

November 2009

NATIONAL ENGINEERING EDUCATION PLAN PROJECT PROGRESS REPORT FOR THE TERTIARY EDUCATION COMMISSION

Purpose: To provide an update on the work-streams in the National Engineering Education Plan (NEEP) Project.

This 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. Progress in each work-stream of the Project is summarised in this report.

1. WORK-STREAM 1 – CAREER STRUCTURES IN ENGINEERING

Career progression models for holders of level 6, 7, and 8 qualifications and trades qualifications have been developed and agreed to by stakeholders. Both models show progression towards technical deepening by attaining higher qualifications and broadening of careers if qualification holders follow a managerial route. This work-stream is complete.

2. WORK-STREAM 2 – DEMAND FOR AND SUPPLY OF ENGINEERS

Table 1 Demand estimates from the project consortium

Qualification Type	Actual qualification completions in 2008	Estimated annual needs – “business as usual”	Estimated annual needs – “innovation led economy	% growth required
Level 6 Engineering Technicians (Dublin Accord)	270	500	750	85% to 178%
Level 7 Engineering Technologists (Sydney Accord)	180	400	600	120% to 233%
Level 8 Professional Engineers (Washington Accord) ¹	1050	1100	1400	5% to 33%
Total	1500	2000	2750	33% to 83%

¹ http://www.ipenz.org.nz/ipenz/Education_Career/accreditation/

The project consortium used four sources of data from the Department of Labour, the Ministry of Education, the OECD and feedback from industry to reach estimates of the likely future demand for engineering graduates. Two scenarios were selected; “business as usual” – based on historic patterns, and “innovation-led economy” – based on increased participation by engineers in building innovation-led businesses (Table 1).

A significant number of new engineering technicians are needed to alleviate the severe shortages on infrastructure projects that industry has experienced in recent years. In relative terms, more of the new degree-holding engineers should be engineering technologists rather than professional engineers. More graduates with Bachelor of Engineering Technology (BEngTech) degrees working in the field or in production allow graduates with Bachelor of Engineering (BE) degrees to work on more complex engineering problems.

The required total number is 2000-2750 new engineers per year. The lower end of the range does not allow for any major increase to drive new high technology industries, or in “out of field” employment (career diversity). The higher figure allows for a level of “out of field” employment considered desirable for the New Zealand economy. Even at the higher figure, New Zealand would still not reach the OECD norm of 12% of tertiary graduates being in engineering. It would be at a similar level to that of the United Kingdom (9%). All OECD countries graduating less than 9% of their graduates in engineering have been experiencing shortages. Therefore the project consortium recommends the target be set at the higher level, 1.8 times the present supply. (The full paper – *The Demand for and Supply of Engineers* - accompanies this report).

3. WORK-STREAM 3 – QUALIFICATION STRUCTURES AND THE NETWORK OF PROVISION

3.1 Bachelor of Engineering (BE)

At the international meeting for the Washington Accord (WA) in June 2009, the signatories² agreed on the immediate implementation of the changes to the international graduate profile for the BE degree. Subsequently, consultation occurred with universities and industry during September/October about the new graduate profile and the implications for the current BE degree in New Zealand. The outcomes were that the majority of industry either required further information on the need for the proposed changes or were satisfied that the current BE degree which complies with the old WA graduate profile, produced graduates to meet their needs.

However, the project consortium has agreed that continued adherence to the WA exemplar standard is vital. There is a need to clarify the extent of the gap between the graduate profile of the current BE degree programmes and the new WA graduate profile, if any. This work is best performed by IPENZ in parallel to its accreditation programme. Once the extent of any gap is defined, it was agreed that a single national approach to programme length is required.

Andrew Cleland has instigated discussions at the IPENZ Standards and Accreditation Board meeting and with the New Zealand Council of Engineering Deans (NZCED) about affirming the new WA graduate profile, measuring the gap, but leaving implementation of change until other countries also implement change. As the universities go through accreditation over the next 2-3 years, the four-year BEs will be assessed against the new graduate profile and gaps identified. This process may be accelerated if:

- the international panellists find that the IPENZ standard is substantially lower than the WA exemplar standard

² The other signatories to the Washington Accord are Australia, Canada, Chinese-Taipei, Hong Kong-China, Ireland, Japan, Korea, Malaysia, Singapore, South Africa, United Kingdom and USA

- Australia decides to change its four-year programme to ensure conformance to the new graduate profile
- there is a strategic move by Government to an innovation-led economy.

The NEEP Project will signal to the TEC that the evaluation of the BEs may show there is a need for additional teaching time and more funding.

3.2 Bachelor of Engineering Technology (BEngTech)

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 and Technology (NZIHT).
- AUT offers a BEngTech (Electrical and Mechanical).
- The Open Polytechnic offers the University of Southern Queensland BEngTech by distance.
- The Metro 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 has received approval and accreditation from ITPQ and five of the six ITPs will commence delivery of the degree in 2010. Otago will commence delivery in 2011.

Discussions are to occur between the providers in the Metro Group and the other three providers about the relationship of the Metro Group BEngTech to the other BEngTechs.

3.3 Diplomas in Engineering

Consultation occurred on the unified diploma system at the same time as the consultation for professional engineer education. There was unanimous support from industry, tertiary providers and industry training organisations (ITOs) for a unified diploma system provided that the detail is right for the national structure to be in place for 2011.

3.3.1 Unified Diploma System

Table 2 Features of the unified diploma system

Feature	Academic Diploma	Work-based Diploma
Level	Level 6	
Responsibility	Leadership shared by ITPs/ITOs	Led by ITOs
Name	New Zealand Diploma in Engineering	New Zealand Diploma in Engineering Practice
Abbreviated Title	NZDE (Discipline)	NZDEP (Discipline)
Total credits	240 credits	120 credits
Paper credits	Multiples of 15 credits	4x15 credits or 2x30 credits and 1x60 credits ³
Knowledge and practice	Reasonable coverage of relevant body of knowledge in discipline, some knowledge of related disciplines	Knowledge and its application to the workplace

³ The 4x15 credits or 2x30 credits would have specific elements of the NZDE as pre- or co-requisites; in order to attempt the 1x60 credits to complete the NZDE (Applied) it would be necessary to have completed the NZDE as a pre-requisite. The 60 credits would be assessed holistically for competence in the practice area of the candidate to the international exemplar standard for engineering technician competence.

Common elements between majors	Mathematics, Mechanics and others as appropriate	
Assessment	Achievement-based assessment graded above a minimum standard for course work and set pieces	Competency-based assessment
International Standard and Professional Membership	Graduate attributes of the Dublin Accord ⁴ apply	Competence standard aligned to international exemplar recognised by the International Engineering Alliance (and used by IPENZ for entry to competence-graded membership (AIPENZ) and CertETn Register)
Entry level – academic	Successful study in NCEA Level 2 in Mathematics, Physics and English	Completion of specified elements of the NZDE would be a pre-requisite or co-requisite for different parts of the NZDEP
Delivery	Flexible – full-time, part-time, block courses and distance	
Quality Assurance	National with industry input – see proposed governance, advisory and quality assurance model	
Marketing	Coherent national marketing co-ordinated through the Governance Group, but also marketing within individual industries via the relevant ITO	

In the system above, it is recognised that students may study the two Diplomas concurrently. If students choose to study mostly theory initially, it will decrease over the duration of the Diplomas as more application occurs in the workplace.

3.3.2 Funding of the Unified Diploma System

The NZDE is delivered by the ITPs, so it will be funded by the EFTS model directly to the ITPs with students paying a tuition fee in addition. The ITOs will receive STM funding for students who enrol through them for the NZDEP.

The ITOs will act as "agents" for the NZDE by encouraging companies and people working in their industry to study part-time towards the two Diplomas.

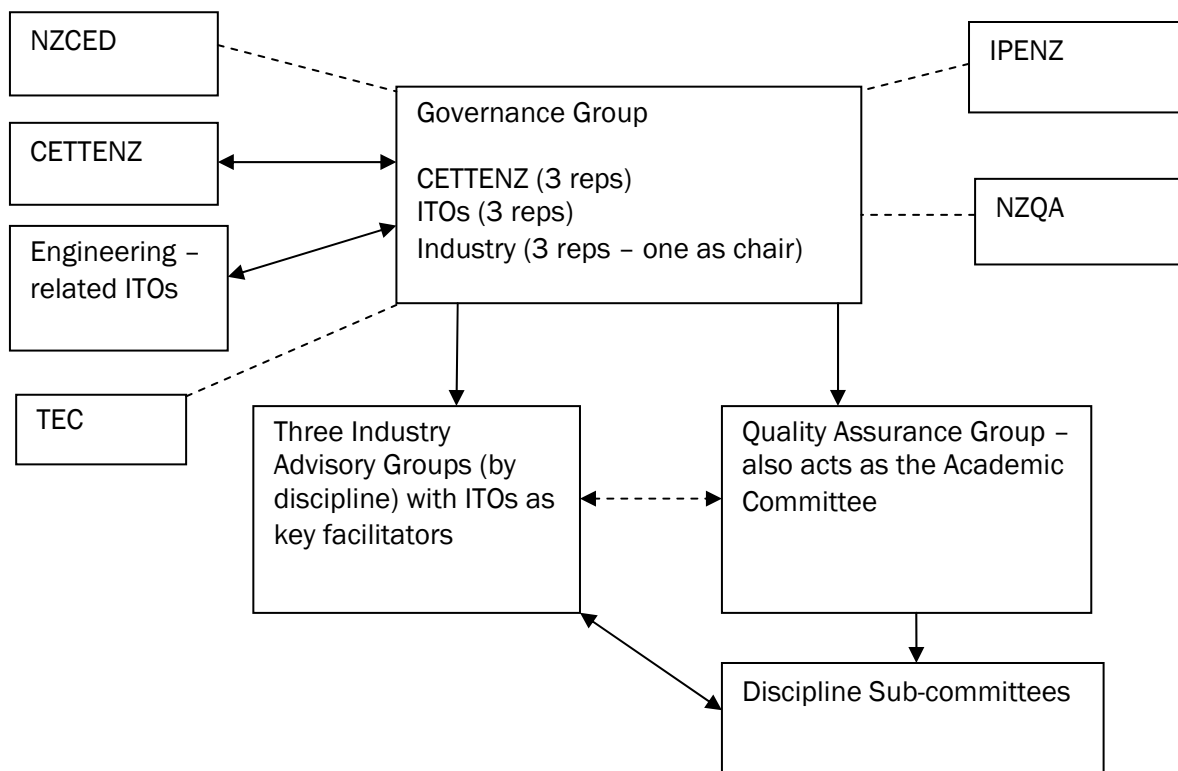
If a student studies part-time towards each of the NZDE and NZDEP concurrently then the EFTS funding and STM funding from the TEC must be no more than one full-time equivalent at any time. In practical terms this limit is unlikely to be reached unless an employee is released onto full-time study leave.

As ITPs will receive the Government funding through the EFTS system, they will be responsible for funding the quality assurance processes and the governance structure in respect of the NZDE. The ITOs receive funding through the STM system and would therefore be expected to fund the quality assurance and governance of the NZDEP. An equitable funding formula partitioning the costs of governance, advisory groups and quality assurance groups needs to be defined.

⁴ IPENZ is a provisional signatory to the Dublin Accord. This international agreement was signed in 2003 and ensures that all technician education programmes recognised by any of the signatories will be recognised as being substantially equivalent by all other signatories. Full signatories to the agreement are engineering bodies in Canada, South Africa, United Kingdom and Ireland.

3.3.3 Proposed Governance Structure

Figure 1 Proposed Governance Structure for the NZDE and NZDEP



The Governance Group is proposed to consist of three representatives from CETTENZ⁵, three from the ITOs and three representatives from industry. The independent chair would be elected from the industry representatives.

The Group would assume the role of a standard setting body under delegation from the ITOs and participating ITPs through setting the programme regulations. However, it would only proceed to make changes to content in response to approved recommendations by Industry Advisory Groups, or on programme regulations after seeking consensus with those bodies. The Governance Group is the designated “owner” of the qualifications and would ensure that the whole system is cohesive and makes decisions at a governance level about the network of provision.

NZCED⁶, CETTENZ, the engineering-related ITOs⁷ and the TEC as funders are recognised as stakeholders in the NZDE and NZDEP.

IPENZ, ITPQ (for the ITPs) and the NZQA are the accrediting bodies.

The three Industry Advisory Groups, one for each discipline, are facilitated by clusters of the relevant ITOs (Infratrains as lead in the civil discipline but involving BCITO, EXITO and

⁵ 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).

⁶ NZCED is the NZ Council of Engineering Deans, for tertiary providers offering four-year professional engineering qualifications.

⁷ ATTTO, BCITO, BITO, Competenz, ESITO, ETITO, EXITO, FITEC, Infratrains, MITO, Tranzqual

others, ETITO and ESITO as leads in the electrical discipline and Competenz as the lead in the mechanical discipline and involving others).

These three Groups are recommending bodies on behalf of industry to the Governance Group. Thus, they would be expected to take a strategic view of the qualifications and network of provision. The members of the Groups must be acceptable to all ITOs and participating ITPs, and the industry representatives should be selected for their ability to take a wide strategic view. Ideally, each group would have a University representative (appointed by the NZCED) to ensure that student progression issues are fully understood and considered.

The Quality Assurance Group/Academic Committee is responsible for overall moderation principles for both the NZDE and NZDEP; programme regulations; and consistent curriculum development and redevelopment between the disciplines. Because of the inter-relationship between the Diplomas, these matters are best considered in a cohesive manner. Information flows between the Industry Advisory Groups and Quality Assurance Group to ensure that the curricula meet the needs of industry.

There are three academic/quality assurance sub-committees, one for each discipline. These sub-committees have joint representation from ITOs and ITPs and will ensure that both the NZDE and NZDEP are delivered to suitable standards in each discipline. In doing so, they would take advice from the Industry Advisory Groups as required, but noting that the Industry Advisory Groups are not involved in the day-to-day moderation or setting of academic standards.

Further engineering disciplines could be added by expansion of the above model.

3.3.4 Development of the Unified Diploma System

Leadership groups consisting of two representatives from ITPs and two representatives from ITOs per discipline are to be formed to lead the redevelopment of the diplomas. The lead groups in each discipline will work collaboratively to design and develop the unified diploma system and then within each discipline, work with the industry advisory groups in the current consortia to develop the curriculum.

The lead groups will:

- decide on the common subjects across the diplomas
- agree on the timeline for redevelopment of both diplomas
- agree on a national network of provision
- recommend to the Governing Group of the NEEP Project any changes to the proposed governance structure (Figure 1).
- interface with the Open Polytechnic who has the diploma as an exit qualification from their BEngTech.

The lead groups meet for the first time on 15 December 2009 to agree on their Terms of Reference and the work-plan to develop the unified diploma system.

3.3.5 Proposed Timeline for Redevelopment

Mid-October 2009 Consultation completed with respective national advisory committees and industry on proposal for NZDE and NZDEP.

Agreement reached between ITOs and ITP sector on the unified diploma system of the NZDE and NZDEP.

30 November 2009 Overall governance structure of unified diploma system agreed.

Jan to March 2010	Framework and curriculum written for NZDE.
April – June 2010	Approval and accreditation documentation written for the NZDE and Dublin Accord accreditation.
31 August 2010	NZDE approved and accredited by providers.

4. WORK-STREAM 4 - SECONDARY SCHOOL ISSUES

Staff from the Ministry of Education attended a consultation meeting on 30 September with representatives from industry sectors, ITOs, ITPs and universities to discuss pathways to tertiary study and employment from the Technology Learning Area in senior secondary school (Years 11-13). About 40 people attended from the tertiary, engineering, architecture, design, construction, processing, manufacturing, food technology, digital, agriculture and business sectors.

Participants recommended four subject groupings in the Technology Learning Area:

- Construction and Manufacturing/Mechanical Technologies
- Design Technologies
- Digital Technologies
- Processing Technologies

Meeting participants acknowledged that Design is applicable to the other three categories as well as having a category of its own.

Expert reference groups are working with the Ministry of Education on the bodies of knowledge and the standards in three of the four subject groupings. This work was completed for Digital Technologies earlier in the year. The goal is to have this work for the three subject groupings finished by the end of 2009.

Work with the Ministry continues to develop pathways from the subject groupings to careers in the sectors listed above.

5. WORK-STREAM 5 - PARTICIPATION OF MINORITY GROUPS IN ENGINEERING

The three groups to be targeted are Maori, Pasifika and women. Research is underway to evaluate support programmes such as SPIES at the University of Auckland and Awhina at Victoria University to identify the right means to attract and retain minority groups in engineering.