

NATIONAL ENGINEERING EDUCATION PLAN PROJECT

SUMMARY FROM CONSULTATION MEETINGS SEPTEMBER 2009

THE FUTURE FOCUS OF PROFESSIONAL ENGINEER TERTIARY EDUCATION

Future Focus

The engineering profession, industry and tertiary providers have an opportunity to focus on building a robust engineering education system for the future. If engineers are to be change agents and participate in driving the New Zealand economy forward, what knowledge and skills should the engineer graduate of 2020 have?

Changes to the Washington Accord

The Washington Accord was signed in 1989. It is an agreement between the bodies responsible for accrediting professional engineering degree programs in each of the signatory countries. It recognizes the substantial equivalency of programs accredited by those bodies, and recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. The Washington Accord covers professional engineering undergraduate degrees. Engineering technology and postgraduate-level programs are not covered by the Accord. (www.ieagreements.com/)

At the June 2009 international meetings, the bodies of the signatory countries agreed to change the graduate profile of the Washington Accord. These changes mean that the size of the knowledge base in the current professional engineer degree will increase both at the technical and contextual levels.

The current four-year degree is not able to accommodate a larger knowledge base. The universities are pushing more engineering content into the first year. There is little time for a graduate to reflect in the degree. The Institution of Professional Engineers New Zealand (IPENZ) accreditation reports on the four-year degree show that contextual knowledge and ethics are lacking in the degree. Some graduates attain this knowledge independently but not all.

Developments in Australia and the United Kingdom

Australia is a signatory to the Washington Accord but has not made any significant progress to incorporate the changes in the Washington Accord graduate profile in its professional engineer degree programmes.

IPENZ has met with Engineers Australia (the sister body to IPENZ) on 22 September 2009 to discuss the changes and their implementation.

In the UK, the introduction of a five-year degree has not had a detrimental effect on the engineering profession. All the best students enter the five-year degree.

Proposed models for a five year degree

3+2 or 5-2 Model

In this model, students enrol for a five-year degree. During the first three years they study engineering principles and are introduced to their area of specialisation and contextual knowledge. In the final two years, students gain industry experience in the

fourth year, return to university in the fifth year for a period of reflection and to complete a final capstone project.

A fifth year enables a larger knowledge base at the technical and contextual levels to be accommodated in the degree. Students can have a period of reflection; study contextual subjects in other academic departments of the universities; and gain knowledge at the forefront of their discipline by becoming familiar with research literature.

Students may exit after three years with an Engineering Principles degree which would not be accredited and is a very different degree from the Bachelor of Engineering Technology (BEngTech). This three-year degree provides students with an introduction to engineering and a systems thinking approach which can be applied to other disciplines. Students may study a second degree in another discipline such as business to complement the Engineering Principles degree. Double degrees are popular in Australia because they produce graduates with a wider range of skills.

4+ 1 Model

In this model the students complete four years of their degree at university. In the final year students may become full-time interns in a company or they may work and study part-time over two years.

This model requires industry to work in partnership with universities to provide places for students. At the end of 2009, there will be 1000 engineering graduates in total from the Universities of Auckland and Canterbury. The question is whether New Zealand industry could provide enough internships for these graduates? Not all industry representatives want the interface with universities nor are they prepared to sponsor students in the final year.

In the United Kingdom, sandwich courses have worked well because industry supports them. Companies select the top students in their second or third years then sponsor them through the remainder of the degree.

A five-year initial degree v. a research masters

The five-year degree provides the initial education for a professional engineer who wants to pursue a practise-based career. If a graduate wishes to study further, they may progress directly to a PhD.

The degree would receive international recognition through Washington Accord accreditation. The appropriate name for this five-year degree is a Masters of Engineering (MEng) which differentiates it from the research Masters of Engineering (ME).

The research masters is for students who wish to follow an academic pathway and may be taken by international students who wish to gain a New Zealand qualification. A post-graduate research masters is not eligible for Washington Accord accreditation.

It will be important for universities to position each masters degree and their respective career pathways in the tertiary market.

Standard of the current BE graduate

The range of current BE graduates is variable. High achieving graduates are world class however, graduates at the lower end are more suited to solving less complex problems which are usually the domain of BEngTech graduates who work largely in the field or in production.

In general, New Zealand graduates are highly rated for their flexibility, problem-solving skills, and design skills. However, their mathematics, science and analytical skills are not as highly developed as those of students in other countries.

New Zealand graduates need to know how to learn and develop good judgement. Contextual knowledge, risk management and knowing how to use codes are important. Graduates have little codified knowledge when they leave university.

Impact of the five-year degree on other engineering qualifications

Currently the number of BEs graduating is higher than the number of BEngTech graduates. However in the workplace, BE graduates may perform roles more suited to BEngTech graduates. Some BE graduates who are pushed down diversify or go overseas.

If a five-year degree is implemented, there are likely to be fewer masters graduates and more students enrolling in the BEngTech who are suited to this qualification. If there is better alignment to the levels of problems that graduates with levels 6 (diploma), 7 (BEngTech), and 8 qualifications solve, there is likely to be less wastage in the system.

A five-year degree will have no significant impact on the diploma qualification which currently has good numbers enrolled. The diploma serves a different student market. It is for the student entering from Year 12 of secondary school or equivalent with the required entry levels. A student from Year 13 with the required entry levels will enter the five-year degree.

Qualifications at levels 6, 7, and 8 need to be marketed to show they are standalone qualifications and each have clear career pathways. Countries that market three distinct qualifications have good support for each qualification.

Articulation to the five-year degree

If a BEngTech graduate wants to move to a five-year degree, they would need to take extra mathematics and other subjects to lift their level up to the required level in the five-year degree. As a result, the graduate would take longer than a further two years to complete the five-year degree.

Diploma graduates may get some credit towards the first year of a five-year degree and would have to study additional mathematics and other subjects.

Timelines

It is likely to be 8-10 years before there are graduates from a five-year degree. If there is widespread support for this degree from industry, tertiary providers and Industry Training Organisations (ITOs), a business case for additional funding will be presented to the Tertiary Education Commission mid 2010. The next step is for universities to design and develop their programmes as well as a transition strategy into the five-year degree.