



ENGINEERS
AUSTRALIA

Engineering skills – supply and demand

Discussion paper

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1. Introductions

Australia is experiencing a shortage of engineering skills in many sectors as reported by Engineers Australia's members, the media, industry and government, with an expectation these shortages will become acute and persistent.

Shortages of engineering skills is not new with Australia previously facing a shortage of engineering skills in the late 1980s and again during the recent mining boom.

The dynamics of Australia's supply of engineers are complex. The immediate situation stems from an increase in demand at a time when borders have been effectively closed for almost two years. Driving demand is ongoing investment in public infrastructure, a resurgent demand for minerals, and the global transition to clean energy and adaption to climate change.

Stated in this way it sounds like a simple issue to resolve, when international borders re-open and the volume of skilled migration increases the issue will subside. However, Engineers Australia's research shows there is a significant cohort of migrant engineers already in Australia who have long-term difficulties in securing employment appropriate to their experience. Continuing to rely on skilled migration puts the nation at risk of perpetually recurring skills supply issues, particularly when experienced engineers are already in Australia who cannot find work. Therefore, returning to pre-COVID migration patterns without addressing this issue would be an inefficient solution and will leave Australia vulnerable to future disruptions.

The academic and professional development of a professional engineer requires the completion of a four-year undergraduate degree and the attainment of five to seven years of experience before being considered capable and competent for independent practice. Research suggests currently only around 25 per cent of higher education students complete their undergraduate degree in the 'minimum time'.¹ This means the development of a competent professional engineer is often greater than 10 years. Engineering technologists and associates required three years and two years of vocational training and similar time of on-the-job experience making it still a seven to ten year endeavour. Maintaining an adequate supply of engineers will require planning and a long term commitment by industry, the tertiary sector and government.

1.1 Project overview

Devising a pathway forward to the current disparity of engineering skills will require a coordinated and well thought-through approach. Engineers Australia is undertaking this project to explore ways to address the skills supply and demand challenges facing Australia and be convenors between the main parties, helping to undertake analysis and designing initiatives to understand and alleviate the situation insofar as possible. The project aim is to provide a better understanding of the issues facing industry (in particular the scale of the issue over the short, medium and long term), the tertiary sector and government with regard to current and future engineer supply and demand and to recommend initiatives that will address the problems and partner with others to implement them.

1 'Australian Engineering Higher Education Statistics 2009-2019' *Australian Council of Engineering Deans*, December 2020 (accessed 22 September 2021) http://www.aced.edu.au/downloads/ACED%20Engineering%20Statistics%20Dec%202020_v2.pdf

This project complements further work within Engineers Australia to build greater diversity in the profession (including better employment outcomes for migrant engineers and improving gender diversity in the engineering profession) and increasing participation in STEM subjects at school. Engineers Australia will release the 15th edition of the *Engineering Profession: A Statistical Overview* following the release of the relevant census data in October 2022. This will provide insights into the dynamics of the Australian engineering workforce over the last five years and inform the scale of change that may be required to ensure a sustainable skills supply.

1.2 Purpose of this discussion paper

This discussion paper is designed to provide a broad view of the situation Australia is facing in relation to the supply and demand for engineering skills. It is a resource to prompt thought and discussion. Engineers Australia will seek the views of our members, industry, government and the tertiary sector through a series of roundtables and other forums which will be informed by this discussion paper. These stakeholder perspectives will progress the discussion and lead to the development of strategies and actions designed to deliver tangible outcomes to alleviate the impact on the engineering profession and in turn the Australian economy and society more broadly.

1.3 About Engineers Australia

Engineers Australia is the peak body for the engineering profession in Australia. Established in 1919, Engineers Australia is a not-for-profit organisation, constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community. We are a professional association with about 105,000 individual members, representing a wide range of disciplines and branches of engineering across all engineering occupational categories (Professional Engineer, Engineering Associate, Engineering Technologist).



2. Defining a skill shortage

2.1 Understanding the terminology

The term 'skill shortage' isn't universally defined, meaning its definition is subjective. In the broader context there are two meanings for the term: employers struggle to recruit a person for a specific vacancy, or employees not having the required skills to do the work they are employed to do.²

The National Skills Commission's definition of a skills shortage is that *"an occupation is considered to be in shortage when employers are unable to fill or have considerable difficulty filling vacancies for an occupation or cannot meet significant specialised skill needs within that occupation, at current levels of remuneration and conditions of employment, and in reasonably accessible locations."*³

In contrast, Andrew Norton, a higher education policy expert from Australian National University, has stated there is a difference between a genuine skills shortage and employers having difficulty filling jobs *at current rates of remuneration*.⁴

In addition, a clear distinction between a skills shortage and an experience shortage should be made. Research commissioned by Engineers Australia and discussed below shows there is a large cohort of skilled migrant engineers in Australia who cannot find suitable work to their experience level (gained overseas).⁵ This is a pool of engineers who have the technical skills but may lack local experience and therefore are not considered for Australian engineering roles.

Having an agreed understanding on what constitutes a skills shortage is important before solutions to the current difficulties facing the profession are proposed. This needs to consider not only the current state of the market but also future demand and supply indicators. Another important consideration is there is likely to be engineering skills that continue to have a structural shortage due to a specific niche or a developing/new area of practice. This also needs to be an area of focus for industry and government.

For consideration:

01. Does the current National Skills Commission's definition of 'skills shortages' reflect the difficulties being faced by the profession?
02. Is there a more suitable way to describe the current and future difficulties in attracting the required skills or experience?

2 'The shortage of engineering and related employment skills' (Chapter 2) Parliament of Australia (accessed 2 February 2022) https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Education_Employment_and_Workplace_Relations/Completed_inquiries/2010-13/engineering/report/index

3 'Skills Priority List Methodology' Australian Government National Skills Commission (accessed 4 February 2022) https://www.nationalskillscommission.gov.au/sites/default/files/2021-06/Skills%20Priority%20List%20Methodology_0.pdf

4 'Regions bear weight of skill shortages' Australian Financial Review, 16 August 2021 (accessed 2 February 2022) <https://www.afr.com/work-and-careers/education/regions-bear-weight-of-skill-shortages-20210815-p58iut>

5 Romanis, J. Barriers to Employment for Migrant Engineers: Research Report (2021) *Engineers Australia* <https://engineersaustralia.org.au/sites/default/files/resource-files/2021-10/barriers-employment-migrant-engineers.pdf>

3. Supply of engineering skills

The supply of engineering skills can be categorised into two channels: graduates from Australian universities and international migration.

The domestic supply includes both Australian citizens and permanent residents, and international students who meet the criteria to remain in Australia after completing an Australian engineering qualification. International migration includes engineers with an overseas qualification who migrate to Australia through various permanent and temporary, independent and sponsored, migration and humanitarian visa schemes provided by the Australian Government.

3.1 Domestic supply of engineers

3.1.1 Early Education

Science, technology, engineering and maths (STEM) skills are critical to Australia's economy. Engineers have helped lead the development of innovation in many industries. The National Skills Commission reports employment in STEM occupations grew by 85 per cent since the early 2000s.⁶ With STEM occupations increasing twice as fast as non-STEM occupations and projections showing they will continue to grow by 12.9 per cent over the next five years, Australia needs to ensure we have a robust supply of upcoming STEM-qualified people, with a heavy emphasis on engineers.⁷

The development of an engineer begins early. Building teachers', students', parents' and careers advisors' awareness of the profession and corresponding career opportunities combined with promoting STEM subjects at the school level is necessary to ensure students have the necessary subject prerequisites, and inclination, to complete an engineering qualification and enter the profession. Research conducted by Engineers Australia reveals Australia's ability to develop engineers domestically is hindered by a reduction in year 12 science and mathematics participation.⁸ 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. Engineers Australia is commissioning research to gain an understanding of what motivates students to choose engineering for their higher education (and why students who didn't choose to study engineering, didn't). Results are expected to be available in the second quarter of 2022.

6 'Australia's shift to a higher skilled, services-based economy' *Australian Government National Skills Commission* (accessed 3 February 2022) <https://www.nationalskillscommission.gov.au/sites/default/files/2021-12/Australia%E2%80%99s%20shift%20to%20a%20higher%20skilled%2C%20service-based%20economy.pdf>

7 *ibid*

8 Kaspura, A 'Engineers make things happen: the need for an engineering pipeline strategy' *Engineers Australia*, (accessed 15 February 2022) <https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf>

While out of scope for this discussion paper, it should be noted that the performance of Australia's early and secondary education system is reported to be declining on multiple fronts. The latest OECD Programme for International Student Assessment (PISA) results show Australian students' performance in mathematics has declined since 2003, with science performance declining since 2012 relative to previous years of Australian education.⁹ The 2018 results are 33 points below the 2003 results for mathematics and 24 points lower than 2006 for science.¹⁰ This is despite government spending on schools hitting almost \$58 billion a year in 2018/19.¹¹

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.¹² Thirty eight 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.¹³ 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.¹⁴ In addition to the lack of qualified teachers, Australia's attitude towards STEM subjects and careers mean fewer students are choosing to take these subjects.¹⁵

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.¹⁶

3.1.2 Higher education and graduate development

Once an individual has decided to study engineering for their higher education, it is a decade-long process for them to be considered competent for independent practice. The path of a professional engineer requires at least a four-year undergraduate degree which current data shows only 25 per cent of graduates complete in the 'minimum' time.¹⁷ Once graduated it takes approximately five to seven years of post-graduate experience before an engineer is considered competent for independent practice.¹⁸ Internships, graduate programs and early career employment opportunities are a critical part of an engineer's development. It is only at the stage of independent practice an engineer would fulfil the current needs of employers for 'experienced' engineers.

9 'Program for International Student Assessment (PISA) Results from PISA 2018: Australia' OECD (accessed 9 February 2022) <https://www.nationalskillscommission.gov.au/sites/default/files/2021-12/Australia%E2%80%99s%20shift%20to%20a%20higher%20skilled%2C%20service-based%20economy.pdf>

10 *ibid*

11 Bolton, Robert (2019) 'Australian maths students fall years behind China' Australian Financial Review (accessed 9 February 2022) <https://www.afr.com/work-and-careers/education/maths-students-fall-years-behind-china-20191202-p53g6g>

12 O'Flaherty, Antonia. (2021) 'Worrying' STEM teacher shortage with pressure felt in rural and remote schools' ABC News (accessed 9 February 2022) <https://www.abc.net.au/news/2021-06-15/school-principals-dont-have-enough-maths-science-teachers/100214738>

13 *ibid*

14 *ibid*

15 Singhal, Pallavi. 'HSC students abandoning high-level subjects' (2018) The Sydney Morning Herald accessed 9 February 2022) <https://www.smh.com.au/education/hsc-students-abandoning-high-level-subjects-20180323-p4z5yn.html>

16 'Program for International Student Assessment (PISA) Results from PISA 2018: Australia' OECD (accessed 9 February 2022) https://www.oecd.org/pisa/publications/PISA2018_CN_AUS.pdf

17 'Australian Engineering Higher Education Statistics 2009-2019' Australian Council of Engineering Deans, December 2020 (accessed 22 September 2021) http://www.aced.edu.au/downloads/ACED%20Engineering%20Statistics%20Dec%202020_v2.pdf

18 Based on Engineers Australia's chartered credential being obtained and depends on the level of experience gained in the profession.



It should be noted however, this only relates to those graduates who enter the profession once graduated. Analysis from the 2016 census shows approximately half of all engineering bachelor graduates, if they were working, were not working in engineering occupations.¹⁹ This suggests the profession is unable to retain a large cohort of qualified engineers which is another contributing factor to current skills shortages. The reasons why so many engineers don't remain in the profession is unknown. One pull factor away from the profession could be that the National Skills Commission predicts cognitive ability to be a highly sought after skill in the future.²⁰ The nature of engineering requires a strong cognitive ability, engineers are therefore being sought by many employers simply due to the value placed on the general skills of an engineering education and their cognitive ability to think and to solve complex problems. In addition, salaries and the prestige associated with working at certain industries and occupations may be greater outside the engineering profession. The desirability of engineering graduates is evidenced by the 2020²¹ and 2021²² Employment Satisfaction Surveys in which graduates of engineering and related technologies scored the highest overall satisfaction for the last two years.

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. Government and industry should find ways to support the next generations of engineers, both improving the uptake of engineering qualifications and increasing the number of graduates entering the profession.

Simply increasing intake of undergraduate engineering students is unlikely to solve the problem in the short term. An immediate action should be to encourage and retain current engineering graduates with employment in engineering jobs. To assist in illustrating the inflows and outflows of the profession Figure 1 below shows a snapshot as at 2019.

19 Palmer, Stuart and Campbell, Malcolm 2018, Using census data to better understand engineering occupational outcomes, in AAEE 2018: Proceedings of the 29th Australasian Association for Engineering Education Annual Conference, Engineers Australia, [Hamilton, N.Z.], pp. 1-7 Supported by Trevelyan, J., & Tilli, S. (2010). Labour force outcomes for engineering graduates in Australia. *Australasian Journal of Engineering Education*, 16(2), 101-122.

20 'Skills and jobs of the future – the Four Cs' Australian Government National Skills Commission (accessed 3 February 2021) <https://www.nationalskillscommission.gov.au/sites/default/files/2021-12/Skills%20and%20jobs%20of%20the%20future%20%E2%80%93%20the%20Four%20Cs.pdf>

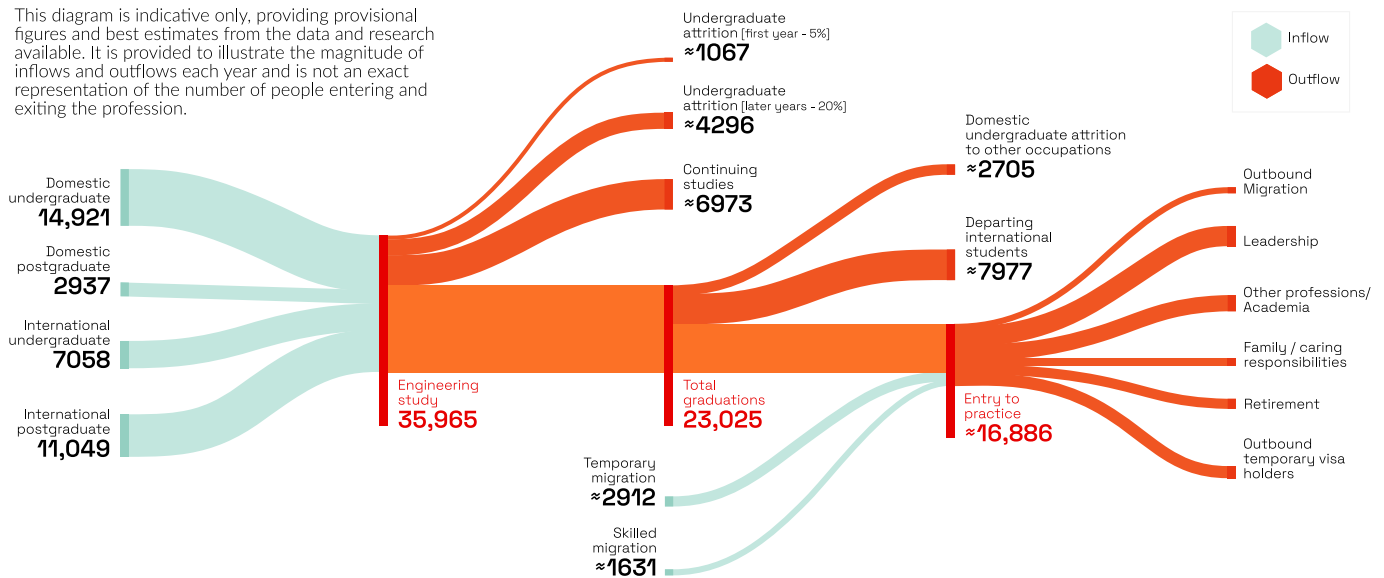
21 Employer Satisfaction Survey, The Social Research Centre, 2020, p5 (accessed 28 February 2022) https://www.qilt.edu.au/docs/default-source/default-document-library/2020-ess-national-report.pdf?sfvrsn=7f3175fe_5

22 Employer Satisfaction Survey, The Social Research Centre, 2021, p5 (accessed 28 February 2022) https://www.qilt.edu.au/docs/default-source/default-document-library/2021-ess-national-report.pdf?sfvrsn=7494208b_0

Figure 1: Inflows and outflows of domestic engineers (2019)²³

Inflows and outflows of Professional Engineers 2019

This diagram is indicative only, providing provisional figures and best estimates from the data and research available. It is provided to illustrate the magnitude of inflows and outflows each year and is not an exact representation of the number of people entering and exiting the profession.



Australian Engineering Higher Education Statistics 2009-2019, Australian Council of Engineering Deans, December 2020 & King, R. Working Paper: Pipelines into Professional Engineering Occupations, Australian Council of Engineering Deans, December 2021

3.1.3 International students graduating locally

Not all international students wish to stay in Australia after graduation, however, the ones that do can face difficulties gaining internships and graduate positions. Organisations don't always want to employ them because of perceptions of visa-related requirements and costs. Additionally, prospective employers face the barrier that they may need to prove they can't find a local person to do the job once the graduate's post-graduate work rights cease and is required to move to an employer-sponsored class of visa (other visa classes are also available). In the current market, given employers' claims of a skills shortage, the National Skills Commission (NSC) and Skills Priority List (SPL), Labour Market Testing rules are unlikely to inhibit sponsorship. Greater awareness of the visa mechanisms available might help business in developing this pool of international students who can then transition to a permanent migration visa but with the added benefit of having developed local experience.

²³ The diagram provides provisional figures and best estimates based on the data and research available. Conservative figures for graduates working out of profession are calculated based on King, R. 'Working Paper: Pipelines into Professional Engineering Occupations' Australian Council of Engineering Deans, December 2021 and Paler, Stuart and Campbell, Malcolm 2018, Using census data to better understand engineering occupational outcomes, in AAEE2018: Proceedings of the 29th Australasian Association for Engineering Education Annual Conference, Engineers Australia, [Hamilton, N.Z.], pp. 1-7. Likewise, the figures used for the flows of migration and departing international students are informed estimates based on the data available.

For consideration:

03. How can Engineers Australia, industry, the tertiary sector and government work together to encourage more school children to study STEM subjects and build motivation for a career in engineering and other STEM-based careers?
04. How can teachers be supported to use engineering as a way to give a practical application to what students are learning in the current science and mathematics curriculum?
05. What more could be done to retain graduate engineers in the profession?
06. How can industry be supported and/or encouraged to provide internships to overseas students and employ international graduates from local universities?
07. How can Engineers Australia collaborate with industry and government to increase the number of women in engineering?

3.2 Migrant engineering supply

Skilled migration will remain essential to the nation's engineering capacity in the short and medium term. At the 2016 census, more than 58 per cent of engineers in the Australian labour force were born overseas.²⁴ This makes Australia's skilled migration program critical to the country's ongoing engineering capability.²⁵ The Government's inclusion of certain engineering occupations on the Priority Migration Skilled Occupation List will assist in the short term, however, longer term thinking is needed to ensure supply.²⁶ This is particularly critical as global demand for engineers increases and other developed nations start to rely more on migrant engineers to shore up their own supply.

The US Bureau of Labor Statistics projects architectural and engineering occupations to grow by 6 per cent from 2020 to 2030 (with most growth coming from engineering) due to a rise in demand in areas such as infrastructure, renewable energy, oil and gas extraction, and robotics.²⁷ In the UK it is predicted that the number of engineering apprentices and graduates will need to double to meet the projected demand.²⁸ An increase in demand for engineering skills globally puts additional pressure on Australia's reliance for skilled engineering immigrants. As seen in figure 2, Australia, the US and the UK all produce lower levels of engineering graduates compared to other G20 countries and the OECD average. If Australia is going to continue to rely on migrant engineering skills for the foreseeable future, we need to ensure Australia is seen as a country of choice, with good employment outcomes and strong wages.

24 Romanis, J. Barriers to Employment for Migrant Engineers: Research Report (2021) Engineers Australia <https://engineersaustralia.org.au/sites/default/files/resource-files/2021-10/barriers-employment-migrant-engineers.pdf>

25 ibid

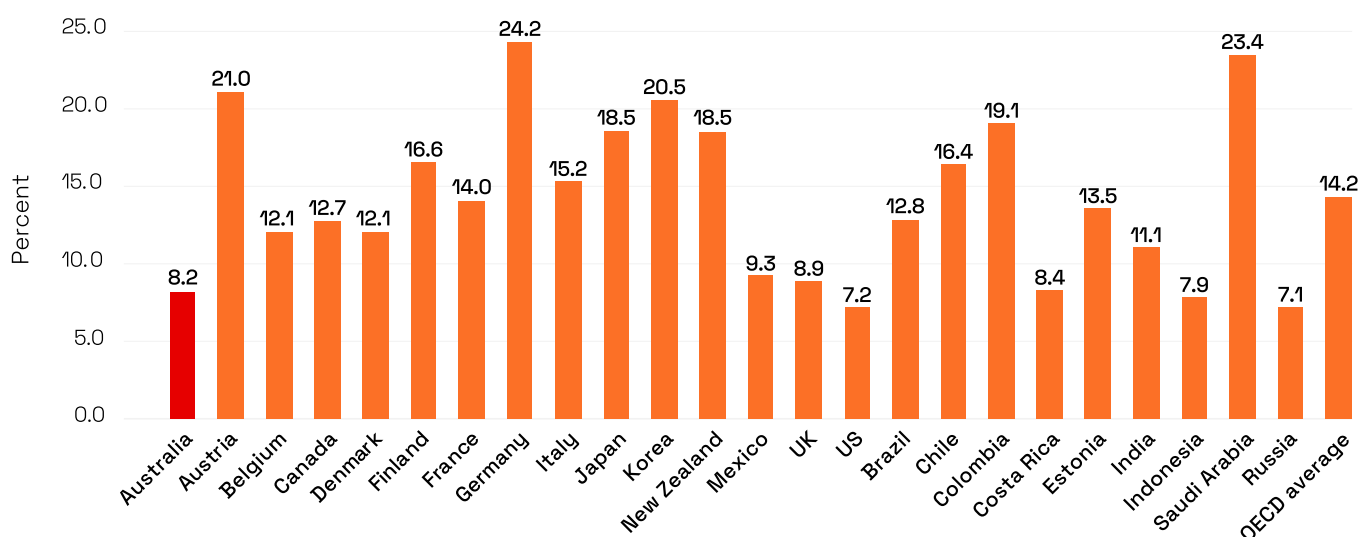
26 'Priority Migration Skilled Occupations List' Australian Government Department of Home Affairs (accessed 24 February 2022) <https://immi.homeaffairs.gov.au/visas/employing-and-sponsoring-someone/sponsoring-workers/pmsol>

27 'Architecture and Engineering Occupations' US Bureau of Labor Statistics (accessed 4 February 2022) <https://www.bls.gov/ooh/architecture-and-engineering/home.htm>

28 'Engineers in demand in the UK and throughout the world' Michael Page Engineering and Manufacturing (accessed 4 February 2022) <https://www.michaelpage.co.uk/our-expertise/engineering-and-manufacturing/engineers-demand-uk-and-throughout-world>

Figure 2: Comparison of G20 country's engineering graduates as a percentage of total graduates (2019)²⁹

Percentage of engineering graduates from G20 countries



3.2.1 Migrant engineering skills in Australia

Migrant engineers in Australia are much more likely than their Australian born counterparts to work in non-engineering roles. The government's migration policy is set to meet the objective of enhancing domestic capability, however, there is still considered to be a shortage of engineers even with a latent supply of overseas-born engineers struggling to find work at their skill and experience level. 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. Engineers Australia's research on barriers to employment for migrant engineers highlights seven barriers to employment for migrant engineers that need to be overcome.³⁰

²⁹ Source: 'Tertiary Graduates by Field' OECD Data (accessed 3 February 2022) <https://www.oecd.org/statistics/compare-your-country.htm>

³⁰ Romanis, J. Barriers to Employment for Migrant Engineers: Research Report (2021) Engineers Australia <https://engineersaustralia.org.au/sites/default/files/resource-files/2021-10/barriers-employment-migrant-engineers.pdf>

These barriers identified are:

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

Work in conjunction to this project is being undertaken within Engineers Australia to support migrant engineers overcome these barriers.

For consideration:

08. What resources can be made available to skilled migrants to support employment in Australia?
09. How can Engineers Australia support industry to employ highly skilled migrant engineers without local experience?



4. Current and future demand

Most information relating to a shortage of skills comes from qualitative data relying on anecdotal evidence regarding businesses' recruitment activities.

Employment vacancy data, for example, shows demand for engineers are at levels not seen since late 2018 however, still significantly less than demand seen during the mining boom.³¹ Understanding current and future demand of engineers is critical to forecasting the required number of engineers needed through undergraduate graduations and skilled migration. Without better quantification of the anticipated demand for engineers over the next decade, it will be difficult to accurately focus on the sectors needing greatest supply. This could lead to adverse consequences such as students being encouraged to study certain engineering qualifications that then find minimal employment opportunities once graduated.

4.1 Projections of demand

The 2020 NSC occupation projections to 2025 estimate an average growth across professional engineering occupations of 12.2 per cent (ranging from 9.1-15.9 per cent), which considerably exceeds pre-COVID population growth (averaging approximately 1.5 per cent per year, or 7.5 per cent over a five-year period) or population growth during the current COVID period (0.1 per cent per year).³² If these projections hold true (and there is considerable uncertainty arising from the economic and social effects of the resurgent pandemic in 2022) then the shortage of professional engineers may become more acute.

At a quantitative level, to help understand demand, the NSC maintains a Skills Priority List (SPL) which provides a current labour market rating and a future demand rating for occupations nationally.³³ Current labour market ratings are also available for occupations at a state and territory level. For demand, the NSC uses survey results of employers who have recently advertised, peak/representative body input, federal and state/territory government input and other available data/evidence to inform the market rating.³⁴ The NSC lists the following engineering disciplines as being in current shortage, with the prediction of strong future demand:³⁵

Schedule 1	Aircraft Maintenance Engineer (Avionics, Mechanical & Structures)	Schedule 6	Mining Engineer (excluding Petroleum)
Schedule 2	Civil Engineer	Schedule 7	Petroleum Engineer
Schedule 3	Electrical Engineer	Schedule 8	Software Engineer
Schedule 4	Geotechnical Engineer	Schedule 9	Structural Engineer
Schedule 5	Mechanical Engineer	Schedule 10	Transport Engineer

31 Bell, M 'Australian Engineering Employment Vacancies Engineers Australia (accessed 22 September 2021) <http://engineersaustralia.org.au/sites/default/files/2021-07/australian-engineering-employment-vacancies-jan-june-2021.pdf>

32 2020 Employment Projections - for the five years to November 2025 (accessed 6 October 2021) <https://lmip.gov.au/default.aspx?LMIP/GainInsights/EmploymentProjections>

33 Skilled Priority List June 2021' Australian Government National Skills Commission (accessed 2 February 2022) https://www.nationalskillscommission.gov.au/sites/default/files/2021-06/Skills%20Priority%20List%20Occupation%20List_0.pdf

34 'Skills Priority List Methodology' Australian Government National Skills Commission (accessed 4 February 2022) https://www.nationalskillscommission.gov.au/sites/default/files/2021-06/Skills%20Priority%20List%20Methodology_0.pdf

35 'Skilled Priority List June 2021' Australian Government National Skills Commission (accessed 2 February 2022) https://www.nationalskillscommission.gov.au/sites/default/files/2021-06/Skills%20Priority%20List%20Occupation%20List_0.pdf

The remaining engineering disciplines are not listed as being in a current shortage with strong demand Australia wide however, the disciplines included have either strong or moderate future demand indicators. The SPL also lists many technologists and associate engineering roles as being in current shortage with strong future demand.³⁶

At a qualitative level, there are many examples in the media that highlight the difficulties companies and engineering firms are facing in all industries. This includes companies working on specialist projects where the demand for the skills they are looking for exceeds the local supply. One example of this is tech companies who are experiencing unprecedented growth reporting a rise in the difficulty in finding engineering talent to support their increase in demand.³⁷

4.2 Future forecasting

Obtaining quantitative data on future demand will be easier for some sectors than other. For example, the Commonwealth and state/territory government's forecast of infrastructure spending and Infrastructure Australia's Infrastructure Priority List can assist to show future demand. Specific reports showing an increase in demand, such as the 2021 Australian Infrastructure Plan and corresponding Infrastructure Market Capacity Report are useful in demand forecasting.³⁸ This report predicts the demand for skills being 48 per cent higher than supply broadly, with more than 41,000 additional engineers estimated to fill the required engineering occupations including civil, geotechnical, structural and materials engineers.³⁹ It should be noted though, that infrastructure projects can be transient, meaning that as a project ends a pool of engineers enters the market as job seekers to be re-deployed. Another example of industries 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 is currently engaging with the Australian Government Department of Education, Skills and Employment and the National Skills Commission to further explore way of forecasting the future demand of engineering skills.

For consideration:

10. How can Engineers Australia support industry and government to better quantify anticipated demand for engineers over the next decade by sector?
11. How can demand data information flow to high schools and universities?

36 ibid

37 Sier, J 'Tech companies paying 'anything to get bodies in front of screens' Australian Financial Review (accessed 14 September 2021) <https://www.afr.com/technology/tech-companies-paying-anything-to-get-bodies-in-front-of-screens-20210818-p58jv9>

38 'Infrastructure Market Capacity' (2021) Australian Government Infrastructure Australia (accessed 9 February 2022) <https://www.infrastructureaustralia.gov.au/sites/default/files/2021-10/Infrastructure%20Market%20Capacity%20Report%20%281%29.pdf>

39 ibid

5. Concluding remarks

Engineers make a big difference to society by solving complex problems, thinking critically, producing technology through its entire lifecycle and integrating technology into our socio-economic systems. As we move to a more complex future, the skills engineers possess will become more important. While the existence of a persistent skills shortage is difficult to quantify, it is clear that Australia is facing an engineering skills disparity that needs to be addressed. This has been highlighted by an increase in demand for engineering skills at the same time as migration has reduced drastically due to COVID-19 induced border closures. The possibility of future disruptions to skilled migration arising from unforeseen externalities should not be discounted.

Australia's ability to train, develop and maintain a local engineering workforce needs to be significantly improved to mitigate the reliance on skilled migrants and to maintain an adequate supply in the future. The lead time of educating and developing an engineer isn't short, and therefore to meet expected future demand of engineers the focus on this needs to start now. With the cognitive skills an engineer possess likely to be in high demand in the future, consideration should be given to how to keep current graduates and mid-career engineers in the profession.

Finally, with Australia's supply of engineering skills currently being so reliant on immigrants, international borders re-opening will help to address this issue in the short term. However, returning to pre-COVID levels of migration is not recommended without consideration on how support can be given to the significant portion of immigrants with engineering skills and qualifications, currently living in Australia, who find themselves either unemployed, underemployed or not working in the engineering profession at a level commensurate with their skills and experience.

This discussion paper is part of Engineers Australia's project on the supply and demand of engineering skills within Australia. It will be used to inform discussions with industry, government and the tertiary sector. If you have any comments on the paper, please email policy@engineersaustralia.org.au

5.1 Summary of questions for consideration

1. Does the current National Skills Commission's definition of 'skills shortages' reflect the difficulties being faced by the profession?
2. Is there a more suitable way to describe the current and future difficulties in attracting the required skills or experience?
3. How can Engineers Australia, industry, the tertiary sector and government work together to encourage more school children to study STEM subjects and build motivation for a career in engineering and other STEM-based careers?
4. How can teachers be supported to use engineering as a way to give a practical application to what students are learning in the current science and mathematics curriculum?
5. What more could be done to retain graduate engineers in the profession?
6. How can industry be supported and/or encouraged to provide internships to overseas students and employ international graduates from local universities?
7. How can Engineers Australia collaborate with industry and government to increase the number of women in engineering?
8. What resources can be made available to skilled migrants to support employment in Australia?
9. How can Engineers Australia support industry to employ highly skilled migrant engineers without local experience?
10. How can Engineers Australia support industry and government to better quantify anticipated demand for engineers over the next decade by sector?
11. How can demand data information flow to high schools and universities?



ENGINEERS
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Engineering skills – supply and demand

Discussion paper

