Grid, Energy EVP Discussion Paper*, 2022, pp5-6, 29

importance of a diverse and inclusive workforce is required to address this shortage of qualified and experienced power system engineers.¹¹

1.2.2 The transformation associated with digitalisation and emerging technologies.

The adoption of new technologies is a key factor for Australia to remain competitive on a global stage. The uptake of digital technologies can only be successful should it be supported by a transformation of our labour market to support it. From space or nuclear submarine technology to the digital transformation of our infrastructure sector or the shift of our manufacturing and industrial practices to the fourth industrial revolution (Industry 4.0), Australia needs to build its sovereign capability by training and upskilling the labour force. A profound transformation of Australia's economy to a high-tech, knowledge intensive complex economy is not only a necessity but would also offer a greater range of new opportunities.

Our research shows¹² how the broad uptake of digital technologies at all phases of asset lifecycles will enhance productivity in infrastructure delivery and operation. The use of digital twins, smart sensors, building information modelling systems, digital engineering and digital asset management tools will ensure Australia is future-ready and that our infrastructure can be managed efficiently, sustainably and effectively. The use of technology has numerous positive impacts on the sector. These include enabling more collaboration and coordination between teams and stakeholders and increasing innovation through improved data capture, enabling a more detailed view of projects.

However, greater emphasis must be placed on integrating nationally consistent digital approaches to infrastructure project planning and operations now if Australia is going to be ready for the demands of the future. Engineers Australia recommends the establishment of a unit focused on Australia's digital infrastructure future to support agile development and the rollout of digital infrastructure tools.

Seamless integration of studies and training into existing business structures to support the use of AI, smart sensors, industrialised construction practices, and other new and innovative technologies and processes, will reinforce an innovation-positive work culture. Programs and tools for businesses to benchmark their status will assist in determining the benefits of innovative and new technologies.

Increased commitment to targets dedicated to projects in innovation, practice improvement and development resulting in long-term benefit, will ensure Australia is not left behind as the world moves to a more connected and digital future. Having greater certainty in the pipeline will encourage innovation and ultimately efficiency, as research and investment will be able to be undertaken in an environment of confidence.

COVID-19 has forced a rethink of the way Australians live, work, and communicate. It has required a rapid response and adaptation in industries and communities everywhere. There is an opportunity for governments and the private sector to invest in research and development, emerging technologies, industries, and careers. There is also the chance to do so with a start-up mindset, which is less constrained than what has worked in the past, and instead reimagines what the future could be.

From a demographic point of view, the global pandemic has triggered a major shift in internal migration, with more workers moving out from capital cities to regional locations enabled predominantly by greater access to technology. De-clotting major capital cities in favour of re-invigorating regional Australia should be a priority. Further investments in infrastructure and access to technology are required to sustain it.

Governments must allocate funding for training and upskilling the labour force and subsidise programs to promote collaboration between industry and academia to encourage greater integration of current and emerging technologies.

¹¹ Engineers Australia, *Energy Governance And The Engineering Voice, Energy EVP Discussion Paper*, 2021, pp18-21

¹² Engineers Australia, *Enhancing Productivity In Infrastructure Delivery: Policy Directions Paper*, 2022, pp25-26

1.2.3 Building resilient supply chains in a changing geopolitical landscape.

Recent global events have shown the importance of building a resilient supply chain to reduce our industries' exposure to the changing geopolitical landscape and increase our sovereign capability. Australia needs domestic manufacturing capabilities to reduce supply chain vulnerabilities, particularly for components that contribute to critical infrastructure.

A workshop conducted by Engineers Australia¹³ has found that in a scenario of a collapse in global governance resulting in major disruption to the global supply chain, the result would be an economic downturn and price increases. Job security will be diminished as projects slow down or stop. Major capital projects would see widespread layoffs.

Although we have yet to experience such an extreme scenario, we can see some clear similarities with what we have been experiencing over the past years. The sharp rise in price for material supplies in the construction industry has triggered a series of business collapses, unable to sustain the domestic housing demand and honour their contracts. The ban on Russian oil, gas and raw commodities has had a snowball effect on all industries, bringing inflation to its highest level in 32 years. Energy prices are set to rise to unprecedented level and impact households and businesses significantly, leading to potential economic downturn.

All these factors have directly impacted not only our productivity but also people's ability to purchase and further stress the need for Australia to develop its manufacturing sovereign capability. The energy sector is a perfect example of how Australia can build a resilient supply chain and self-sufficiency to protect itself from external factors. But as discussed in 1.2.1, a comprehensive national transition strategy needs to be clearly defined by the government so that real tangible adjustments in the labour market can be made.

Australia needs coherent and stable policy settings focused on community and integration of engineering solutions with political, economic and social concerns. Priority should be given to building strong manufacturing sovereign capability to reduce our dependence on imports. In response to global supply chain disruptions, governments should support measures to improve the capability of Australian manufacturers. In the short term, implementing 'buy local' policies will help domestic suppliers in the procurement phase.

1.2.4 The adaptability of our workforce to meet the needs of emerging industries and areas of traditional economic strength.

Chartering a path to net zero is an undeniable imperative, and a major economic shift will need to happen in Australia to achieve it. The cost of inaction is simply too high, and Australia needs to shift onto a new pathway now and start to prepare for the future needs to avoid major setbacks. A key element in a successful shift is the adaptability of our workforce to meet the needs of emerging technologies.

Given the high skill base of the fossil fuel workforce, and the increasing likelihood of substantially reduced global demand for fossil fuels over the coming decades, mapping the training needs of the fossil fuel workforce would support a 'just transition' and play a role in addressing skill shortages¹⁴.

Research, such as that conducted recently in Queensland¹⁵, shows some positive outlooks within the labour market and skills impacts from decarbonisation activities. According to this research, the realignment of sectors will have a limited impact on the broader economy and will induce a growth in clean economy jobs of 2.5 per cent on average each year between now and 2030. It will also add a total of up to 1 million new jobs to the Queensland labour market by 2050. The level of structural adjustment the labour market needs is not as significant as initially thought as 80 per cent of the tasks needed in a clean energy economy are already being performed. The key lies in the coordination of the transition and the training required to upskill the workforce to the 20 per cent of new tasks.

¹³ Engineers Australia, *Industry Responses In A Collapse Of Global Governance, Workshop Report For Attendees*, 2019, p7

¹⁴ Engineers Australia, *Integrating Distributed Energy Resources In The Electricity Grid, Energy EVP Discussion Paper*, 2022, p38

¹⁵ Deloitte, *Powering the future: Skilling Queenslanders for the clean transformation*, Deloitte Access Economics, 2021, pp. 2, 9-10-11

Governments need to invest and coordinate training strategies to help the labour market to adapt to the new structural needs the clean energy economy will require. The example of Queensland and the research done on the potential benefits of an early shift to clean energy, indicates how, if started early, the clean economy offers a wide range of options for the Australian labour market to operate structural changes with minor disruptions and for businesses to thrive. However, the government needs to lead the way and define a clear roadmap, setting coherent policies with long-term views to allow this transition to be properly planned and resourced.

One first simple action item for the government to update is the Australian and New Zealand Standard Classification of Occupations (ANZSCO) codes, which are too generic (e.g. Electrical Engineer) and not reflective of the current or future energy sector, making analysis difficult. Other engineering roles are simply captured as 'Other Engineering Professionals'. ANZSCO codes relating to engineering in the energy sector should be updated to reflect the modern engineering workforce.

The energy and university sectors are both already going through massive transformation. The engineering workforce needs to have knowledge of an increasingly wide range of areas. In the past, the Australian Power Institute (API) has worked to upgrade university labs and create contemporary teaching resources, but that funding no longer exists. Those teaching modules are now 10 years old, and universities do not have the resources to update them. Many people in the power industry, and Engineers Australia members, are concerned that we have a growing knowledge gap as a result.

Training incentives and programs need to be offered to businesses and the Australian workforce to ease the shift and ensure a safe and fair transition to net zero. The Australian labour market has already shown its resilience and capacity to adapt to change, and it now needs the government's full support to shift to a net zero future and tackle climate change in the most positive way.

1.3. Job security, fair play and conditions, including role of workplace relations

The [Professional Engineers Employment And Remuneration Report 2021/22](#)¹⁶ shows how job security is a major concern in the engineering profession. Cost-cutting, insufficient skills development, lack of in-house engineering capacity, poor graduate development, misallocation of resources, reduced adherence to professional standards, all these are claimed to be the main factors impacting engineering capability.

Engineers Australia strongly encourages all engineering firms to build robust engineering skills competency frameworks based on international standards. As Australia's representative to the International Engineering Alliance (IEA), Engineers Australia has endorsed the Chartered credential as the highest available technical credential for an engineering professional, like 29 other countries across the world, among which the UK, the USA, Canada or Japan to list a few. The IEA's defined professional competencies are supported and endorsed by the World Federation of Engineering Organisations (WFEO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). They are used as international standards across the engineering world.

As such, a credential like the Chartered credential offers a tangible global benchmark, and a strong foundation for engineering companies to build their engineering skills competency framework on. An engineering skills competency framework is a structure that sets out and defines specific competencies required by individuals working at different levels within an organisation. It brings clear benefits for both employers and their engineering workforce.

From an employer point of view, it helps build an understanding of your workforce capability and skills management, two critical factors to deliver on any organisation's objectives and to keep their workforce engaged. It allows mapping of the existing skills within an engineering workforce as well as defining the needs by translating the workforce requirements of business plans into clear statements of individual and team capability. Greater visibility for an employer translates into more data-driven decision-making, better allocation of resources by a better selection process at the recruitment stage, lowering the need

¹⁶ Professional Australia, *Professional Engineers Employment And Remuneration Report 2021/22*, 2021, p57

for cost-cutting, and boosting staff retention by enhancing job security, fair play and safe conditions for the engineering workforce.

From an employee point of view, implementing a robust engineering skills competency framework would bring greater visibility for all on what skill level each engineer is sitting, what is needed for them to demonstrate or acquire in skills to progress within their career. Developing clearly defined expectations, hence a fair go to all engineers, would empower them in targeting the right development and upskilling required to develop strong in-house engineering capability. Fairer working conditions, clear development pathways and opportunities to grow are essential elements to ensure a more secure and empowered workforce delivering greater results and less inclination to leave the profession.

Engineering Education Australia, Engineers Australia's wholly owned subsidiary and registered training operator, has been assisting engineering firms to build their own engineering skills competency framework showing evidence of boosted employee morale and retention every time. These skills competency frameworks are multi-disciplinary and scalable frameworks that can be customised to suit any organisation and profession. The digital transformation these frameworks have undergone in recent years has brought greater level of practicality for the application of such frameworks, with software like SkillsTx and offering a more visual mapping and ease of use, ensuring updates can be performed rapidly and with little effort.

Engineers Australia recommends government to lead the way by implementing robust skills competency frameworks based on international benchmarks within all its departments and set it as standard for all industries to reach to promote greater level of job security and conditions within the Australian labour market.

1.4. Pay equity, including the gender pay gap, equal opportunities for women and the benefits of a more inclusive workforce.

Engineers Australia's [Women in Engineering](#) report provides an accurate summary of the under-representation of females in the engineering talent pool despite remaining the biggest employer of the STEM professions.

Diversity in the workplace is an essential component of a productive workforce. About 80 per cent of female engineers surveyed agree that they bring a unique perspective to their team; that their daily work is dynamic, challenging, and has a positive impact on broader society; and that they are passionate about their work. One concerning pattern observed is that female engineers have a disproportionately high rate of "imposter syndrome". Over 56 per cent agree that they feel like an imposter at work, doubting their own skills, abilities and/or accomplishments – compared to just 34 per cent of men, and 38 per cent of women in other fields. The incidence of imposter syndrome appears consistent across different engineering sectors.

In general, it seems that workplace challenges are more prevalent in larger companies (defined here as organisations with 100 or more employees). While larger companies seem more likely to have infrastructure in place offering flexible work arrangements and tend to have greater female representation in their workforce, they are also more likely to suffer from issues around gender inequality and poor workplace culture. About 21 per cent of female engineers working in larger companies report that there is bullying, harassment and/or exclusion of women in their workplace (triple the incidence of the same in smaller companies). Women working in larger companies are also significantly less likely to agree that they have equal opportunities to men (52 per cent, compared to 73 per cent of those working in smaller companies). They are also less likely to feel that they can be themselves at work.

Meanwhile, about 2 in 3 agree that they are paid well – on par with male engineers. Women working in the mining sector are more likely to believe they are paid well (86 per cent); the opposite is true of those in consulting and professional services (50 per cent).

The gender pay gap is further highlighted in Professional Australia's latest report¹⁷, with female engineers reporting an average earning of 90.2 per cent of male engineers' earnings - a gender pay gap of 9.8 per cent. It also emphasizes a "scissor effect" for female; while female engineers tend to start with a higher salary, they rapidly fall behind their male counterparts, with the point of convergence at only around three years of experience.

Retention of female engineers in the workforce is directly impacted by the issues outlined above. About 2 in 3 of the surveyed women who left the engineering profession did so as they felt that their opportunities for career progression were limited, and/or they experienced gender discrimination, bullying or sexual harassment. Our research¹⁸ shows that the key issues driving women out of the engineering profession are:

- A non-inclusive culture in the workplace
- Unequal opportunities in the workplace
- Imposter syndrome
- Poor work-life balance
- Lack of female role models

Addressing these issues is a difficult task, as they tend to stem from ingrained attitudes and norms; formal processes and policies often fall short. Certain workplace initiatives can also exacerbate the very issues they are intended to address. Implementation of gender quotas, for instance, can lead to perceptions that certain women are given their positions only on the basis of their gender, and are in fact unqualified or undeserving.

Below are some potential areas where Engineers Australia and others, can work with and support industry in developing and implementing initiatives:

- Gender bias training
- "Reversed mentoring": young women mentoring senior leadership
- Supportive female mentorships and networks
- Workshops and resources for women to navigate gender-based issues in the workplace and progress their careers (e.g., salary negotiation skills)
- "Opt-out" policy for promotions
- Policy improvements: escalation processes for bullying and harassment; leave and flexible working arrangements
- Investment in the industry / profession (e.g., creating more and higher-value jobs)

As a nation, we need to ensure we are providing equal opportunity across the whole of society; to create economic prosperity, to compete globally in innovation and, because it is fair and just. Diversity and inclusion go hand in hand. To employ a diverse workforce is only half the effort, to then create a culture of inclusivity where that diversity of thought is embraced and encouraged is the other half.

Diversity and inclusion efforts are most successful when they are driven by a commitment from organisational leaders. For this commitment to be meaningful, it requires leaders to understand why diversity and inclusion matter. Engineers Australia encourages more Australian companies to join initiatives such as the Champions of Change Coalition, which aims at changing the status quo and disrupt the system on sexual harassment and overall promote a more diverse and equal workforce in Australia. More support from governments needs to be provided to raise awareness on these types of initiative and promote a more just, diverse, equal and fair labour market in Australia.

¹⁷ Professional Australia, *Professional Engineers Employment And Remuneration Report 2021/22*, 2022, pp38-39

¹⁸ Engineers Australia, *Women In Engineering: Identifying Avenues For Increasing Female Participation In Engineering, By Understanding The Motivators And Barriers Around Entry And Progression*, 2022, pp55-56

1.5. Labour force participation, labour supply and improving employment opportunities.

1.5.1 Reducing barriers and disincentive to work, including the role of childcare, social security settings and employment services.

Reducing barriers and disincentive to work, especially for working parents, is an imperative to increase retention in the engineering profession. Women are disproportionately affected in that regard as they are likely to take greater responsibility for childcare.

Although working arrangements have considerably improved, with COVID-19 accelerating this change particularly, not all sectors of the engineering industry are treated equally. Our research¹⁹ shows that 59 per cent of female engineers in the construction say that their work hours are long and/or inflexible compared to 29 per cent in other sectors of the industry.

Working long hours and poor work-life balance is a problem in engineering in general with 3 out of 10. Women and men saying their work hours are long and/or flexible, with unreasonable workload adding to the level of stress and mental health issues. Home schooling has been a major barrier to work for many impacted by lockdowns, particularly in states most affected like Victoria and NSW.

Anecdotally, we hear from our members, tertiary and industry partners how more businesses are looking into solutions to reduce that barrier by offering day care subsidies or creating in-house day care capability to help STEM returners. But these are costly and not affordable to all.

Similarly, albeit more employers have policies or initiatives in place to enable flexible access to parental leave for parents, like 97.2 per cent of the Champions of Change Coalition members²⁰, most are still largely affected by it and too many women especially are forced to abandon their career to care for their children instead.

We also hear from our members the challenges returning to work after parental leave or parental leave related sabbatical can have, predominantly on women once again. They often come back on a part-time basis, which adds to the complexity. Engineering being a team-lead type of work, many struggle to keep abreast, having to miss important meetings scheduled on their off-days. It impacts the team's productivity, despite everyone's best efforts to accommodate it and reinforces the 'imposter syndrome' too often felt by women and leads many to leave their profession for more accommodating professions like in the finance sector.

Engineers Australia supports the government's announcements on extended parental leave for all and greater level of support subsidies for day care. We recommend further investments from the government in STEM returner programs to reduce barriers and disincentives working parents are facing.

1.5.2 Improving labour market outcomes for those who face challenges in employment

Our research²¹ shows that there is an increasing awareness that engineering needs to be a more socially engaged profession. A more inclusive industry may provide part of the solution and encourage young people to join, retain people considering their options or bring back people that have moved into other occupations.

Australia has a number of untapped resources to bolster the engineering workforce. Addressing diversity is particularly relevant in Australia, where most engineers were born overseas, we have an engineering workforce that has the lowest percentage of women of all the STEM professions, and where we have trouble retaining graduates in the engineering workforce.

¹⁹ Engineers Australia, *Women In Engineering: Identifying Avenues For Increasing Female Participation In Engineering, By Understanding The Motivators And Barriers Around Entry And Progression*, 2022, pp51, 55

²⁰ Champion of Change Coalition, *2021 Impact Report Summary, Men Stepping Up Beside Women On Gender Equality*, 2021, p9

²¹ Engineers Australia, *Integrating Distributed Energy Resources In The Electricity Grid, Energy EVP Discussion Paper*, 2022, pp34-36

People from a range of socioeconomic and sociocultural backgrounds, with different genders, abilities, and experiences, must be included as homogeneity in teams' limits innovation and leaves blind spots in planning and risk management practices.

Aboriginal and Torres Strait Islander engineers

Creating a genuine engagement with Aboriginal and/or Torres Strait Islander communities has been identified as important. Reaching out to Aboriginal and/or Torres Strait Islander children in urban, rural and remote communities at a young age and putting forward positive role models would be valuable. Another important element would be to increase the relevance of Indigenous knowledge and world views by incorporating it into the mainstream curriculum.

In the workplace, we need more focus on incorporating Indigenous knowledge into engineering projects, such as land conservation and sustainability, as well as understanding and respect for Indigenous culture.

Government needs to include and promote the incorporation of Indigenous knowledge into any tenders released, as well as demonstration by bidders of their understanding and respect for Indigenous culture to set new standards within industries.

Engineers Australia supports the Australian Academy of Technological Sciences & Engineering (ATSE) recommendation²² on government education departments needing to invest in programs to improve and provide culturally appropriate and engaging delivery of STEM education for Aboriginal and Torres Strait Islander students, particularly acknowledging Traditional knowledge, and including mathematics instruction 'in language'.

These should be developed in consultation with Aboriginal and Torres Strait Islander communities to raise interest and show the possibilities of a career in engineering to Aboriginal and Torres Strait Islander students.

Engineers with a disability

Many engineers with a disability face challenges in both study and the workplace. This is often based on false assumptions about what they are capable of achieving. There are many successful engineers with a disability and many limitations can be overcome with reasonable adjustments to the work environment or the use of technological aids. The Engineers Australia community, Engineers with Disabilities Australia, reports that one in five Australians report having a disability. Reasonable adjustments to include people with a disability would encourage diversity, but also innovation and project outcomes.

Government needs to promote training on how to implement reasonable adjustments in the workplace and financial incentives to encourage disability employment

Nonbinary gender inclusion

Gender dynamics can cause some people to feel they have to mask their true selves to fit in and succeed at work. Without social support the profession becomes unwelcoming. This can be extremely stressful and lead to some people deciding that they would rather leave the profession. There are some simple steps that can be taken such as gender expansive language and expanding the gender options in administrative systems.

Engineers Australia is proud to be a founding partner of InterEngineer, a community designed to provide an avenue for LGBTQIA+ engineers and allies to communicate, network and advocate.

Government needs to set the standard for all to follow by implementing nonbinary gender inclusion awareness programs and promote the expansion of gender options in all Australian administrative systems.

²² Australian Academy of Technological Sciences & Engineering, *Our STEM Skilled Future: An Education Roadmap For An Innovative Workforce*, 2022, p14

Neurodiversity

It is estimated that 10 per cent of the population are neurodivergent and the real number could be twice that many. Like the rest of the population, many engineers are neurodiverse with conditions such as Attention Deficit Hyperactivity Disorder (ADHD), Autistic Spectrum Disorder (ASD) and dyslexia. Neurodiverse people process information differently and have different strengths. In an information occupation like engineering, having people that think differently on your team is an advantage and may lead to the idea that others are looking for. Understanding the way neurodiverse people think and making simple adjustments to work to their strengths will lead to more successful projects and fewer people leaving the occupation.

Government needs to introduce industry standards on neurodiversity inclusion promoting neurodiversity awareness and management training to better integrate them to the Australian labour market.

Intersectional Analysis

Intersectionality is the idea that categories such as gender and ethnicity do not operate independently of one another. Looking at elements of diversity as separate issues will not address all the issues and ignores the compounding impacts of marginalisation. The experience of a woman with a disability may be completely different to those of other women. Using intersectionality as a framework to consider these issues will provide a better understanding of people's lived experiences by thinking about the cultural, structural and organisational barriers to participation in the engineering workforce. Intersectional thinking also allows us to consider that we are all intersectional in our advantages and disadvantages and that it can change depending on context.

Engineering problems are complex and getting more so. At the same time, engineering does not attract enough young people and loses too many along the way. The reasons are complex and interrelated. However, a workplace that values diversity and inclusion is more likely to attract and retain people.

Veterans

The transition to the civilian workforce can be challenging for many veterans. Mental health concerns, physical disabilities, discrimination, negative stereotypes, a great number of stigmas can plague those who have sacrificed their lives to allow us all to live in peace. Yet their experience, skills, focus, commitment, and drive are second to none. Unfortunately, many lack accreditations in form of certifications and/or degrees as most go through cadetship programs, which are not recognised by universities.

The Australian Defence Force (ADF) is one of the largest employers of engineers in Australia with thousands of professional engineers, engineering technologists and engineering associates among its ranks. Despite their training reputation and skills within the industry, many engineers are not able to easily transition, due to their lack of recognition of their training programs and this despite the clear appetite many sectors of industry have for them, such as in the defence suppliers and rail.

Engineers Australia has partnered with the ADF to provide industry recognition to their engineering staff and developed a special pathway for them to gain their Chartered accreditation. More initiatives like this one need to be offered to veterans to increase their transferability of skills to the civilian workplace.

Government needs to integrate automatic recognition of ADF's training and cadetship programs with professional peak bodies and universities to ease veterans transition to civilian workforce.

Regional, rural and remote areas

New technologies have shortened distances between countries and greatly helped Australia to emerge as part of the global economy. However, the 'tyranny of distance' is still a reality for people living in regional, rural and remote areas. As discussed earlier, those populations living in regional, rural and remote (RRR) areas are not provided with the same level of opportunities as their metropolitan counterparts.

The ATSE report²³, to which Engineers Australia participated, reinforces the need to address the limited access to resources for these students. There are fewer opportunities, teaching quality and even infrastructure for regional, rural and remote areas students, which often inhibits the inclination to pursue higher education part and become an intricate part of Australia workforce needs. The shortage of mathematics teachers is a national concern, yet it affects RRR schools even more than the metropolitan ones.

National statistic draws a grim outlook for RRR students, with 10.7 per cent of remote students and 35 per cent of very remote students scoring below the minimum standard compared to only 3.8 per cent metropolitan students. Less than a quarter of years seven to year ten students have an in-field mathematics teacher every year.

RRR areas are not offered the same chances to develop into prosperous hubs, and have access to the same education, job opportunity and technology as in metropolitan areas. COVID-19 has fast-tracked digital transformation across a range of industries but widened the gap between RRR and metropolitan areas, with RRR students and workforce having limited access to the technology needed.

Government needs to increase its investment in infrastructure, technology and teaching capabilities to disenclave RRR areas, and improve the chance of employment and retention in RRR communities.

1.5.3 Skills, education and training, upskilling and reskilling, including in transitioning sectors and regions.

Digital Skills, Upskilling and Reskilling

Broad uptake of digital technologies in all industries and especially in engineering has increased the need for digital skills. It is imperative for Australia to build a strong pipeline of digital technology workers to remain competitive and internationally relevant.

The engineering profession has been an early adopter of digital technologies. The use of computer assisted design (CAD), building information modelling systems (BIM), digital twins, smart sensors, digital engineer and digital asset management tools has brought numerous positive impacts on the industry. It has become a near-requirement for most roles and has been a source of new employment opportunities. This demand won't falter in the coming decades. The need for upskilling the current workforce while increasing the depth and breadth of digital skills available is key to Australia's ambitions to build smart cities capable of responding to the needs of a growing population and climate change.

Engineers Australia supports ATSE's recommendation²⁴ for the government to work with industry peak bodies to establish simple industry standards for digital skills (e.g., cybersecurity, artificial intelligence, data analysis, etc) to enable the acknowledgement of skills acquired through diverse educational mechanisms such as microcredentialling (i.e., small, focused courses that rapidly upskill individuals), on-the-job training and vendor-provided training.

Upskilling and reskilling are particularly relevant to reallocate workforce impacted by the decarbonisation of our economy and the transition to cleaner energy. Training programs to upskill and reskill need to be coordinated and adapted to the new requirements, with emphasis on flexible entry and exit pathways so that it can be delivered in shorter timeframes. The key lies in greater collaboration between and within industry, vocational and university training bodies, and policymakers would result in courses that are relevant to industry needs with practical, problem-solving content.

Government must allocate funding for training and upskilling of the labour force in digital skills. Part of this funding should support subsidised programs, to promote collaboration between industry and academia, fostering greater integration of current and emerging technologies. Commitment to increased

²³ Australian Academy of Technological Sciences & Engineering, *Our STEM Skilled Future: An Education Roadmap For An Innovative Workforce*, 2022, pp13-14

²⁴ Australian Academy of Technological Sciences & Engineering, *Our STEM Skilled Future: An Education Roadmap For An Innovative Workforce*, 2022, p16

targets for projects dedicated to innovation, practice improvement and development resulting in long-term benefits such as improved return on risk profile.

Education

Engineers Australia's [Engineering Skills – Supply And Demand](#) research²⁵ highlights how Australia's ability to develop engineers domestically is hindered by a reduction in year 12 science and mathematics participation. Increasing take-up of STEM subjects and building awareness of the engineering profession early in a person's education is critical to bolstering the pipeline of engineers. This requires long term commitment and planning by industry, government, schools and the tertiary sector.

Contributing to this is a teaching workforce struggling in the areas of mathematics and science. Reports of teacher shortages, particularly in the learning areas of mathematics, technology and science are having an effect on the declining mathematics performance of students. Over 38 per cent of secondary teachers are reported to have taught subjects outside of their field of expertise, with maths, science, technology and English being the main areas. An Australian Education Union report shows more than 70 of the schools surveyed employed science and mathematics teachers who were not qualified in the subject. In addition to the lack of qualified teachers, Australia's attitude towards STEM subjects and careers means fewer students are choosing to take these subjects.

This is a concerning trend which needs to be addressed if Australia is to increase its domestic engineering supply. The PISA results highlight only one in three high-performing male students in Australia expect to work as a professional engineer by the age of 30, while this figure is one in five for female students. Inspiring primary and secondary school students to undertake STEM subjects is a necessary first step, however having a strong cohort of primary and secondary teachers who are qualified to teach the required subjects is just as important.

Engineers Australia recommends the government provides more funding to STEM programs in schools which have been proven to be effective, such as EA Junior Club, Engineering is Elementary, Khan Academy, Re-Engineering Australia Foundation, F1 in schools STEM challenge and Year 13 (more in appendix 1).

Further to attracting greater numbers to a career in engineering is to provide relevant and effective undergraduate and postgraduate training matching industry demand. The transition to net-zero has shown the difficulty in integrating emerging technologies in tertiary curriculum. Research outlines three ways these areas that could be improved to help bridge any potential gaps:

- The pace of change and the development of technology makes it difficult for university course content and laboratories to keep up. The API assisted with this work around 10 years ago, but that funding no longer exists.
- Modern engineers are required to work in complex multidisciplinary teams, be digitally savvy, have good interpersonal skills and apply systems thinking. They are now expected to help develop social licence (trust), apply principles of sustainability to all their work, and engage directly with a broader range of stakeholders.
- With the pace of change and expanding expectations, some members expressed concern that the basics are being neglected in some areas such as system control engineering.

Collaborative partnerships on innovative pathways to engineering qualifications are a viable way to offer more industry relevant undergraduate and postgraduate training to students. Industry must take the lead in the creation of these new innovative pathways as it is uniquely placed to offer real-world experience through workplace learning, apprenticeships and technical trainers with up-to-date skills and knowledge of new equipment, tools and processes.

²⁵ Engineers Australia, *Engineering Skills – Supply And Demand; Discussion Paper, 2022, p7*

Government must provide support to these industry-led initiatives by collaborating with industry, professional peak bodies, unions and universities, reviewing these programs and coordinating the successful ones nationally to generate improved results.

1.5.4 Migration settings as a complement to the domestic workforce.

Better support needs to be provided to migrants to improve employment outcomes which will increase the pipeline of 'experienced' engineers immediately. Continuing large scale intakes of qualified engineers will not significantly develop Australia's engineering capability and may start to harm Australia's reputation as a country with good employment prospects for migrant engineers. Better utilisation of the skills currently in Australia (both through migrants and those looking to re-enter the engineering workforce) should be sought in the short term. Action is needed to modify Australia's migration program to ensure a better fit for the policy objectives with more of a focus on employment outcomes²⁶.

Migrant engineers are an untapped resource that can help Australia to address skills supply requirements in the engineering profession. While migrant engineers can bring their unique skills and experience into the role, many employers remain wary when it comes to employing migrant engineers, as they are seen to need more investment and bring more risk.

Our research identified seven barriers that employers and recruiters perceive to hiring overseas-born engineers. These barriers identified are:

- A lack of local knowledge and experience
- Perceived cultural differences in soft skills
- Visa or sponsorship working rights issues
- A lack of people who can 'vouch' for them locally
- Certification queries
- 'Flight risk' concerns
- Tendency to hire 'networks' at senior-level roles.

Engineers Australia's [Barriers To Employment For Migrant Engineers](#)²⁷ outlines six key opportunities to address these barriers:

- Positioning migrant engineers as a collective talent pool and talking to the size of the opportunity for employers
- Providing credible, trusted information on employment pathways for migrant engineers
- Increasing local networks by developing networking and sponsorship programs/ opportunities for migrant engineers
- Coordinating initiatives to build local knowledge and experience of migrant engineers
- Assisting humanitarian visa holders with their credentials assessment
- 'Making it easy' for employers to access the talent pool.

In taking advantage of these opportunities to address the barriers, Engineers Australia can help to ensure sufficient skilled engineers for the industry's planned projects, both now and into the future.

The government's migration policy is set to meet the objective of enhancing domestic capability, however, a shortage of engineering skills is reported even with a latent supply of overseas-born engineers struggling to find work at their skill and experience level. Improving the employment outcomes of migrant engineers is crucial for Australia to be seen as a destination of choice. This is particularly critical as global

²⁶ Engineers Australia, *Engineering Skills - Supply And Demand; Discussion Paper, 2022*, pp12-13

²⁷ Engineers Australia, *Barriers To Employment For Migrant Engineers; Research Report, 2021*, p6

demand for engineers increases and as other developed nations start to rely more on migrant engineers to shore up their own supply.

Continuing large scale intakes of qualified engineers will not significantly develop Australia's engineering capability and capacity unless better support systems are provided to help them secure engineering work when they are here. Without these support systems, increased skilled migration may start to harm Australia's reputation as a country with good employment prospects for migrant engineers²⁸.

State and territory governments should provide specialist programs to support skilled migrants to transition into occupations that align with their skills and qualifications, and should provide greater opportunities for them to engage in leadership roles across the sector. Where such programs exist, they should be subject to regular review to determine efficacy and allow for continuous improvement²⁹.

1.6. The role of collaborative partnerships between governments, industry, unions, civil society groups and communities, including place-based approaches.

Commercialisation of engineering STEM innovation

Innovation, education and manufacturing sovereign capability are pillars of a complex and sophisticated economy. Reaching self-sufficiency levels is not something industry or governments can do on their own. The creation of collaborative ecosystems conducive to of STEM innovation and domestic manufacturing capability has proven to be a source of jobs and growth. But financial independence for such ecosystems to gain maturity and become sustainable. For this, the commercialisation of STEM innovation is paramount.

Our studies³⁰ show that for Australia to improve its capacity to commercialise STEM innovation, there are three core issues where a policy shift is required:

- Improving models of collaboration and ecosystem development
- Reforming grants processes and tendering for government contracts
- Reducing regulation and incentivising investment in STEM start-ups in line with global best practice

Collaboration is the cornerstone of developing STEM and start-up ecosystems. Providing ease of access for large conglomerates, start-ups and VCs alongside academia and government will be fundamental in determining the quality of Australian innovation. It will also be critical when standing up to global competition. Given the relative infancy of the Australian ecosystem, government has a larger role to play, particularly in enticing other critical actors to participate. Where domestic deficiencies exist, for example a lack of seed-focused STEM VCs, government provides a means for these firms to develop.

To promote collaboration, Engineers Australia has the following recommendations:

- Start-up ecosystems, such as Lot Fourteen, in collaboration with government, should continue to explore and develop partnerships with vibrant STEM ecosystems in the UK, US and other world-leading countries. They should do this with the purpose of learning from best practice, cooperating on STEM innovation, and promoting Australian start-ups abroad commercially.

²⁸ Engineers Australia, *Strengthening The Engineering Workforce in Australia: Solutions To Address The Skills Shortage In The Short, Medium, And Long Term*, 2022, p17

²⁹ Engineers Australia, *Enhancing Productivity In Infrastructure Delivery: Policy Directions Paper*, 2022, p9

³⁰ Engineers Australia, *Commercialisation Of Engineering Innovation, EVP Directions Paper Technology & Industry Workstream*, 2022, pp4, 11-12

Given the prevalence of venture capital funding in the US and UK, these international partnerships should be leveraged to give Australian start-ups access to funding from overseas when it is not available domestically. Tax and other incentives should be explored to encourage this practice.

- Focus on putting start-ups at the centre of STEM innovation hubs, rather than focusing on larger conglomerates domiciled abroad. This includes actively seeking input from start-ups, accelerator programs, incubators and other actors involved in the STEM innovation ecosystem. By putting start-ups, and SMEs more broadly, at the centre of innovation, the emphasis will naturally turn to commercialisation and scaling – with the associated benefits in terms of jobs, economic growth and creating opportunities for Australians.
- Recognise the important role government plays, particularly in the early stages of developing a national STEM ecosystem and encourage collaboration. This means providing grants not only for start-ups, but also for STEM-focused VCs, and grants to support industry collaboration to promote the holistic development of the ecosystem. Critical to this, however, is ensuring that the long-term plan is for minimal government involvement to ensure ecosystems are self-sustaining and are not a financial drain on government.
- Recognising the limitations of the small Australian market, government should play a significant role in supporting start-ups to expand into the wider Asia-Pacific market. Given Austrade's networks in these countries, there would be opportunity to leverage these networks for Australian start-ups.

Education

Collaborative partnerships can have a significant role in raising interest at school in STEM. Engineers Australia has been and will continue to advocate for government to assist teachers, students and parents to better understand the 'jobs of tomorrow' and the career opportunities available through studying engineering. Collaborating with peak bodies like Engineers Australia will bring additional support. Further fundings is needed for existing initiatives such as those listed in appendix 1 would allow for more schools and students to be involved and generate greater influence on the early uptake of STEM subjects and see a future in engineering.

ATSE³¹ also recommend further collaboration between peak bodies, educators and government education departments to develop and support the implementation of collaborative teaching practices. Strategies should leverage virtual mechanisms such as online synchronous teaching from subject matter experts for multiple classes that allow both the students and teachers to learn. They should also consider group/co-marking of student work, collaborative lesson planning, sharing of established lesson plans and team teaching, where appropriate. This cultural change needs to be championed by school leadership and departments of education.

To help reduce the shortage of mathematics teachers Australia is currently facing, ATSE recommends the Government education departments develop and fund a targeted paid internship program for undergraduate tertiary mathematics students to expose them to RRR teaching career options that they may not have otherwise considered. This includes programs that target metropolitan students to attract them to RRR settings, and RRR students to support their retention in RRR communities.

Higher Education

The rate of Australian engineering graduates is influenced by factors such as a lack of connection to industry in turn making it challenging to gain experience and financial hardship playing a major role as disincentives to qualification completion. To combat this, collaborative partnerships between governments, universities, industry and peak bodies could allow for a more agile and innovative approach to tertiary education and greater level of uptake and completion of qualifications.

³¹ Australian Academy of Technological Sciences & Engineering, *Our STEM Skilled Future: An Education Roadmap For An Innovative Workforce*, 2022, pp13-14

As the peak body for engineering, Engineers Australia offers all engineering students a mentor program to better connect them to industry and help them understand where best job opportunities lie as well as an internship hub to help them gain that vital first experience. Industry and governments need to strengthen their internship offering to students in all years of study, with government taking the lead, to showcase the breadth of engineering and increase retention rates. Engineers Australia advocates for internships to be paid to support students who are working and studying as well as for youth allowance and scholarships to be increased.

Engineers Australia also supports the exploration of new innovative approaches on tertiary pathways. In Victoria, for example, an industry-led initiative is looking into replicating some of the successful new study models trialled in the UK, Germany and Canada. This new approach aims at attracting more students to study engineering through an apprenticeship model which would allow them to be employed and work while studying. This would solve all three aforementioned disincentives by showing clear job outcomes, experience and financial relief. Industry, universities, governments, peak bodies and unions are all collaborating to shape this new type of degree and replicate the success seen abroad.

A first cohort of students is hoped to start next year in a Bachelor of System Engineering in collaboration with Victoria University. The same collaborative partnership is attempting to set in place another pathway offering this time a dual qualification as an electrician and electrical engineering. The current proposal is to broaden the scope of potential students interested by potentially integrating within the program some of the mathematics subjects from years 11 and 12 (elementary mathematics & mathematics general) without hindering the ATAR requirements. They would start by becoming a qualified electrician then upskilling to a Bachelor in electrical engineering.

While these two new approaches would lengthen the completion time, between one to two years respectively, as presently proposed, it would make up by incentivising greater numbers of students, increasing retention rates and allowing faster upskilling to experienced engineer level through the experience gained.

Industry-led collaborative partnerships require the government's support by allocating funding and incentives for employers.

Skilled Migration

As outlined previously, a review of the current skilled migration system is a necessity as supply challenges could be partly alleviated by supporting skilled migrant engineers who are currently living in Australia, who are not working in an engineering role, to find an engineering job. Addressing the influencing factors impacting this cohort will assist with current shortages by tapping into the underutilised pool of skilled migrants that are already in Australia.

The Grattan Institute's recommendation³² to the government slash the skilled occupation list and hundreds of visa sub-categories to make way for a demand-driven immigration system is a great first step to establishing a well-needed collaborative partnership between governments, industry, peak bodies, unions and communities to tackle the supply shortages in many professions. This collaboration partnership would allow the government to better understand industry needs and answer them more accurately and efficiently.

Although skilled engineer migrants aren't the only solution, they are an essential piece of the puzzle. The current difficulties linked to migration policies in place are hindering the engineering industry, limiting its capacity to tap that underutilised pool of talent and its chance to attract overseas talents. The current skilled visa application process needs to be shortened and simplified so that Australia can compete with other countries in the world to attract the best talents.

Engineers Australia supports the current government proposal to rethink the current system in place. We encourage the government to collaborate with industry, peak bodies and unions to implement a more

³² Grattan Institute, *Rethinking Permanent Skilled Migration After The Pandemic*, 2021, p4

efficient, attractive and demand-driven system for Australian employers and much needed talents as complement to the domestic workforce.

1.7. Other relevant topics and approaches.

Occupational Licensing & Mutual recognition schemes

Registering engineers is important because it ensures engineering professionals meet benchmarked education, training, professional conduct and competency standards. It allows consumers to feel confident in the abilities of the engineers they hire and the products they use. However, the emergence of these multiple schemes across the country has raised concerns from businesses and sole practitioners around the added financial impact registration of engineers in multiple states can have on productivity and employment.

Free and efficient movement of the current suite of skilled, qualified engineers throughout Australia is imperative. Therefore, there is an urgent need for mutual recognition schemes. Mutual recognition is supported by The Mutual Recognition Act 1992³³ which is an overarching piece of legislation which supports states and territories to act in the same way.

In 2020, National Cabinet agreed to implement reforms to the current Mutual Recognition Act 1992. The amendments passed by the Commonwealth Parliament in June 2021 create “Part 3A” in the Mutual Recognition Act which describes a mechanism for implementing Automatic Deemed Registration (ADR). Although agreed to and passed at the Commonwealth level, it is up to individual states to decide the extent to which the new rules will be applied.³⁴

The Automatic Mutual Recognition of Occupational Registrations (AMR) scheme removes the need for people to apply and pay for an additional registration or licence when working in another state or territory, saving them time and money.³⁵

To be eligible for AMR, individuals must also hold and maintain a registration or licence in their home state or territory that covers the activity they intend to carry out in a second state or territory.³⁶ If the person meets the requirements, they are entitled to automatic deemed registration (ADR) to work in a second state or territory. This process is not automatic; hence, it can be ambiguous to refer to the changes to the Act as “AMR”.

Engineers Australia supports occupational mobility for engineers as it delivers benefits from both a business and individual practitioner perspective. It is common for professional engineers to work on projects in their home state as well as other jurisdictions.

Government must provide an avenue to resolve the ADR issue to reduce the negative impact the various statutory registrations currently impose on occupational mobility and overall engineering industry productivity, by working with state governments to establish a system similar to what is in place for other licencing systems, such as the drivers licence.

³³ Mutual Recognition Act 1992 Cth <https://www.legislation.gov.au/Details/C2021C00272>

³⁴ Australian Government, *Intergovernmental Agreement on the Automatic Mutual Recognition of Occupational*, 2020

³⁵ Australian Government, Department of Premier and Cabinet, *Cutting cross-border red tape for skilled workers*, <https://deregulation.pmc.gov.au/priorities/improving-occupational-mobility>

³⁶ *ibid*

2. Appendix

2.1. Engineers Australia Supported Programs

- [EA Junior Club](#)
- [Engineering is Elementary Program](#)
- [Year 13](#)
- [Explore Careers](#)
- [CSIRO STEM Schools program](#)
- [Khan Academy](#)
- [Power of Engineering](#)
- [Re-Engineering Australia, F1 in schools STEM challenge](#)
- [STAR portal](#)
- [Engineers Australia internship hub](#)
- [Engineers Australia's mentor program](#)
- [STEM returners](#)
- [Champions of STEM](#)
- [InterEngineer](#)
- [Indigenous Engineers Group](#)
- [Women in Engineering Committee](#)



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