Engineers Australia

Clean energy workforce capacity study submission

May 2023

ENGINEERS
AUSTRALIA

Contents

Clean energy workforce capacity study submission

Engineers Australia

11 National Circuit, Barton ACT 2600

+61 2 6270 6555

policy@engineersaustralia.org.au

engineersaustralia.org.au

About Engineers Australia

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

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

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

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

As society and technology have advanced, so has the practice of engineering. This has driven the development of new and specific subgroups of engineering across a wide range of industries. These subgroups are also known as areas of practice. Engineers Australia is currently working with stakeholders to develop a Hydrogen Engineering Area of Practice and may develop others in the clean energy space.

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

Engineers Australia has been working to understand the engineering workforce and the factors that influence supply and demand, including the barriers facing women and migrants. To that end, Engineers Australia has developed a range of initiatives to strengthen the engineering workforce in Australia.

Context for engineers

Labour market conditions in Australia are strong, and the unemployment rate has fallen to the lowest levels we have seen in decades. The Australian Government forecasts this to be strongest in jobs that require higher level qualifications. Jobs and Skills Australia data shows demand for engineers and a correlation between state involvements in clean energy projects and increase in clean energy engineering vacancies. The energy transition, driven by the need to decarbonise, provides excellent opportunities for Australians in the economy and as energy consumers. Taking advantage of these opportunities requires an engineering workforce that is fit for purpose.

The transition to clean, reliable, affordable energy requires a massive buildout in the planning, design, construction, operation and maintenance of renewable energy generation. This requires significant growth in the engineering workforce in a context where we are already experiencing a shortage and when the clean energy industries compete with infrastructure and defence projects to gain the necessary skills.

A lack of awareness of the profession early in a student's life and a decline in mathematics and science subjects taken at school have resulted in fewer domestic students taking up engineering studies. Of those who graduate with an engineering qualification, around 35 per cent do not enter the profession, further reducing Australia's supply of engineering skills. Australia has a structural issue in the domestic supply of engineers, making migrant engineers critical to ensuring Australia has the skills needed to deliver on current and future projects. This is further exacerbated by the need to import some of the skills required

for new clean energy technologies. If they cannot be developed locally, migration will be the only option. However, with just under half of all overseas born qualified engineers in the labour force not working in engineering roles, continuing large scale intakes of qualified engineers through Australia's skilled migration program will not significantly develop Australia's engineering capability. Australia's migration program needs to focus on employment outcomes by being more targeted in the engineering skills we seek, and once here, skilled migrant engineers need to be supported to find engineering work.

Strengthening the engineering workforce in Australia

Australia is experiencing perhaps its greatest-ever engineering skills shortage, with more than 50,000 engineers estimated to be needed over the next few years, with the majority of disciplines and nearly all sectors of the economy requiring more engineers. Demand for engineering skills is strengthening due to a healthy infrastructure pipeline and many of our national priorities, including the clean energy transition and a resurgence in demand for minerals, relying on the engineering profession.

Australia's engineering workforce has two main supply channels – Australians who choose engineering for their tertiary education and career and skilled migrant engineers. Supply from both channels is decreasing at a time when demand is increasing. Australia has relied on skilled migrant engineers for its engineering workforce for many years now, with around 60 per cent of the engineering workforce in Australia having been born overseas. However, only about 40 per cent of skilled migrant engineers in Australia are employed in an engineering role, and compounding the problem is the number of young Australians choosing to study engineering has been declining since 2014 and a decrease in the number of school students choosing to study intermediate and higher-level mathematics. Our analysis of 2021 census data has shown that over 70 per cent of the additional engineers added to Australia's labour force between 2016 and 2021 were born overseas.

A report by the former National Skills Commission predicts STEM occupations will increase by 12.9 per cent over the next five years. At the same time, Australia's production of domestically trained engineers is declining. The decrease in commencements of engineering students means we are unlikely to see an increase in graduate levels until at least 2025, which is unlikely at current rates without intervention.

With demand for engineering skills expected to continue to increase, our research shows Australia needs to address five areas to build an engineering workforce that can meet our current and future needs.

- First, we need to encourage more young Australians to choose to study engineering. Research shows one of the many required actions here is to raise awareness of what engineering 'is' and what engineers 'do'. We need to make engineering more real for school students and their parents/carers, teachers and careers advisers, and share positive messages about engineering as a career, that it is rewarding and fulfilling and contributes to making the world a better place (an important consideration for younger Australians). We also need to encourage the uptake of the prerequisite subjects required for engineering study.
- Second, we need to improve engineering study completion rates. Only ~25 per cent of four-year engineering qualification students complete their degree in the minimum time of four years, and only between 50-65 per cent of commencing engineering students graduate with an engineering degree.
- Third, we need to actively retain engineers in the engineering workforce. Around 60 per cent of qualified engineers in Australia work in an engineering role. An engineering qualification is an asset for life. The engineering mindset and skillset, grounded in problem-solving, design and systems thinking, are highly versatile and valued in the broader economy.
- Fourth, we need to re-examine our skilled migrant workforce and the systems that support it. Lifting the number of skilled migrant engineers coming to Australia is unlikely

to boost Australia's engineering workforce unless we also provide better support systems once they are here to help them find engineering work. This is critical as Australia is one of many countries experiencing increased demand for engineers. For skilled migrants, this needs to include clear pathways to permanent residency and the ability to find employment at a level commensurate with their skills and experience.

- Finally, we need to explore ways of improving how the future engineering workforce is planned. Improved demand data, fed back to universities and schools, can help close the information loop and ensure the engineers we need in the future are being trained now.

Summary of actions for government, industry and the tertiary sector

Engineers Australia has developed a comprehensive inventory of initiatives that can strengthen the engineering workforce. Below is a summary of the immediate actions governments, industry and the tertiary sector can take to assist in alleviating the current supply challenges and shore up the future supply of engineers. Collaboration and partnership between all stakeholder groups will be required for the initiatives to be successful.

Government

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.
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. Incentivise contractors to provide graduate programs and internships for engineers through procurement processes.
4. Offer engineering internships and graduate programs in agencies and departments with an engineering capability.
5. Offer incentives for students to undertake engineering associate (2-year) and engineering technologist (3-year) qualifications.
6. Provide Commonwealth Supported Places (CSP) for accredited engineering master's qualifications to help articulate other STEM bachelors' qualifications to the level of professional engineers and to help retain engineers in the workforce by upskilling them in new and emerging fields.
7. Provide financial support to engineering students to help lift engineering study completion rates and reduce time-to-completion.
8. Provide financial support to STEM programs in schools that have been proven effective.
9. Provide more support to skilled migrant engineers who are already in Australia but have been unable to secure an engineering job.
10. 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 help and incentivise engineers working out of field to return to engineering.
11. Support schools to encourage more young Australians to choose to study maths and engineering studies.
12. Refine Australia's migration program objectives to be more targeted, to attract migrants with the specific experience and skills required, increasing their employability.
13. Additional focus should be given to engineers from allied (Five Eyes) nations to ensure the availability of engineers who can be cleared for Defence related work (as we anticipate Defence-related work will be a source of demand for many engineers of nearly all disciplines).

Industry

1. Consider specific initiatives to help retain engineers in the workforce, including visibility of career pathways, upskilling and re-skilling opportunities through micro-credentials, providing mentoring and sponsorship opportunities, providing more attractive career opportunities and addressing imposter syndrome.
2. Consider where and how all occupational categories in the engineering team can be best utilised when undertaking workforce planning.
3. Identify ways to support the employment of skilled migrant engineers by offering employment opportunities to this cohort of engineers and assisting in addressing the barriers identified in Engineers Australia's research report.
4. Offer mid-career engineers a senior 'sponsor' within the organisation to help develop their career pathway, offering opportunities for development and advancement.
5. Offer scholarships to engineering students to help lift engineering study completion rates, reduce time-to-completion and retain engineers in the engineering workforce.
6. Offer supportive graduate programs to recent graduates. Many engineering students, especially high-performing students, secure a non-engineering job in their third or final year of studies. Engineering organisations need to compete with these organisations by providing attractive internship and graduate program opportunities, with an emphasis on engaging and attracting students earlier in their post-secondary studies than in previous years.
7. Partner with local schools to support STEM programs and provide opportunities for early career engineers to engage with and inspire the next generation.
8. Provide supportive internship opportunities to engineering students. Please refer to Engineers Australia's internships hub for more information. The internships hub has been designed to help link internship opportunities in industry with students and tertiary education institutions. This is one of the most important ways industry can strengthen the engineering workforce because it helps keep engineering students in the profession and provides valuable work-integrated learning opportunities. Many students find it very difficult to find internship opportunities. Industry experience is a pre-requisite to the completion of most programs and difficulties obtaining this experience delays graduation of students.
9. Provide work experience opportunities to school students interested in learning more about our profession. Engineers Australia's guidelines for Providing work experience to engineering students can help industry to offer a rewarding experience.

Tertiary education

1. Advocate for Commonwealth Supported Places (CSPs) for the two-year postgraduate conversion master's to encourage graduates from other STEM fields to become professional engineers.
2. Contact engineering students who withdraw from their course to determine if further support can retain them in their studies and/or inform these students of other engineering occupational categories (Associate, Technologist) that may appeal to them and retain them in the profession, utilising the studies they have already undertaken.
3. Explore other innovative pathways to engineering qualifications.
4. Help students to find graduate program employment opportunities by working with industry and government.
5. Promote the utility of engineering associate and technologist qualifications individually and as pathways to 4-year degrees for those who choose to extend their qualifications.
6. Support engineering students to strengthen inclusivity, diminish imposter syndrome (especially for female students) and alleviate financial burden (e.g. through scholarships).
7. Use the Engineers Australia Internships Hub and other linkages to industry to assist students in finding internship opportunities. The internships hub has been designed to help link internship opportunities in industry with students and higher education institutions. This is one of the most important ways the engineering workforce can be strengthened because it helps keep engineering students in the profession and provides valuable work-integrated learning opportunities. Many students find it very difficult to find internship opportunities.

For more information on Strengthening the engineering workforce, see the full report here.

Women in engineering

Australia needs to increase the participation and retention of women in engineering. Engineering is the largest employer of the STEM (Science, Technology, Engineering and Maths) professions. However, engineering has the lowest female representation of the STEM professions, with just 16 per cent of Australian engineering graduates and 13 per cent of the Australian engineering workforce female. This is in stark contrast to other STEM fields, such as biological sciences, where gender representation tends to be far more balanced.

Engineers Australia commissioned research in 2021/22 to understand the initiatives and influencing factors that effectively drive greater female participation in engineering. This requires understanding the fundamental motivators and barriers influencing girls to pursue (or not pursue) engineering as their area of study and potential career.

Participation in engineering can be conceptualised as a journey comprising three broad stages: initial consideration of and choice to study engineering; studying engineering at university; and going on to work in the engineering profession. Based on the research, led by independent accredited agency Ergo Strategy, Engineers Australia has identified key areas that need to be addressed:

- The main reason stated by women who didn't study engineering was a lack of familiarity with engineering. There needs to be more awareness of what engineering involves.
- A lack of positive perceptions of the engineering profession – seen as male dominated and challenging, and not impactful or fulfilling.
- Poor STEM engagement throughout schooling – many girls don't feel supported to do well in STEM.
- While generally a positive experience studying engineering at university, students feel less supported to do well in their studies compared to other degrees.
- Most female engineers feel valued at work and are passionate about their work. However, there are significant issues for women with workplace culture and unequal opportunities.

The research reveals that when it comes to female participation in engineering, the most significant problem lies in the initial stage of consideration – the primary and high school years. Most girls do not even think of engineering as a career option, with only 7 per cent of surveyed women in non-engineering fields saying that they had seriously considered engineering. This is therefore where our efforts should focus most because it represents the largest opportunity to increase the number of women in engineering.

Longer-term initiatives that address the systemic issues outlined above are critical. However, there is certainly still a place for 'short and sharp' initiatives like school talks – the key is to ensure that women are represented in these initiatives and that the messaging speaks to the key motivators of career choice. Initiatives also need to be early – targeting students from junior high school (and even earlier).

There are significant issues with workplace culture; only 55 per cent of female engineers say they have equal opportunities to men, and nearly 1 in 5 say there is bullying or exclusion of women in their workplace. These issues appear to be the primary driver of women leaving the engineering workforce.

Initiatives in this space should focus on combatting the non-inclusive culture prevalent in some engineering workplaces, particularly larger firms (e.g., gender bias training; reverse mentoring). They should also empower women to progress in their careers and to navigate the challenges faced in the workplace (e.g. female-focused mentoring and networking; career progression structures that help mitigate gender barriers).

For more information on Women in Engineering, see the full report here.

Better utilisation of migrant engineers

Engineers Australia believes skills supply could be addressed by accessing the existing pool of overseas-born engineers who make up over 58 per cent of Australia's engineering workforce but are significantly more likely than their Australian-born counterparts to be unemployed or 'underemployed' i.e., in roles at a more junior level than their skills and experience warrant.

Engineers Australia commissioned research which identified seven barriers employers and recruiters perceive to hiring overseas-born engineers. These range from a lack of local knowledge and experience to perceived differences in soft skills, and a lack of local people who can 'vouch' for these engineers. On a more individual level, barriers also encompass visa or sponsorship working rights, and concerns regarding international certification validity and perceived 'flight risks'.

Based on this research, Engineers Australia identified six key opportunities to address these barriers:

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

A further obstacle exists for migrant engineers on student or temporary visas working for companies which do a substantial amount of work for the Commonwealth Government. In many instances, companies cannot use migrant employees on government work until they have attained permanent residency or citizenship. As a result, they are less interested in employing migrant engineers on temporary visas. Consideration should be given to how migrants from allied and neutral countries can work on Commonwealth Government projects, subject to appropriate security checks.

Under the current program, visa classes exist which enable migration if the applicant agrees to remain in a regional location for two to four years. This obligation can pose barriers to finding a job which matches the migrant's skills and experience. For engineers, this is mainly because the great majority of engineering roles are in metropolitan areas, particularly Sydney and Melbourne. More information needs to be provided to migrants regarding the employment opportunities in each region. The obligation to remain in a regional area should be reduced to a shorter period, such as six months, if employment opportunities do not exist.

For more information on Barriers to employment for migrant engineers, see the full report here.

Other considerations

Supporting regions and communities

Support should be given in the regions where clean energy projects will be built and those where existing fossil generation will close (the Hunter, Victoria, Queensland). Government needs to provide information that reinforces the opportunities of the clean energy transition.

Fossil fuel workforce

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 shortages. Many of the tasks needed in a clean energy economy are already being performed. Other workers may just require on-the job-training, micro-credentials or short courses.

ABS Census Data

The Australian Census conducted by the ABS every five years provides the most complete picture of the engineering qualified workforce and those working in engineering occupations in Australia. Consideration should be given to collecting multiple qualifications during census surveying to better ascertain the population of qualified engineers in Australia, as the Census presently captures only the highest qualification held by a respondent, which can provide statistically significant variation of the data and may lead to an under or over-count (based on our current understanding and analysis we believe there to be an under-count of qualified engineers in the Census data).

ANZSCO

Engineers Australia supports the work being done by the Australian Bureau of Statistics to update ANZSCO codes in Australia. Many emerging occupations, including in the clean energy sector, will not be captured for some time by the ANZSCO classification scheme. Consideration should be given to how occupation classifications can be more agile to account for skills shortages and examined in more detail for specific engineering skill sets.

Emerging or established areas such as Hydrogen Engineering are being considered by Engineers Australia in our work related to areas of practice and specialisations. Ideally, these should also have a set of definitions under ANZSCO, not only for identification but also for the advancement of industry. Other emerging skills critical to the energy transition should be reviewed and included in ANZSCO to ensure we can target the right skills and experience.

The emerging area of 'sustainability engineering' resonates and we would welcome the opportunity to contribute to early discussions on potential resultant occupations. Introducing new classifications in this area will likely impact university offerings and their professional accreditation to international benchmarks.

The migration program and ANZSCO

Currently, visas such as the skilled independent visa 189 or skilled nominated visa 190 require an applicant to be assessed and provided an ANZSCO occupation. If we need skills not directly associated with an ANZSCO occupation, they cannot be on the skills occupation list (or state/territory equivalent). Therefore, immigrants with these skills cannot migrate to Australia through these visas. Engineers Australia is aware with the release of Australia's Migration Program Review report may change this.

Contact us

The engineering skills and labour supply will likely worsen before it gets better, especially if nothing is done. The research, analysis and consultations conducted to date by Engineers Australia have culminated in an inventory of tangible, outcomes-focused initiatives (both existing and possible future initiatives) which would alleviate the severity of current and future skills shortages within the engineering profession in Australia. Engineers Australia welcomes the opportunity to discuss the ideas outlined in this paper with interested parties. If you would like to engage with the work being undertaken, please contact policy@engineersaustralia.org.au


ENGINEERS
AUSTRALIA