

NATIONAL ENGINEERING EDUCATION PLAN PROJECT

REVIEW OF ENGINEERING QUALIFICATION STRUCTURES - OVERVIEW

Purpose: The purpose of this paper is to provide the background to the review of the qualification structures at Levels 6, 7 and 8 which is one of the work-streams in the National Engineering Education Plan (NEEP) Project.

1. EXECUTIVE SUMMARY

The National Engineering Education Plan (NEEP) Project is a collaborative research and development venture between all major participants and stakeholders in the New Zealand engineering education sector. It seeks to develop a coherent national plan for ensuring that the right number of the right types of graduates is produced to meet New Zealand's needs and that the right programmes of study are available.

In respect of qualification structures, review and development work is proceeding on all three types – those for professional engineers, engineering technologists and engineering technicians as follows:

- In respect of professional engineer tertiary education, the goal is to define the qualification that will ensure continued adherence to international best practice whilst meeting the needs of New Zealand industry. The relevant international benchmark standard is defined by the Washington Accord, which is evolving. How New Zealand should respond, is discussed in a separate discussion paper.
- For engineering technologists, a nationally co-ordinated Bachelor of Engineering Technology (BEngTech) degree offered by six of the largest Metropolitan Institutes of Technology and Polytechnics (ITPs) has been designed and is undergoing approval and accreditation. There are also offerings through three other providers which should be consistent.
- For engineering technicians, a Diploma in Engineering structure that would include all engineering disciplines, and be offered in a nationally cohesive governance and delivery framework has been developed to a conceptual stage. This structure is set out for feedback in a separate discussion paper.

Other streams of work include estimating the demand for graduates in each qualification type, and better defining the pathways to engineering study (including senior secondary school, recommended pre-entry achievement and recognition of prior learning). Documentation of these is available at www.ipenz.org.nz/need.

2. BACKGROUND

In November 2008, a consortium of representatives from NZCED¹, CETTENZ², Industry Training Organisations (ITOs), the Institution of Professional Engineers New Zealand (IPENZ) and industry was successful in gaining funding from the Tertiary Education Commission (TEC) to develop a National Engineering Education Plan (NEEP Project).

The overarching issues behind the project are the long-term shortage of engineering skills in New Zealand and the need to ensure that New Zealand's engineering education offering meets international best practice and can be delivered effectively by a nationally co-coordinated network of provision. OECD comparisons³ show New Zealand to have significantly fewer engineering graduates than comparable countries, despite a difficult geography and dispersed population that might indicate the need for greater numbers rather than fewer.

Prior to 2005, the New Zealand tertiary education system had been producing about 1200 graduates holding engineering degrees – the bulk (approximately 1000) holding a four-year Bachelor of Engineering (BE) or BE(Hons) degree, and the remainder a three-year BEngTech.

In 2006 and later years, the number has risen to about 1400, largely through a rise in the number of BE graduates. A separate work-stream in the NEEP Project has shown that growth in employment demand for engineering degree holders is expected to exceed growth in other employment sectors in the next five years. This suggests that the need is perhaps for 2000 engineering degree holders per year, some with the professional engineering qualification, and some with the three-year engineering technologist qualification. This work-stream has also shown that there is also a shortage of engineering technicians.

IPENZ's other research to date has shown a complex range of issues to be contributing to what is regarded as an unsatisfactory situation:

- There is a lack of clarity about pathways from senior secondary school, and a lack of consistency in entry requirements to engineering programmes.
- Career pathways are unclear from particular qualifications and this is hampering the provision of quality careers advice and qualification promotion (particularly in relation to Levels 6 and 7 qualifications – the Diploma and BEngTech).
- Some engineering schools with low enrolments (particularly at Levels 6 and 7) cannot maintain the critical mass of students to adequately cover specialist areas within the programme.
- There is insufficient co-ordination of offerings between the disciplines and between qualification levels to ensure a suitably co-ordinated national network of provision across all provider institutions, or to maximize the use of resources.

There is a growing international trend, and increasing support nationally, to increase the academic level of professional engineering qualifications beyond the current four-year BE to better prepare professional engineering graduates for practice at the forefront of the profession, driving leading-edge design and innovation.

¹ NZCED is the NZ Council of Engineering Deans, for tertiary providers offering four-year professional engineering qualifications.

² CETTENZ is the Council for Engineering Technician and Technologist Education New Zealand, a bipartite council of the Engineering Deans or Heads of Department from the ITP and university sector responsible for three-year degrees (Sydney Accord criteria) and two-year Diplomas (Dublin Accord criteria).

³ www.oecd.org/edu

As part of the plan, there is also a need to consider the structure of the Diplomas of Engineering, and ideally move closer to the model desired by industry – a replacement for the New Zealand Certificate in Engineering (NZCE) that is easily understood, nationally consistent, with maximum transferability between disciplines, available to students in a range of geographic locations, and with sound educational pedagogy.

Another desired outcome is to clarify the delivery and cross-crediting arrangements between the Diploma and the BEngTech. It is important to give stakeholders (prospective students, current students and industry) consistent messages about engineering education.

The goal of the NEEP Project is to recommend to the TEC in June 2010 an engineering education plan and a network of provision for New Zealand.

3. CAREER PROGRESSION – RELEVANT OUTCOMES

Work began in the NEEP Project with the development of two career progression models – one for Levels 6, 7 and 8 qualifications on the National Qualifications Framework, and the other for trades qualifications at Levels 2 - 5 – see Appendices One and Two.

Both models show two types of progression. If higher qualifications are attained, technical deepening occurs and the engineer is able to resolve more complex engineering problems. If the skill development is in leadership or management skills, engineers have the opportunity to reach different managerial levels in an organisation ranging from Team Leader to General Manager.

Both models have been widely circulated among industry/employers, tertiary providers and students who have accepted the models. They clearly show how a career in an engineering trade or as a technician, technologist or professional engineer might progress.

The review of qualification structures at Levels 6, 7 and 8 needs to sit in this wider context.

4. REVIEW OF THE QUALIFICATIONS STRUCTURES

New Zealand through its membership of the Dublin, Sydney and Washington Accords⁴ aspires to maintain its engineering education standards for qualifications at Levels 6, 7 and 8 respectively in accordance with good international practice.

4.1 REVIEW OF THE FOUR-YEAR BE DEGREE AT LEVEL 8

The two major multi-lateral professional engineering qualification recognition systems are the Eur-Ace standard (agreed through the European Network for Accreditation of Engineering Education) and the Washington Accord. Each of these has exemplar graduate profiles. The Eur-Ace graduate profile corresponding to a professional engineer is the so-called second cycle degree (five years of study). This is substantially equivalent to the newly approved (June 2009) exemplar for the Washington Accord – a programme now acknowledged to require four to five years of study dependent on the entry level.

⁴ IPENZ is a signatory to the Washington and Sydney Accords and a provisional signatory to the Dublin Accord. These international agreements ensure that all education programmes recognised by any of the signatories are recognised as being substantially equivalent by all other signatories. The concept of substantial equivalence enables the programmes to have the distinct national or local character of the country or region being served by the programme.

All signatories of the Washington Accord need to respond by ensuring their professional engineering education system produces graduates at the right level of competence.

In the United States, the American Society of Civil Engineers states that the BE cannot accommodate the increasing body of knowledge in engineering and science and is demanding that United States licensing bodies require a further full year of study over and above the present four-year Washington Accord degree.

Ireland is moving to a five-year Master of Engineering (MEng) as the requirement for chartered status in 2013.

In Europe, graduates with only first cycle degrees tend to work in industry and not undertake careers providing engineering services in public practice. The second cycle degree holder dominates the public practice field. In the United Kingdom, the four-year MEng(Hons) is deemed equivalent in outcomes achieved to the second cycle degree.

The key issues for New Zealand are to:

- ensure that the IPENZ-accredited qualification achieves a graduate profile that both meets the present and future needs of New Zealand
- ensure that the qualification structure used in New Zealand (without limiting options that might be considered as an alternative to the present four-year BE degree) is able to consistently meet that graduate profile; if necessary recommending a different qualification structure
- ensure that there is nationally consistent advice to aspiring students to indicate to them the pre-entry educational standard that will give the student a reasonable chance of succeeding in the qualification
- ensure that compatibility with Australia and other key international partners is maintained in so far as is reasonably possible.

A discussion paper has been written on these matters. Consultation will occur with industry/employer groups and tertiary providers currently delivering the BE. The goal is to reach consensus on the way forward for New Zealand professional engineer education. If the change is significant, a secondary aim is to develop a business case by mid-2010 requesting the TEC to fund any changed qualification.

4.2 REVIEW OF THE THREE-YEAR BEngTech AT LEVEL 7

Currently there are four versions of the BEngTech offered in New Zealand:

- The Western Institute of Technology in Taranaki (WITT) offers a BEngTech (Civil) through the New Zealand Institute of Highways Technology.
- AUT offers a BEngTech (Electrical and Mechanical).
- The Open Polytechnic offers the University of Southern Queensland BEngTech by distance.
- The Metropolitan Group of ITPs (CPIT, MIT, Otago, Unitec, Wintec and WelTec) has collaborated to redevelop a BEngTech with three majors and a common framework. The Group is seeking approval and accreditation to deliver the degree in 2010.

Work continues in this area to develop clear pathways into the BEngTech and out of the degree to higher qualifications.

4.3 REVIEW OF THE TWO-YEAR DIPLOMA AT LEVEL 6

When the tertiary qualification structure was revised to bring in the New Zealand Qualifications Framework, it became evident that the nationally-governed NZCE would be discontinued. It was envisaged that ITOs and ITPs would develop qualifications to meet the needs of industry in its place. In practice, a number of qualifications did emerge, but the concept of a standardized national qualification was lost, against the wishes of many but not all industry sectors. Over time, the need for economies of scale in delivery and recognition that different industry sectors had sufficiently similar needs, did lead to some consolidation and towards national offerings within three engineering disciplines.

Three consortia were formed between 1985 and 2005 to oversee the development and delivery from a provider perspective of the Diploma in Engineering which replaced the NZCE. Each consortium was responsible for one of the disciplines in the Diploma – civil, electrical or mechanical. The diplomas developed by these consortia do not have standard forms – they can be unit standard-based national diplomas or have achievement-based assessment.

Separate and differing governance structures were set up for each consortium. Representatives from the ITPs, Universities, relevant ITOs and industry became members of the advisory groups to the consortia. Over the years, only limited communication has occurred between the consortia on the development and delivery of the Diploma in each discipline.

In the civil discipline there are two separate qualifications – the academic diploma which is an achievement-based qualification (not unit standard-based) and the applied “experiential” diploma. The academic diploma (240 credits) is called the New Zealand Diploma in Engineering (NZDE) (Civil) and is recognized by Infratrain and the Institution of Professional Engineers New Zealand (IPENZ) as the benchmark theory qualification for civil engineering. It is being redeveloped to 15 credit papers. The National Diploma in Engineering (NDCE) (Applied) is administered and awarded by Infratrain and embodies the work experience component (132 credits) of the old NZCE. Qualification learning outcomes are aligned with the Institution of Professional Engineers (IPENZ) competence standard for engineering technicians and graduates from the qualification are eligible for Associate Membership of IPENZ (AIPENZ) and Certified Engineering Technician (CertETn) registration through IPENZ without further assessment.

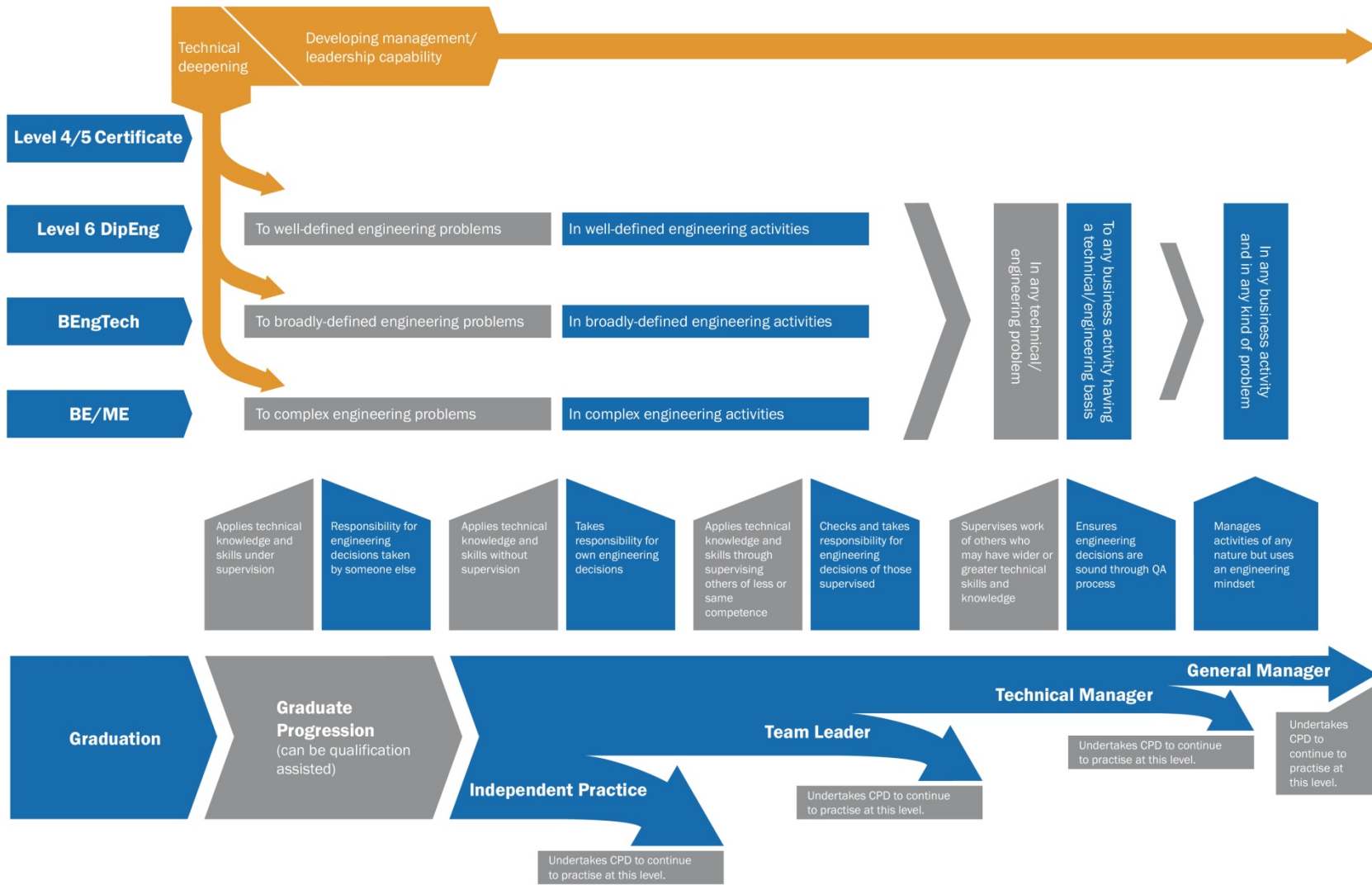
The National Electro Technology Education Consortium (NETEC) has been in existence for 23 years. The NDE (Electro technology) has recently been redeveloped and NETEC intends that an achievement-based assessment process will occur with cross-crediting to unit standards. At this time there is no clear indication that the Electro technology ITO (ETITO) will accept this cross-crediting.

The consortium formed to deliver the NDE (Mechanical) is the most recently formed consortium (2005). AUT, as the lead provider, wrote the common document for the mechanical discipline, although this was later adapted to more closely align with the underlying unit standards. This Diploma has achievement-based assessment which cross-credits to relevant unit standards. The NDE (Mechanical) also includes an optional 60-credit practical endorsement on top of the theory component, which is completed in the workplace. The joint industry/ITO/provider National Moderation Panel is recognised by Competenz as the group responsible for the Diploma, associated unit standards and the moderation of assessment.

Work has begun between the ITOs and consortia to redevelop the diplomas into a unified diploma system. A paper has been written and timeline set for the redevelopment. Consultation will occur with the members of the Diploma Consortia, their respective

programme advisory committees, relevant ITOs and industry to reach agreement on a unified diploma system. The goal is to have a unified system developed, approved and accredited for delivery commencing in 2011.

APPENDIX ONE



APPENDIX TWO

