Submission to the Inquiry into Industry Skills Councils, Senate Education, Employment and Workplace Relations Committee Australian Government

August 2010

Joint submission from Engineers Australia and Consult Australia

Contact:
Leanne Hardwicke, Director, International and National Policy, Engineers Australia
Tel: 02 6270 6544 Email: lhardwicke@engineersaustralia.org.au
www.engineersaustralia

1. Introduction

This submission to the inquiry into Industry Skills Councils raises matters that broadly relate to the effectiveness of Industry Skills Councils in the operation of the national training system. The submission discusses the issue of consistency across Industry Skills Councils and the approach taken to developing training packages for paraprofessional engineering associates, particularly the apparent reluctance of Skills Councils to engage with the engineering profession and industry in the development of the packages.

Engineers Australia is the peak body for engineering in Australia, representing all disciplines and branches of engineering. Engineers Australia has around 93,000 individual members Australia-wide making Engineers Australia the largest and most diverse engineering association in Australia. All Engineers Australia members are bound by a common commitment to promote engineering and to facilitate its practice for the common good.

Engineers Australia has a responsibility to ensure that its members are held in high esteem across the globe and the organisation has invested a large amount of time and energy in developing and implementing a rigorous accreditation program for bachelor degrees, associate degrees, and advanced diplomas.

Consult Australia is the peak industry body representing consulting companies that provide professional services to the built and natural environment. These services include design, technology and management solutions for individual consumers through to major companies in the private and public sector including local, state and federal governments. Consult Australia represents over 270 companies, from large multidisciplinary corporations to small niche practices, collectively employing over 50,000 staff.

Consult Australia's vision is to drive business success for consulting companies in the built and natural environment through collaboration, education, support and advocacy. We are dedicated to providing support and advocacy to our members with integrity, commitment, evidence based positioning, responsible actions and respect. Consult Australia achieves these goals through a range of top down (improving regulation and creating opportunities) and bottom up (building capacity and community to reduce risk) support and services to members.

2. The engineering profession

There is a broad range of skills and services that fall within the ambit of engineering and not all of these are provided by "professional" (four year university trained) engineers. Most professions, including engineering, acknowledge the broad scope of possible practice within them, and allow for differences in qualifications and for specialisation in areas of work.

Engineering practitioners can be divided into three main occupational categories. The occupational categories can be differentiated by the type and length of education and training undertaken by the engineer. These are:

- Professional engineer (4 year bachelors degree)
- Engineering technologist (3 year bachelors degree)
- Engineering associate/technician (2 year advanced diploma or associate degree).

These categories and the engineering work typically undertaken by them are outlined in appendix 1.

Professional engineers, technologists and associates come together in different combinations to undertake projects and programs. Their activities and competencies are often closely inter-related and it is difficult and sometimes artificial to say where the responsibilities of one category ends and those of the next category begin. There are activities that could be undertaken, in different circumstances, by members of any of the three categories. Other activities are clearly the province of one category but not of another – for example, the province of a professional engineer but not an engineering associate, or vice versa. Professional experience can further blur the lines when choosing staff for particular jobs. For instance, engineering associates with 10 or 20 years of experience may have the functional responsibility for work that is undertaken by a professional engineer.

Engineering practitioners work across all industry sectors. The traditional focus of engineering activities has been in infrastructure and manufacturing. Infrastructure includes facilities and systems such as transportation networks, energy and water supplies and waste removal. Manufacturing is also wide ranging, including automotive, electronics and biomedical products. The profession has expanded to incorporate a whole range of areas of practice such as mechanical, communications, chemical, geotechnical, and metallurgy. The following list includes just some of the areas in which engineering practitioners commonly practice:

- Acoustics
- Aeronautics
- Agriculture
- Arbitration
- Automation and control
- Biomedical
- Bridges and viaducts
- Building services
- Building surveying
- Civil
- Chemical
- Coastal and oceans
- Communications
- Computing
- Construction management
- Dams
- Electric power
- Electronics
- Engineering education
- Engineering survey
- Environment
- Fire safety
- Food technology
- Foundations and footings
- Fuels and energy
- Geotechnics
- Industrial
- Local government
- Maintenance
- Manufacturing
- Materials
- Metallurgy
- Military
- Mining and tunnelling
- Naval architecture
- Nuclear
- Petroleum and gas
- Pipelines
- Process control
- Public health
- Quality management
- Railways
- Risk
- Roads and highways
- Software
- Space
- Structural
- Telecommunications
- Transportation
- Water resources

In the 2006 Population Census, the labour force of qualified engineers was 249,791, of whom 156,622 held degrees or higher and 93,169 individuals held diploma level qualifications.

3. Accreditation of engineering programs

Since 1965, Engineers Australia has undertaken an accreditation program for university programs and courses, and accredit all of the undergraduate engineering programs offered by Australian universities, at their Australian and overseas campuses, to international standards. There are 35 Universities offering over 230 Bachelor of Engineering Programs to approximately 50,000 students and every engineering school in Australia is reviewed on a five-yearly cycle.

Accreditation involves an evaluation of undergraduate engineering education programs offered by universities and other educational providers and a judgment against designated criteria set down in accordance with the Engineers Australia accreditation policy. An accredited engineering education program is judged as providing satisfactory preparation for graduates to enter the profession in the appropriate occupational category and to gain admission to Engineers Australia in the grade of Graduate Professional Engineer, Graduate Engineering Technologist, or Graduate Engineering Associate.

Engineers Australia has gained international recognition of Australian engineering academic qualifications by taking an active role in international accreditation programs. These programs promote and maintain international comparability between engineering programs. The importance of international benchmarking cannot be overstated. There are three agreements covering mutual recognition in respect of tertiary-level qualifications in engineering.

Australian engineering degrees are internationally benchmarked through the Washington Accord, and the Sydney Accord. The Washington Accord, signed in 1989 by the original participants, recognises substantial equivalence in the accreditation of university qualifications in professional engineering. Most of the accredited courses are of four years duration.

The Sydney Accord commenced in 2001. It recognises substantial equivalence in the accreditation of qualifications in engineering technology, normally of three years duration.

The Dublin Accord is an agreement for substantial equivalence in the accreditation of tertiary qualifications in associate/technician engineering, normally of two years duration. It commenced in 2002.

Engineers Australia is a signatory to the Washington and Sydney Accords and became a provisional signatory of the Dublin Accord in 2010.

With a view to Australia becoming a signatory to the Dublin Accord, Engineers Australia has been working towards accrediting award based training programs at the Advanced Diploma level.

The benefits of accreditation by Engineers Australia for all occupational categories are many. Employers recognise that the accreditation system helps to ensure that all engineering graduates across Australia are operating at a comparable level, and that they can feel confident of a graduate's skill when choosing to employ them. Accredited qualification form the basis of negotiated mutual recognition agreements with overseas licensing bodies and under free trade agreements, which facilitates the global mobility of engineering practitioners. Currently, these benefits are only widely enjoyed by professional engineers and engineering technologists because of issues related to interaction with and between skills councils.

3. General comments

3.1 Advanced Diploma Accreditation Guidelines

Engineers Australia has invested a significant amount of time, energy and resources into the development of a set of Advanced Diploma Accreditation Guidelines, which outline accreditation requirements and focus on delivery of graduate outcomes that are benchmarked to the capabilities and performance indicators of the Dublin Accord agreement.

The accreditation guidelines also heavily reference the compliance standards set out in the Australian Quality Training Framework, and minimize the effort required by individual Registered Training Authorities (RTOs) to submit an individual training program for accreditation.

Engineers Australia's Australian Engineering Accreditation Centre has been working to support the introduction of an Advanced Diploma accreditation system by:

- providing direct support to individual TAFE institutions/RTOs;
- providing constructive input to reviews of the national training package, while
- interacting with regulatory and curriculum bodies at the state and national level. For example Industry Skills Councils

Despite the large volume of work undertaken to produce the Engineers Australia Advanced Diploma Accreditation Guidelines and efforts to implement an accreditation system, very few Advanced Diploma programs have been submitted to Engineers Australia for accreditation and it is unfortunate that so few Advanced Diplomas in engineering can be currently accredited in Australia.

Engineers Australia has identified a number of factors inhibiting the accreditation of Engineering Advanced Diplomas in Australia and impeding the potential for Australian TAFE institutions/RTOs to deliver engineering based Advanced Diploma outcomes that can satisfy standards compliant with those set by the Dublin Accord.

3.2 Competency based training packages

Engineers Australia agrees that competency based training packages are an excellent framework for the design of engineering training programs. The focus on the delivery of competency based graduate outcomes and in-depth consultation with industry stakeholders are core ingredients of a 'top-down' educational design philosophy.

Engineers Australia believes that training programs delivered at the certificate level have been effectively implemented across a wide range of engineering disciplines and provide an effective training framework at the trade level. TAFE institutions/RTOs appear to work effectively at this level, developing the training experiences that collectively map together to deliver the selected competencies within the rules set by the training package.

The educational design process uses experiential and collaborative learning provided both in the workplace and by the institution/RTO mixed with traditional lock-step modes to deliver the units/elements of competency and associated underpinning skills and knowledge.

One of the key issues seems to be the attempted extrapolation of the competency based educational design and delivery methodology from the trade to the paraprofessional (Advanced Diploma) level. This has been noted to be more of a problem in some disciplines of engineering than others, but weaknesses have been identified in all domains.

The Skills Councils themselves, and in particular the advisory bodies and education committees that are responsible for training package development appear to focus too much on extrapolating competency unit definitions and packaging rules from the trade levels upwards, rather than making a fresh start from an independently developed and broadly informed graduate outcomes specification set at the paraprofessional level.

The development of Advanced Diplomas in engineering must reference the standards set by the Dublin Accord and the competency standard for Engineering Associate published by Engineers Australia. There does not appear to be recognition of this need, or an ability to take such a 'big-picture' approach. Without referencing these standards, graduates are left without a clear pathway to membership of Engineers Australia and associated professional development programs, entry onto the National Register of Engineering Associates and are also not able to have their qualifications recognised internationally via the Dublin Accord.

Those responsible for competency standard development appear often to be more aligned with trade skills development and more comfortable with work-based learning environments. The fact that advanced diploma programs are often populated with full time school leavers, studying within a TAFE institution/RTO environment does not seem to be explicitly addressed or sufficiently differentiated from the notion of providing an articulation or development pathway for existing tradespersons.

At the TAFE institution/RTO level, there is lack of confidence sometimes expressed in the national training packages at the Advanced Diploma level. Lack of definition, particularly of necessary underpinning skills and knowledge, inappropriateness and the absence of what are perceived to be necessary competency units and/or component elements are frequently expressed concerns.

These concerns appear to undermine any attempt to implement a rigorous, 'top-down' educational design process, focusing on the development, assessment and delivery of the designated competencies.

Training packages at this level, while voluminous in nature, actually provide very little guidance into the training design process itself. The concept of identifying and building appropriate foundation skills and knowledge and then developing and assessing competence over a range of crafted learning experiences in a variety of contexts is not well understood by those responsible for training design. There is really a need for Skills Councils to publish supporting guideline documentation that complements the endorsed components of the training package and steers learning developers in a rigorous learning design process that closes the loop on competence delivery.

Competence at the paraprofessional level involves an ability to address problems in a variety of contexts, as distinct from an ability to undertake a single, defined task as may be the case at the trade level. The assessment of competence under these conditions requires a multidimensional approach.

In the few instances where Skills Councils have attempted to supplement the endorsed training package with guideline information there has been a very much greater understanding of intent expressed by all stakeholders, including those responsible for authoring the training package in the first place.

In some instances, Engineers Australia has found that the actual training design at the RTO level has appeared as a re-engineering of an earlier curriculum based Advanced Diploma. Effort is invested to demonstrate compliance with governance and audit requirements and the delivery of designated competencies, but in fact through a lock-step process, individual competencies are linked to pre-existing learning modules, rather than through an integration of multiple learning experiences and contexts, mapped across an entire training program.

As well, there have been instances in the past where a national training package is rejected at the State level because it does not meet local training requirements. A State-accredited, customised training program is sometimes the end result, and although claimed to be competency based, sometimes appear more often to be built on established curriculum and

a modular based learning approach. The two Advanced Diplomas programs that have been accredited by Engineers Australia fall in this category.

Despite these issues, Engineers Australia strongly endorses the national training package as the framework for educational design and the development of Advanced Diploma training programs. However, very significant changes are needed to achieve this. These changes must begin with appropriate stakeholder input and the appointment of persons with appropriate paraprofessional training design expertise within the Skills Council environment, to develop competency based training packages uniquely applicable to the Advanced Diploma level. Benchmarking the graduate outcomes specification against international standards and mapping against the competency requirements specified by professional bodies such as Engineers Australia is an essential part of the consultation process that is currently not addressed. As the consumer of engineering graduates, employers and employer groups also require opportunities to inform Skills Council decisions on training package development.

Again at the TAFE institution/RTO level, there is often not the skills of educational design, or the robust engagement with industry stakeholders that are necessary to implement a 'top-down' approach to training development, based on the guidance and choices presented by a sound training package foundation.

3.3 Articulation issues

Articulation to Bachelor of Technology and Bachelor of Engineering programs from the Advanced Diploma outcome does not appear to be a potential pathway that is strongly identified by those responsible for the education design function within the Skills Council operating environment.

Most universities today offer very little advanced standing credit for Advanced Diploma holders, and there is very little faith in the educational outcomes offered by current paraprofessional training provided by the vocational sector in Australia, something that would change if an accreditation system was implemented at the Advanced Diploma level.

Consequently, a number of universities are introducing curriculum based 2-year (full time) engineering study programs resulting in either an Associate Degree or Advanced Diploma outcome with curriculum designed to optimise available credit for graduates articulating to the Bachelor degree level.

Engineers Australia does not necessarily see this to be a satisfactory strategy, because graduates are not necessarily equipped with the broad ranging terminating capabilities that are defined in the Engineers Australia National Generic Stage 1 Competency Standard for entry to practice in the Engineering Associate (paraprofessional) occupational level. The competency based training package approach conceptually should provide a superior outcome in this regard.

There are significant benefits to creating clear pathways between vocational and higher education where students can maintain lifelong learning by jumping in and out of education between vocational and university provided training. However, it is essential that all members of the Engineering Team are supported by the education system and that graduates are produced ready to participate productively in the labour market at all levels.

3.4 Approach by Skills Councils

A further key observation by Engineers Australia while undertaking work to support the development of an accreditation system for Advanced Diplomas has been the variety of approaches undertaken by the various Skills Councils operating in the engineering field.

The different Skills Councils have operated independently and on an industry basis rather than taking into account the general nature of engineering as a profession and skill-set across industries and coordinating approaches and strategies to this specific area of skills development. This is an issue of coordination that should be considered by the Committee in the course of this inquiry.

Each Skills Council seems to be focussed on the specific nature of the trade and established workplace practices of the sector in which they operate. However, for engineering practice at the paraprofessional level, there are generic competencies that apply to all disciplines, and these are provided in international benchmarks (Dublin Accord) and professional body competency statements like those developed by Engineers Australia. When comparing existing training packages across the disciplines, there appears to be a lack of coordination in identifying the generic competencies that frame the training package outcome at the paraprofessional level for all fields of engineering practice.

Although there is provision for the sharing units of competency across training packages, individual Skills Councils appear to independently devise what they believe should be generic and common competencies. There does not appear to be an overarching forum at the national level that can oversee benchmarked standards and set up such a common framework and generic elements for paraprofessional training package development. This situation is frustrating given the depth of work already undertaken within the Dublin Accord and the Engineers Australia National Generic Competency Standards for Engineering Associate to develop common competencies.

3.5 Identifying Areas for Coordination

Engineers Australia is pursuing concerns around the need for recognition of core competencies through its involvement in the Australian National Engineering Taskforce (ANET). ANET is formed of the Association of Professional Engineers, Scientists and Managers Australia (APESMA), Engineers Australia (EA), Consult Australia, The Australian Council of Engineering Deans (ACED) and the Australian Academy of Technological Sciences and Engineering (ATSE). Together these organisations represent the major professional, industrial and academic interests in the engineering profession.

ANET was formed to investigate the ongoing shortfalls in national engineering services capacity, in recognition that engineering skills shortages continue to constrain Australian innovation and growth. This is a national problem, with a recognised skills shortage in generic and specialist scientific and engineering disciplines, with effects in national, sectoral and regional labour markets. Skills Australia recently identified engineering as a ‘high-risk’ profession requiring specific interventions to allow industry and the community to function efficiently into the future. Similarly, the National Resources Sector Employment Taskforce identified a shortage of engineers in the resources sector, which has the ability to exacerbate existing systemic shortages in engineering skills across other key sectors of community infrastructure, including the intermodal freight system.

Working together with industry and government, ANET models a workforce development intervention into engineering services to provide solutions to these key skills shortages which are projected to constrain industry's capacity to meet community need into the future. Coordinating with Government and bodies like the Skills Councils is one of ANET's primary focusses to ensure that interventions into the engineering profession are based on best-practice, underpinned by quality research, and modelled to ensure that the profession is sustained and maintained into the future, as a key national interest skills area.

To this end, ANET has received funding from the Commonwealth Department of Education, Employment and Workplace Relations to conduct two research projects into supply shortfall in the engineering profession. One of these research projects investigates the relationship between VET and Higher Education. It will consider ways that these programmes link to employment and the potential to provide students with pathways to higher education, identifying best practice, informing the design of stronger pathways for VET-qualified engineering officers into higher education, enhancing employment and learning outcomes for students and industry, and increasing the supply of qualified engineering personnel to meet national and specific sectoral skills needs.

As part of this project, the research will consider competencies and investigate the issue of Government-industry coordination on skills, including identifying key areas where coordination may be improved. The outcomes of this research will therefore be of direct interest to the Committee's inquiry into the Skills Councils. The research project will report by March 2011, and will provide a series of policy recommendations.

4. Conclusion

Australia is experiencing a critical engineering skills shortage and any initiatives put in place by Australian Government's to support the education and employment of engineers across the engineering team are warmly welcomed by Engineers Australia.

The accreditation of engineering programs is a proven method of ensuring that graduates best meet the needs of employers and as much as possible, training outcomes for individuals and enterprises translate into appropriate employment outcomes.

Appendix 1: The engineering team

Engineering work is undertaken by individuals trained at both university and through the vocational educational system. As a group, these engineers form the “Engineering Team.” Engineers, technologists and associates come together in different combinations to undertake projects and programs. Their activities and competencies are often closely inter-related with some features of engineering being common to all three categories. All members of the “engineering team” work together and provide services to each other in order to complete engineering tasks.

Professional Engineers: The benchmark qualification for professional engineers is the four-year Bachelor of Engineering university degree. Professional engineers are required to take responsibility for engineering projects and programs in the most far reaching sense. This includes the reliable functioning of all materials and technologies used; their integration to form a complete and self-consistent system; and all interactions between the technical system and the environment in which it functions. Professional engineers have a particular responsibility for ensuring that all aspects of a project are soundly based in theory and fundamental principle, and for understanding clearly how new developments relate to established practice and experience and to other disciplines with which they may interact.

Engineering Technologists*:* The benchmark qualification for engineering technologists is the three-year Bachelor of Engineering Technology university degree. Engineering technologists normally operate within a relatively well-defined technical environment, and undertake a wide range of functions and responsibilities. They are typically specialists in a particular field of engineering technology and their expertise lies in familiarity with its current state of development and its most recent applications.

Within their specialist field, their expertise may be at a high level, and fully equivalent to that of a professional engineer; but they are not expected to carry the same wide-ranging responsibilities for stakeholder interactions, for system integration, and for synthesising overall approaches to complex situations and complex engineering problems.

The competencies of engineering technologists equip them to approve and certify many technical operations such as calibration and testing regimes, compliance with performance-based criteria for fire safety, and design of components and sub-systems and of installations such as building services in circumstances that do not call for significant new development.

Engineering Associates*:* The benchmark qualification for engineering associates is the two-year Advanced Diploma of Engineering under the Australian Qualifications Framework or the Associate Degree in Engineering. These courses are delivered by the university and vocational education system.

Engineering associates focus mainly on practical applications. They may be expert in installing, testing and monitoring equipment and systems, in the operation and maintenance of advanced plant, and in managing or supervising tradespeople in these activities. They may be expert in selecting equipment and components to meet given specifications, and in assembling these to form systems customised to particular projects.

Engineering associates are often required to be closely familiar with Standards and Codes of Practice, and to become expert in their interpretation and application to a wide variety of situations.