IPENZ
ENGINEERS NEW ZEALAND

PROPOSAL FOR REDEVELOPMENT OF THE DIPLOMAS IN ENGINEERING INTO A NATIONALLY COHERENT STRUCTURE ENCOMPASSING ALL ENGINEERING DISCIPLINES

Purpose: The purpose of this paper is to set out a proposal for a national Diploma in Engineering qualification structure and to invite feedback from members of each diploma consortia, their existing respective programme advisory committees, the relevant Industry Training Organisations and industry.

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1. EXECUTIVE SUMMARY

The purpose of this paper is to set out a proposal for a national Diploma in Engineering qualification structure and to invite feedback from members of each existing diploma consortia, their existing respective programme advisory committees, the relevant Industry Training Organisations (ITOs) and industry. The goals of such national co-ordination would be to achieve a better recognized, understood and supported engineering technician education system in New Zealand, thereby better meeting the needs of industry and students.

The proposal is for a 240 credit New Zealand Diploma in Engineering (NZDE) which would include the academic learning, and a 120 credit New Zealand Diploma in Engineering (Applied) (NZDE (Applied)), which would include assessment of practical components. The latter would have the former as a pre- or co-requisite. These Diplomas would be available in three disciplines (civil, electrical, mechanical) in the first instance, but further expansion would be possible.

Delivery of the NZDE would be through a cluster of Institutes of Technology and Polytechnics (ITPs) and of the NZDE (Applied) through ITOs. Opportunities for co-delivery in more than one discipline would enable economies of scale in the tertiary providers. Common size units of learning would also be adopted.

The Diplomas would be subject to a national governance structure, based on industry, ITP and ITO representation. The structure includes industry advisory groups as recommending bodies in each of the disciplines, and a national quality assurance system to ensure consistent achievement of equivalent outcomes.

Key questions for the consultation include the nature of reporting of assessment and achievement in the NZDE – whether it should be based on a graded 10 point (E to A+) or competence-based (not achieved, achieved, merit, excellence) system. This has consequences for the registration of the NZDE on the National Qualifications Framework (NQF) alongside the NZDE (Applied).

Feedback is sought on the Diploma names and structures, governance, industry advisory, quality assurance and assessment systems from industry, tertiary providers, regulators and other interested parties.

2. BACKGROUND

This paper should be read in conjunction with a paper entitled *Review of Engineering Qualification Structure – Overview* which sets out the wider context in which the present discussion paper sits.

3. PROPOSED MODEL FOR DIPLOMAS IN ENGINEERING

At a meeting in June, chaired by the Institution of Professional Engineers New Zealand (IPENZ) and attended by the Chairs of the three consortia, the Chair of CETTENZ[1] and representatives from the relevant ITOs (Infratrain, ETITO, ESITO and Competenz), a unified diploma system with majors in civil, electrical and mechanical was proposed. This was defined as an ideal model – consultation is to occur about the suitability of that model for meeting the needs of particular industry sectors and providers. If that model is accepted then transitional arrangements will be considered.

The meeting participants agreed that any nationally co-ordinated qualification structure should be based on two diplomas – an academic diploma which covers the underpinning knowledge for an engineering technician and an applied diploma which has practical work-based components. Such a system allows for purchaser diversity i.e. students may choose to study the diploma or employers may choose to fund employees in study. The key features of this unified system are outlined below.

3.1 UNIFIED DIPLOMA SYSTEM

Feature	Academic Diploma	Applied Diploma
Level	Level 6	
Responsibility	Leadership shared by ITPs/ITOs	Led by ITOs
Name	New Zealand Diploma in Engineering	New Zealand Diploma in Engineering (Applied)
Abbreviated Title	NZDE (Discipline)	NZDE (Applied) (Discipline)
Total credits	240 credits	120 credits
Paper credits	Multiples of 15 credits	4x15 credits or 2x30 credits and 1x60 credits[2]
Knowledge and practice	Reasonable coverage of relevant body of knowledge in discipline, some knowledge of related disciplines	Knowledge and its application to the workplace
Common elements between majors	Mathematics, management and others as appropriate	
Assessment	Model 1 - achievement-based assessment graded above a minimum standard for course work and set pieces Model 2 – competency-based	Competency-based assessment

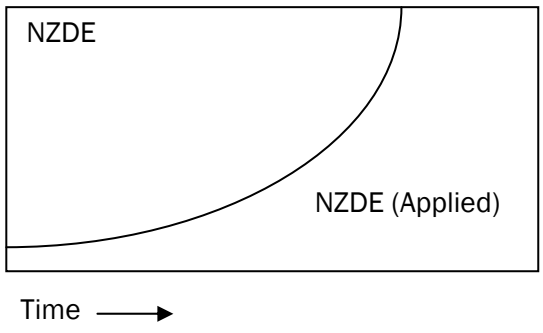
[1] CETTENZ is the Council for Engineering Technician and Technologist Education New Zealand, a bipartite council of the Engineering Deans or Heads of Department from the ITP and university sector responsible for three-year degrees (Sydney Accord criteria) and two-year Diplomas (Dublin Accord criteria).

[2] 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.

	assessment	
International Standard and Professional Membership	Graduate attributes of the Dublin Accord[3] 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 NZDE (Applied)
Delivery	Flexible – full-time, part-time, block courses and distance	
Quality Assurance	National with industry input – see proposed governance, advisory and quality assurance model in Section 5	
Marketing	Coherent national marketing co-ordinated through the Governance Group, but also marketing within individual industries via the relevant ITO	

When comparing this system above with the old New Zealand Certificate in Engineering (NZCE), the total number of credits for the NZCE was about 300 whereas the NZDE and NZDE (Applied) has 360 credits in total. The 240 credits of the NZDE and first 60 credits of the NZDE (applied) are seen as broadly equivalent to the NZCE. The last 60 credits of the NZDE (Applied) takes the candidate to a higher level of proficiency, often termed the ability to practise independently in their discipline as an engineering technician.

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. In this scenario, the split between theory and practice is about two thirds/one third.



3.2 NOMENCLATURE

Discussions have occurred with the New Zealand Qualifications Authority (NZQA) about the name "New Zealand" in the NZDE (Applied) appearing on the National Qualifications Framework (NQF) which is normally the domain of national qualifications with unit standard-based assessment. NZQA is supportive of the redevelopment of the Diplomas and is working through its internal approval processes to enable the name to appear on

[3] 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.

the National Qualifications Framework. This process is occurring at the same time as the consultation process on the redevelopment of the Diplomas.

3.3 ASSESSMENT

Two possible models of assessment for the NZDE are proposed for discussion and feedback. The two models are detailed below and stakeholders are asked to indicate their preference during consultation.

Model 1. Achievement-based assessment graded above a minimum standard

In this model the 16 papers of 15 credits each would be graded on a 10 point (E, D, C, C+, B-, B, B+, A-, A, A+) scale. A qualification with this grading system cannot be registered on the National Qualifications Framework, but can be registered on the NZQA KiwiQuals Register.

Advantages

- This form of assessment is consistent with assessment used in the Bachelor of Engineering Technology (BEngTech) and university degrees. Consistency provides greater clarity about the levels students need to attain to progress from the NZDE to higher qualifications.
- Students may have greater motivation to achieve higher grades and complete the qualification.
- Employers are familiar with this form of assessment and clearly understand the difference in capability between students who average A, B or C grades in their course of study.

Disadvantages

- This form of assessment is not consistent with the competency-based assessment which will be used in the NZDE (Applied).
- The NZDE will appear on the Kiwiquals Register and the NZDE (Applied) will appear on the National Qualifications Framework[4]. Potentially this will be confusing for students and employers unless the two Diplomas are clearly marketed as a package.

Model 2 Competency-based assessment

In this model the 16 papers of 15 credits each would be graded on a four point scale – not achieved, achieved, merit and excellence. This nationally-coordinated qualification would be registered on the National Qualifications Framework[5].

Advantages

- This form of assessment is consistent with the assessment used in the NZDE (Applied) and with the National Certificate of Educational Achievement (NCEA) which students and employers are increasingly familiar with from secondary school.
- The two Diplomas (NZDE and NZDE (Applied)) will be clearly viewed as a package by employers and students.
- Both Diplomas will appear on the same register (National Qualifications Framework)[6].

[4], [5], [6] subject to NZQA approval

Disadvantages

- The level that students need to achieve to progress to higher qualifications in engineering will need to be determined. For example, if a student averages "achieved" across the 16 papers in the NZDE, how many credits will be transferred to a higher qualification?
- Students and employers may view this form of assessment as providing less clarity about the level of student capability compared to the 10 point scale.

3.4 QUALITY ASSURANCE

The quality assurance body for the NZDE with achievement-based assessment is the Institutes of Technology and Polytechnics Quality (ITPQ) as the ITPs are the providers. Then the approved qualification goes to NZQA to be placed on the Kiwiquals register. If the Auckland University of Technology (AUT) also delivers the NZDE, then their quality assurance process will be through the Committee for University Academic Programmes (CUAP) then NZQA.

The quality assurance body for the NZDE and the NZDE (Applied) with competency-based assessment determined by the ITOs will be NZQA.

The standard setting body (owner of the qualifications) is established in Section 5 on governance.

4. PRACTICAL ISSUES

4.1 COMMON ELEMENTS IN THE NZDE

To support student choice, the first 60 credits should have as much common material between engineering disciplines as possible. Thus, common elements in the three majors that might be covered in the first semester of the NZDE include: mathematics, physics, drawing, engineering computing and elements of communication. Management and personal development including ethics might be covered as common material later in the Diploma.

There may need to be some flexibility in the design of the common 15 credit papers so they are still appropriate to each discipline e.g. each discipline does two of three modules within a paper.

4.2 ENTRY REQUIREMENTS

Agreement needs to be reached on the advice given to prospective students. This advice should be framed as the level of achievement regarded as necessary for students to have a reasonable chance of success in the NZDE and NZDE (Applied). IPENZ has drafted *Minimum Levels of Achievement that Lead to a "Reasonable Chance of Success" in studying for Engineering Qualifications* (see Appendix One) as a base for discussion.

Entry to the NZDE for a school student must be possible from successful study in Year 12 whereas in contrast, success from Year 13 is required for entry to the BEngTech and BE. This suggests that the opportunities for co-delivery of the Diploma and BEngTech are limited. Some common courses at Level 5 and Level 6 could be explored, but these would lie outside the areas of study reliant on mathematics.

4.3 STAIR-CASING

There needs to be agreement on stair-casing from the trades through to the NZDE, BEngTech and the Bachelor of Engineering (BE). It must be recognized that in the BE all providers have moved engineering material down to Year 1 and as a result less credit is available than was the case a decade ago when transfer from the NZCE was still common. The following guidelines for stair-casing are proposed.

- Completion of a trades qualification can provide some credit at the point of entry to the NZDE and NZDE (Applied). However the lower knowledge of underpinning mathematics and physics is a concern. The extent of credit may differ between the disciplines.
- On completion of an NZDE, students may be able to receive up to 180 credits towards a BEngTech. Additional study in mathematics may be required for students to reach Level 5 in this subject. If students have completed the NZDE (Applied) or have relevant knowledge gained on the job, they may receive extra credit.
- If students want to move from the NZDE to the BE they may receive up to 120 credits depending on university entry requirements and would be required to study additional mathematics to reach Level 6.

4.4 TRANSITIONAL ARRANGEMENTS

Transitional arrangements for implementation of this model for the NZDE and NZDE (Applied) must be considered and a clear communications plan developed for industry, employers and students which states how existing qualifications align with the proposed Diplomas.

5. GOVERNANCE

In the context of accreditation, the IPENZ Quality Assurance requirements[7] state that:

- National qualifications must be registered at Level 6 on the National Qualifications Framework and other qualifications must be registered at Level 6 on the New Zealand Register of Quality Assured Qualifications as a New Zealand qualification.
- All providers of the qualification must be accredited to do so by the appropriate Approval and Accreditation Body.
- To meet the IPENZ recognition criteria (which are benchmarked to the Dublin Accord) the qualification developer must be able to demonstrate to the satisfaction of IPENZ that the process of qualification development has involved key engineering stakeholders at a national level.
- A qualification advisory committee is in place (that involves key engineering stakeholders at a national level - ITOs, professional bodies, providers, key employers etc) which is responsible for ongoing review of the curriculum and standards within the qualification and for providing advice on industry developments and associated education and training needs.
- There is a process in place to moderate assessments conducted by all providers of the qualification, which has national engineering stakeholder input.

[7] http://www.ipenz.org.nz/ipenz/Education_Career/accreditation/two_year.cfm *IPENZ Manual for Engineering Technician Education Qualifications*

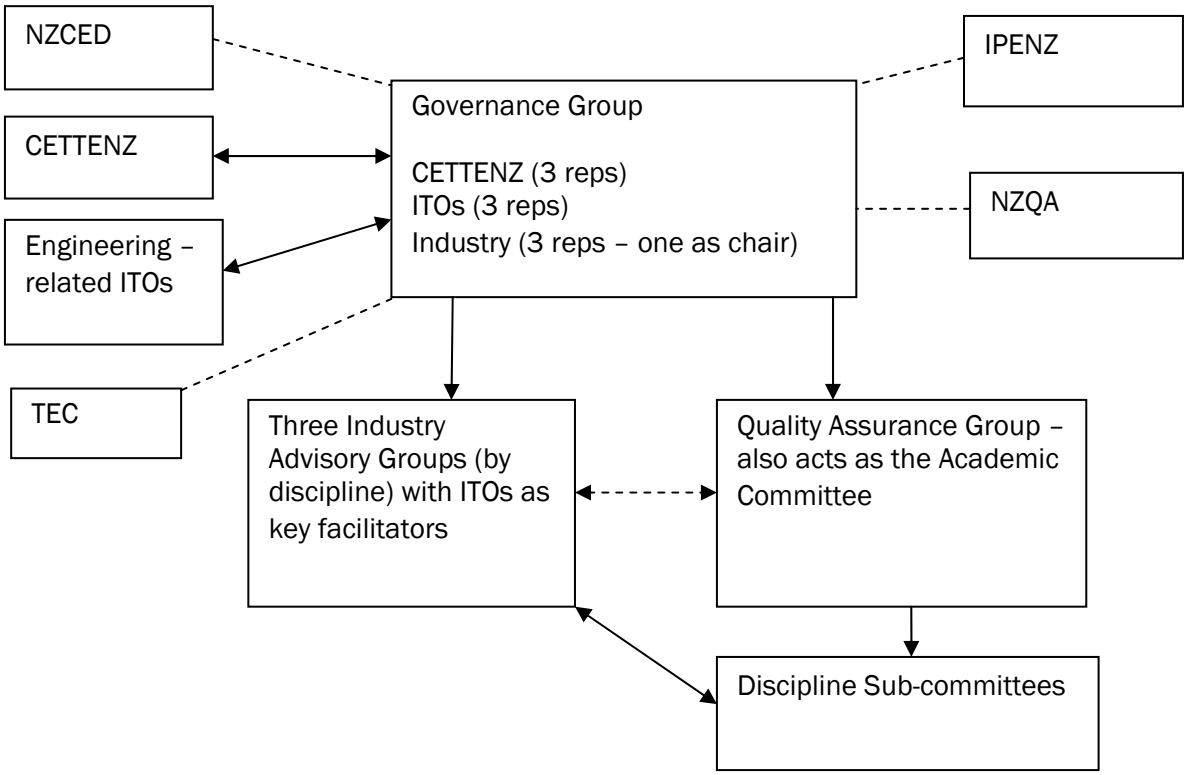
5.1 PROPOSED GOVERNANCE STRUCTURE FOR THE NZDE AND NZDE (APPLIED)

The Governance Group is proposed to consist of three representatives from CETTENZ, 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.

NZCED[8], CETTENZ, the engineering-related ITOs[9] and the TEC as funders are recognised as stakeholders in the NZDE and NZDE (Applied).

Proposed Governance Structure



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 (Infratrain as lead in the civil discipline but involving BCITO, EXITO and 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

[8] NZCED is the NZ Council of Engineering Deans, for tertiary providers offering four-year professional engineering qualifications.
[9] ATTTO, BCITO, BITO, Competenz, ESITO, ETITO, EXITO, FITEC, Infratrain, MITO, Tranzqual

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 NZDE (Applied); 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 NZDE (Applied) 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.

AUT University has given a preliminary indication that whilst it is involved in Diploma engineering education, it would attempt to ensure that its Diploma in Engineering is managed in a manner consistent with this national ITP/ITO system.

6. FUNDING OF THE NZDE AND NZDE (APPLIED)

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 NZDE (Applied).

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 NZDE (Applied) 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. The TEC requires the ITPs and ITOs to manage this process.

The ITOs may need to review their cadetships to enable them to comply with this proposed funding model.

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 have the funding and would therefore be expected to fund the quality assurance and governance of the NZDE (Applied). An equitable funding formula partitioning the costs of governance, advisory groups and quality assurance groups needs to be defined.

7. TIMELINE FOR CONSULTATION AND REDEVELOPMENT

Mid-October 2009 Consultation with respective national advisory committees and industry on proposal for NZDE and NZDE (Applied). Consultation

	will occur online and in a series of five main centre meetings held in mid-September.
	Agreement reached between ITOs and ITP sector on the unified diploma system of the NZDE and NZDE (Applied).
30 November 2009	Overall governance structure of NZDE agreed.
31 March 2010	Framework and curriculum written for NZDE.
31 May 2010	Approval and accreditation documentation written for the NZDE.
30 June 2010	Approval and accreditation documentation written for Dublin Accord accreditation.
31 August 2010	NZDE approved and accredited by providers.

8. BODIES TO BE CONSULTED

Electrical Workers Registration Board

Engineering Associates Registration Board

Chartered Professional Engineers Council

Construction Industry Council and its members

Engineering Leadership Forum members

NZCED

CETTENZ

Trades Forum

All relevant ITOs and ITF

Engineering, Printing and Manufacturing Workers Union

Department of Building and Housing

EECA

Department of Labour

NZ Transport Authority

NZ Defence Force

NZ Manufacturers and Exporters Association

EMA (Northern)

EMA (Central)

APPENDIX ONE

August 2009

MINIMUM LEVELS OF ACHIEVEMENT THAT LEAD TO A "REASONABLE CHANCE OF SUCCESS" IN STUDYING FOR ENGINEERING QUALIFICATIONS (DRAFT ONLY)

The following is recommended entry advice for those entering tertiary study in engineering on the basis of qualifications achieved in secondary school. This advice is in the form of the minimum level of achievement that leads to a reasonable chance of succeeding in the particular qualification. Individual tertiary providers may establish different entry requirements (for example different number and level of credits, competitive entry based on aggregate grades and other criteria). They may also have pathways for individual students who have not achieved these standards or have come via a different pathway if the provider believes the student has a reasonable chance of succeeding in the qualification.

	NCEA	Other qualifications
Diploma of Engineering	Meet literacy and numeracy requirement and achieve at least 36 Level 2 NCEA credits, from a subject cluster, including a minimum of: • 12 in physics • 12 in mathematics • 12 in chemistry (chemical /process engineering only) Other subjects in which qualifying credit may be recognised are technology or graphics. Note: the qualifying credits should come from across the curriculum for each subject.	At least C Pass in Sixth Form Certificate in both Physics and Maths
BEngTech	Achieve University Entrance, with at least 42 Level 3 NCEA achievement-based credits, from a subject cluster, including a minimum of: • 14 in physics • 14 in mathematics with calculus • 14 in chemistry (chemical /process engineering only) Other subjects in which qualifying credit may be recognised are statistics, technology or graphics. Note: the qualifying credits should come from across the curriculum for each subject.	B Bursary with 45% or more in both Physics and Calculus (and Chemistry if studying Chemical /process engineering) or Equivalent Cambridge score or Equivalent International Baccalaureate

	NCEA	Other qualifications
BE	Achieve University Entrance, with at least 60 Level 3 NCEA credits from a subject cluster, including a minimum of: • 16 in physics • 16 in mathematics with calculus • 16 in chemistry (may not be required for all programmes) Other subjects in which qualifying credit may be recognised are statistics, technology or graphics. Note: particular providers may set a higher entry standard either for particular papers or for entry as a whole. The qualifying credits should come from across the curriculum for each subject and some credits should be at merit or excellence level.	'A' Bursary with 60% or more in both Physics and Calculus (and Chemistry if studying Chem/ process engng) or Equivalent Cambridge score or Equivalent International Baccalaureate

CREDIT FOR TRANSFER BETWEEN PROGRAMMES

- In general, where a qualification has been awarded and not relinquished, the maximum credit is UP TO 50% of the qualification being sought, ASSESSED ON A CASE-BY-CASE BASIS. However, when a qualification is relinquished, the MAXIMUM credit transferred to another qualification may be HIGHER.
- Credit from Level 4 study towards any Level 6 or above qualification would not normally be given.
- From Level 5 Certificates towards a Level 6 Diploma of Engineering
  - Up to 120 credits (1.0 FTE)
- From a Diploma of Engineering towards a BEngTech
  - Up to 180 credit points (1.5 FTE year)
- From Diploma of Engineering towards a BE
  - Up to 120 credits (1.0 FTE)
- A candidate holding a Diploma in Engineering and a Diploma in Engineering (Applied) (e.g. the NDipEng(Applied) in the civil or mechanical fields) can expect to receive separate credit for both Diplomas.
- From a BEngTech towards a BE
  - Up to 240 points (2.0 FTE years)