

19 December 2011

Committee Secretary,

Senate Education, Employment & Workplace Relations Committees Inquiry -

The shortage of engineering and related employment skills

I wish to make a submission to this Inquiry because:

1. I believe that other inquiries, investigations and commentaries on the shortage of engineers inadequately identify the causes, and therefore miss some rather obvious possible solutions
2. I have raised these issues in other forums that do not seem interested, or willing, to canvas alternative thinking
3. I see many of the effects of the engineering shortages in my employment and in the wider community
4. I studied engineering and commenced employment before the era of industry dis-aggregation, markets and privatization, which I regard as at least partially responsible for current engineering shortages
5. I am acutely aware that my son, who has just completed his second year of engineering studies, and his fellow students are being deprived of opportunities that were open to me

My submission to the Inquiry is formatted to address its Terms of Reference.

This submission is provided by me as a private citizen, and I have no issues with confidentiality.

I trust you will accept my submission.

Yours faithfully,

Frans Brouwer
MIE Aust (Membership No

Terms of Reference

The nexus between the demand for infrastructure delivery and the shortage of appropriate engineering and related employment skills in Australia, with particular reference to:

The wording of the TORs seems to provide little opportunity to identify what may have started the sustained and significant shortages of engineering skills, or when they started. Thus submissions to this Inquiry may not highlight a number of possible options and strategies (refer TORs c and e in particular) to overcome the effects of the shortage.

Omitting the origins of the shortage from the TORs seems rather like the Inquiry into the West Gate Bridge collapse investigating weather conditions on the day, and ignoring earlier stages of the project such as structural design and erection methods (both identified as causes) and quality of materials. A possible consequence of constraining such investigations, sometimes unintentionally, is that the same failure mode is built into the successor structure.

By not reviewing their origins, inquiries into engineering shortages could make corrections via various options and strategies, without having addressed the long-term structural deficiencies. This Inquiry is admittedly not alone in that respect.

(supplementary TOR) the causes and timing of the (sustained) engineering shortage

An ANET paper¹ states "Professional engineers, engineering technologists and technicians have been in short supply ... over a period of several decades." and "This is a fact recognised by Government reviews, industry surveys and engineers themselves." (ANET p5).

The supply/demand balance for engineers has long fluctuated with economic cycles, but significant and sustained shortfalls seem to have started less than 20 years ago, and the "fact" does not appear to have been generally recognised until at least 10 years later.

Just over two decades ago, redundancy packages were offered in Government-owned enterprises and utilities, including:

- Telecommunications (Telstra),
- Energy (State Electricity Commission of Victoria and Gas and Fuel),
- Public Works (Melbourne Metropolitan Board of Works), and
- Transport (tram, metropolitan and country rail, ports).

Many of those who accepted never returned to engineering, some because they were already eligible to retire and others because they used the packages to enter small business (newsagencies, milk bars, motels, etc).

Then industry "dis-aggregations", privatization and outsourcing of engineering functions, starting about 1993 and mostly in the very same sectors, created a greater demand for engineers due to:

- loss of critical mass (splitting up functions allows little redundancy for leave, training, promotion and departures); and
- diversion of engineers into contractual, regulatory and compliance framework activities that became necessary for "ring-fenced" successor organizations.

¹ Australian National Engineering Taskforce (ANET) paper "Scoping our future – addressing Australia's engineering skills shortage" December 2010

One of the most serious consequences of dis-aggregation was that the on-the-job training and payment of engineering students via 3-4 year cadetships dried up. Many students were forced to seek alternative part-time employment, and missed out on a solid practical engineering exposure and purpose to accompany their rather theoretical studies.

In summary, it is considered that:

1. Redundancy packages introduced to reduce staffing in state-owned utilities in the late 1980s shrank the pool of experienced engineers,
2. The breakup and sale of state-owned utilities in the early 1990s initiated a sustained shortage of engineers,
3. Dis-aggregation has introduced commercial requirements that cause a high proportion of engineering activity to be essentially non-technical or not directly productive, and
4. The privatized successor bodies are too small to support engineering cadetships and large numbers of vacation students on their own.

(a) the implications of the shortage for infrastructure delivery in terms of economic development, cost, efficiency, safety and disputation;

No comment - I do not wish to address this TOR because it relates to a consequence of the shortage of engineering skills, and any worthwhile actions to increase the supply of engineers should improve infrastructure delivery.

(b) the impact of the long-term outsourcing of engineering activities by government on skills development and retention in both the private and public sectors;

This TOR is partially addressed under the supplementary TOR inserted above (the impact of dis-aggregation on cadetships and practical training for engineering students).

(c) options to address the skill shortage for engineers and related trades, and the effectiveness and efficiency of relevant policies, both past and present;

A survey of websites of engineering firms indicates a preference to employ graduates, and to offer vacation employment only for the "penultimate year".

That "...most engineering undergraduates must undertake an internship as part of their accredited degree plan" (ANET p21) suggests that ANET also is not considering multiple-year cadetships. This overlooks a major engineering resource - the many students who are capable in numeracy and technology, but who spend their first three years of university working part-time in non-engineering employment.

The engineering profession should be able to assist a co-ordinated approach by employers to review the roles they need, and to help out students over several years. Redesigning some engineering processes should release experienced engineers from routine but necessary tasks that do not require a degree, and help to reintroduce traditional cadetships.

This author has for several years assisted with tasks for Vacation Students. The reluctance of managers to become involved has been partially overcome by identifying projects several

weeks beforehand, and preparing 1-2 page scopes with a few notes on problems, issues and understanding the technology or circumstances. A handful of hours in preparation greatly reduces the burden of supervision.

In summary, options to address the skill shortage include:

1. Redesigning engineering workforce processes to isolate routine work that could be performed by engineering students instead of experienced engineers,
2. Preparing scopes for tasks to be performed by vacation students, and
3. Expanding the duration of vacation employment to more than just the penultimate year.

(d) options for infrastructure delivery using alternative procurement models which aim to foster collaboration and achieve effective community outcomes, including skills development and retention;

No comment - other more qualified people, particularly economists and politicians, could better address this TOR.

(e) effective strategies to develop and retain engineering talent in the private and public sectors through industry training and development, at enterprise, project and whole-of sector levels;

The following comments are related to opportunities for engineering talent in the form of students. Graduates and experienced engineers may have their own issues, but they are more employable once they have a degree than students.

The **electricity supply** sector created the Australian Power Institute (API), which has established a scheme of bursaries to engineering students, with opportunities for vacation employment from the end of second year. In Victoria, industry participants such as SP AusNet, the Distributors, AEMO and Wilson Transformers provide positions for API students for one, two or three months at a time. It is expected that students would not work at the same place twice, so as to gain a broader exposure.

From personal experience, the work delivered under supervision has generally been of a quality almost approaching that of new graduates, within the variability caused by an individual student's level of confidence.

A whole-of-sector approach to bursaries and vacation employment has helped to overcome issues of critical mass. By working together, the five Distributors and SP AusNet can attract and effectively manage students, and can provide a diversity of work - far better than they could have done individually.

The **rail industry** (refer website www.railcareers.net.au/site/Internships/php) has links to potential employers, but a co-ordinated vacation employment strategy is not obvious. Within the general transport sector, the following offer vacation work to penultimate year students, as well as work experience for secondary students:

- **Victorian Department of Transport** (refer website www.transport.vic.gov.au/about-us/careers-at-dot/engineering-opportunities/engineering-vacation-work-program)
- **Vicroads** (refer www.vicroads.vic.gov.au/Home/Employment/VacationEmployment.htm)

The water industry created the H2Oz website [H2oz.org.au](http://www.h2oz.org.au) that allows students to attach expressions of interest. It also issued a National Water Skills Strategy Business Plan in October 2010 (refer <http://www.awa.asn.au/uploadedFiles/National%20Water%20Skills%20Business%20Plan%20-%20Final.pdf>) that recognized and included an action plan. However, a strategy for vacation employment was difficult to find.

In local government, the Municipal Association of Victoria provides a comprehensive set of links to council websites (refer www.mav.asn.au/careers/Local-government-careers/Pages/local-government-careers.aspx).

In the resource sector, the National Resources Sector Employment Taskforce Final Report July 2010 included the following recommendations:

3. Graduate more engineers and geoscientists

3.1 *That universities with a teaching profile that delivers professionals to the resources and construction sectors formalise and strengthen their ties with each other and industry, and articulate their role and strategic intentions in their mission statements.*

3.2 *That the Australian Council of Engineering Deans work with the Minerals Council of Australia, the Australian Petroleum Production & Exploration Association, and the Australian Constructors Association (taking into account work being done by the Australian National Engineering Taskforce) to encourage their members to provide structured, work-integrated learning opportunities, such as internships and mentors, for all first and second-year engineering students.*

In summary, several industry sectors have recognised the value of co-ordinating efforts to provide paid vacation and part-time employment for engineering students, but this recognition has not uniformly translated into action. A review of industry websites shows a wide range of recognition and action, including:

- sectors that have bursaries and/or co-ordinated programmes,
- others that have conducted inquiries and made recommendations only,
- several that have identified shortages, but have not investigated further, or have not identified any meaningful options or strategies.

(f) opportunities to provide incentives to the private sector through the procurement process to undertake skills development;

No comment - other more qualified people, particularly economists and politicians, could better address this TOR.

(g) consequences of skills shortage in the construction sector to the public sector's capacity to effectively procure and manage infrastructure projects;

No comment - other more qualified people, particularly economists, could better address this TOR.

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(h) the impact of delayed and stalled infrastructure projects on economic development, workplace productivity and employment; and

No comment - other more qualified people, particularly economists, could better address this TOR.

(i) other related matters

The following matters are not directly related to the TORs of this Inquiry, but would represent additional benefits if comprehensive strategies to address engineering shortages were to be implemented via expanded engineering student vacation employment.

Expansion of vacation employment opportunities for engineering students beyond the required three months could have a number of widespread benefits:

1. It takes them out of part-time work such as hospitality (bars, waiting, kitchens), cleaning, retail, and assistance at sporting and entertainment events. This would provide opportunities for unemployed youth, older unskilled workers and migrants, thereby reducing the unemployment rate and providing a net benefit to government (lower costs in social services and higher income tax receipts).
2. Knowing before they have left secondary school that paid engineering-related work will be available may do more to attract and retain students in engineering courses (presently 40-50% drop out) than efforts to arrest "... a declining uptake of key mathematics and science prerequisite courses..." (ANET, p19).
3. The demand for overseas-trained engineers would decrease, thereby easing the brain drain for source countries.
4. Extending a cadetship concept to other professions would reduce overall migration levels, relieving pressure on infrastructure and the environment.