

## **The Engineering profession in some relevant countries**

Domingo Docampo, January 31, 2005.

**Summary:** This report shows some data extracted from selected internet sites related to the engineering profession in Europe, North America and the Pacific. Its main purpose is to sample the status of the engineering profession by looking up the information available at public web sites throughout the world.

### **Engineering in Europe**

To facilitate the mobility of professionals, the EU has put in place legislation to ensure that professional qualifications are recognised on a mutual basis between all Member States, so that a person entitled to practice a regulated profession in a EU country should be able to practice the same profession in any other EU country and use the appropriate title. Even if the profession is not regulated in the home country, a person should still be able to practice in a Member State where it is regulated, if proof of satisfactory education and professional experience is provided.

The engineering profession is regulated under Council Directive 89/48/EEC, the First General System Directive. Applicants must have successfully completed a post-secondary course of **at least three years'** duration, at a higher education institution. If the duration of the education and training is at least one year less than that required in the Member State where the applicant wants to be recognised, this Member State may require proof of professional experience of a maximum of twice the shortfall in duration of education and training.

In 2002 the European Commission presented a proposal for a new framework Directive for the recognition of professional qualifications, with a few important changes that, if adopted, will alter the way Member States deal with applications.

\* It shall no longer be possible to ask for professional experience as a requirement for giving recognition. Only compensation measures (adaptation period or aptitude test) can be applied: applicants shall have the right to choose between the two.

\* Professional bodies at a European level can agree on a "common platform", i.e. establishing a set of criteria the fulfilment of which would grant recognition more or less automatically, if the common platform is approved by the European Commission.

\* There are specific Annexes to the Directive establishing "minimum training conditions" which all EU countries should apply for certain professions (Med., Arch., Pharm., etc). This means that the education and training for these professions is to some extent harmonised throughout Europe, and that member states must notify and get approved the officially recognised titles which fulfil the criteria of the directive. Those who hold an "accredited" diploma and the right to use the protected title and practice as a doctor or architect are granted automatic recognition in any other Member State.

The Commission proposal is currently under discussion in the European Parliament and the Council of Ministers. More information can be found at the Online Legislative Observatory of the European Parliament, <http://www.europarl.eu.int/oeil/> using the key words Recognition of Qualifications in the search. It will certainly not be adopted until 2005, with an implementation date at earliest 2007.

## The role of FEANI and the Eur Ing title

FEANI, the European Federation of National Engineering Associations, promotes the EurIng designation as a guarantee of competence for professional engineers. It is intended to facilitate the movement of practicing engineers within and outside the geographical area represented by FEANI and to establish a framework of mutual recognition of qualifications in order to enable engineers who wish to practice outside their own country to carry with them a guarantee of competence. To qualify for the EurIng designation, the following requirements must be met:

- \* Minimum **three years** of engineering education recognised by FEANI, and given by a university (U) or other recognized body at university level, admitted by FEANI.

- \* Minimum **two years** of valid professional experience (E).

- \* In case the education and experience together is less than the minimum **seven years** formation required, the balance to seven years should be covered by education (U), experience (E), or training (T) monitored by the approved engineering institutions, or by preliminary engineering professional experience.

The European Commission has recognized the EurIng designation as a valuable tool for the recognition of national diplomas among member States. The Commission considers that an engineer who has obtained the title of Eur Ing should not normally be required to undertake an adaptation period or sit an aptitude test.

## A Navigation through European Countries

**Austria:** Engineers must be registered as "Ziviltechniker" or "Ingenieurkonsulent" in order to practice. The Professional body, <http://www.oiv.at/>, Österreichischer Ingenieur-und Architekten-Verein offers no information in English.

**Belgium:** The engineering profession is not regulated in Belgium. The Flemish **Koninklijke Vlaamse Ingenieursvereniging** **vzw** <http://www.kviv.be/>, KVIV, is the only professional organisation uniting the university trained engineers, having obtained a degree after **5 years** of study from Flemish universities which have conferred on them the legally protected title of "ingénieur", abbreviated "ir.". Within the French-speaking, the **Federation Royal d'Associations Belges d'Ingenieurs Civils et d'Ingenieurs Agronomes** <http://www.fabi.be/> plays the same role.

**Denmark:** Neither the engineering profession nor the use of the designation "ingenior" (engineer) are protected by law. The engineering education is regulated by a common University Law. The final official advice or guidance towards the Ministry of Education comes from an Advisory Board (TUR). The **Society of Danish Engineers**, <http://ida.dk/>, has no formalised, direct influence. But indirectly it has a great influence

**Finland:** The membership of the **Finnish Association of Graduate Engineers**, TEK, <http://www.tek.fi/inenglish.html> can be awarded to a person who has successfully completed the MSc degree in engineering or architecture at a Finnish university, or to a person who holds some other relevant Finnish MSc degree in science and is occupied in the technical branch, or to a person who has successfully completed a degree equivalent to the MSc in engineering in some other country and is occupied in technical branch in Finland.

**France:** The **Commission des Titres d'Ingénieurs** <http://www.commission-cti.fr> is a French governmental body. Its mission is to assess that the Engineering Education programmes reach the requested standards. The French Engineering Register includes all the holders of an engineering degree recognised by the State, as well as people recognised by the professions as having performed the job of an engineer. The **Conseil National des ingénieurs et scientifiques de France**, <http://www.cnisf.org>, CNISF, is the institution in charge.

**Germany:** It is only compulsory to register with a Chamber in order to practice as a consulting engineer and use the title "Beratender Ingenieur". The recognition of engineering qualifications is the responsibility of the individual Länder. The title "Ingenieur" is an academic title awarded after completing a "Diplomstudium" at a university or "Fachhochschule". **The Association of German Engineers, VDI**, <http://www.vdi.de/vdi/english/index.php> is a non-profit organization of 126,000 engineers and natural scientists. **Full members** are engineers and natural scientists with a degree as well as persons who are entitled by German law to use the professional title of engineer. **Junior members** are Full members under the age of 30 or 33 years of age.

**Ireland:** The engineering profession is not regulated in Ireland. However, to use the title "Chartered Engineer", it is necessary to qualify through a professional review and become member of the **Institution of Engineers of Ireland (IEI)**, <http://www.iei.ie>. Engineering education programmes which satisfy the appropriate criteria laid down in the IEI document 'Accreditation Criteria for Engineering Education Programmes-Nov 2003' are deemed to meet the educational standard required of individuals seeking the Institution's Registered Professional Titles. Eligibility to a particular grade of membership in the Institute depends on academic qualifications and experience.

**Ordinary Member (MIEI) :** An accredited engineering degree or its equivalent.

**Chartered Engineer (CEng MIEI):** applicants for this title must hold an accredited engineering degree or equivalent and four years postgraduate training and experience (minimum 8 years formation) to standards prescribed by the Institution. Candidates must complete a Professional Review.

**Italy:** To practice, engineers are required to pass a State examination and register with a local office of l'Ordine degli Ingegneri. In addition, in order to perform professional activities covered by law, it is necessary to enrol in the local register. The authority for examining applications is the Ministero di Grazia e Giustizia and the Organization of the Engineering Profession is the **Consiglio Nazionale Degli Ingegneri** <http://www.tuttoingegnere.it/web/ENG/> (page in English in construction).

**Luxembourg:** In order to practice independently as an engineer, it is obligatory to register with l'**Ordre des Architectes et des Ingénieurs-Conseils**, <http://www.oai.lu/> Its official mission, determined by Luxemburgish law, is to guarantee the application of the rights and duties specifically linked to public interests covered by the architects and consulting engineers profession. It is compulsory for each architect and consulting engineer, whether a natural or legal person, who wants to exercise his profession on an independent basis in the Grand-Duchy of Luxembourg, to be registered with this organization.

**Netherlands:** The engineering profession is not regulated in Netherlands. However, the official academic title "ingenieur (ir/ing)" is protected by law. Membership in the **Royal Institution of Engineers in the Netherlands**, KIVI NIRIA, <http://www.ingenieurs.net:80/Resource.phx/plaza/kivi-in-english.htx> is open to graduates and students (from 1st year onwards) of the Dutch Universities. University engineering education entails 5 years study and the education of the universities of professional education entails 4 years study. Graduates of engineering faculties at Dutch universities of technology are awarded the degree of 'Master of Science' in Dutch 'ingenieur' (abbreviation 'ir.') and are allowed to use the title ir., which is protected by law. Graduates of the Dutch universities of professional education are awarded the degree of 'Bachelor of Engineering' in Dutch 'ingenieur' (abbreviation 'ing.') and are allowed to use the title ing., which is protected by law. KIVI NIRIA has only one grade of membership -'member'- and there is no professional title.

**Portugal:** The practice of the profession of Engineer needs a compulsory registration as member of **Ordem dos Engenheiros**, a non profit Institution for granting the professional title of Engineer, which regulates the Engineering practice of its members and awards qualification titles (Senior and Conselheiro) as well as expert titles (Especialista). OE has implemented the Accreditation System for Engineering Courses in Portugal. An engineer must be a member of OE to be awarded the title and to practice the profession. Applicants must have obtained an engineering degree, completed a training period and taken the admission exam. OE must also define objective criteria for exemption from admission exams, and these criteria must be periodically revised. These criteria are based on the course curriculum, education means and evaluation methods under which the process of Accreditation of Engineering Courses takes place. OE's current Admission Examination Policy exempts students of Accredited Engineering Courses from the exam. <http://www.feani.org/ESOEPE/PT-accred/PThome.htm>.

**Spain:** In order to practice it is compulsory to be registered with professional bodies recognised by Law and protected by constitutional rights. These professional organizations are "el Colegio de Ingenieros" or "el Colegio de Ingenieros Técnicos" for each branch of Engineering. The same applies to "el Colegio de Arquitectos" and "el Colegio de Arquitectos Técnicos" in the case of Architecture. In addition, there are some learned societies grouped in two national bodies, **Instituto de la Ingeniería de España**, IIE, <http://www.ies.es>, e **Instituto de Ingenieros Técnicos de España** (INITE), <http://www.inite.es>. Both represent the members of the Institutes in general affairs concerning the engineering profession in Spain at all levels, and represent the Engineering Profession in FEANI.

**Switzerland:** It is necessary to be registered with the Swiss Register of Engineers, Architects and Technicians in order to apply for some competitive contracts in certain Cantons. The French speaking Cantons, Ticino and Lucerne have minimum specific requirements. There are three levels of Register: REG A ETHZ, EPFL, (Engineering Universities) IAUG (Architectural School), REG B HTL/FH (Ingénieur ETS/Ingenieurin HTL, Ingenieur HTL (= Höhere Technische Lehranstalt)/Ingenere STS and REG C Eidg. Dipl. Baumeister and others. The authority examining applications is the **Swiss Register of Engineers, Architects and Technicians** <http://www.schweiz-reg.ch>

**UK:** The engineering profession in the United Kingdom is regulated by the **Engineering Council, ECUK**, <http://www.engc.org.uk>, through 35 engineering Institutions who are licensed to put suitably qualified members on the ECUK's. The Register of Engineers has three sections: Chartered Engineer, Incorporated Engineer and Engineering Technician, titles protected by the Engineering Council's Royal Charter which may only be used by registrants. Applicants must show that they have a satisfactory educational base, have undergone approved professional development, and, at interview, must demonstrate their professional competence against specific criteria based on the ECUK's current regulation Standards UK-SPEC, [www.uk-spec.org.uk](http://www.uk-spec.org.uk).

**Chartered Engineers (CEng)** are characterised by their ability to develop appropriate solutions to engineering problems, using new or existing technologies, through innovation, creativity and change. They might develop and apply new technologies, promote advanced designs and design methods, introduce new and more efficient production techniques, marketing and construction concepts, pioneer new engineering services and management methods. Chartered Engineers are variously engaged in technical and commercial leadership and possess interpersonal skills.

**Incorporated Engineers (IEng)** are characterised by their ability to act as exponents of today's technology through creativity and innovation. To this end, they maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation. Incorporated Engineers are variously engaged in technical and commercial management and possess effective interpersonal skills.

**Engineering Technicians (EngTech)** are involved in applying proven techniques and procedures to the solution of practical engineering problems. They carry supervisory or technical responsibility, and are competent to exercise creative aptitudes and skills within defined fields of technology. Professional Engineering Technicians contribute to the design, development, manufacture, commissioning, operation or maintenance of products, equipment, processes or services.

To become a CEng, IEng or EngTech a candidate needs to demonstrate competence and commitment through appropriate academic qualifications, experience and training, by an assessment which may involve writing a dissertation, attending an interview or sitting an examination, and by membership of a Licensed Member organisation. CEng or IEng registration will usually require a professional review interview, undertaken by two trained representatives of the Licensed Member. Those with full registration are authorised to use the designatory letters CEng, IEng, and EngTech as appropriate.

## **A Navigation through Non European Countries**

**Australia:** The requisite qualification for the registration of professional engineers is a **four-year** engineering qualification accredited by the <http://www.ieaust.org.au/> **Institution of Engineers**, or equivalent.. Membership is open to three occupational categories: professional engineers, engineering technologists, and engineering associates. The Standards, set by the <http://www.ieaust.org.au/membership/general.html> National Generic Competency Standards, recognise two stages of competency:

**Stage 1** is the level of competency needed for entry to practice as a qualified

member of the engineering team Applicants holding an engineering qualification which has been *accredited, recognised or approved* by Engineers Australia are immediately eligible, under Stage 1 Competence Standards, for admission as a **Graduate**, as Professional engineer with a **four-year** Bachelor of Engineering degree, or as Engineering technologist with a **three-year** Bachelor of (Engineering) Technology degree. For admission as a **Member**, as well as holding such a qualification, the applicant must be able to show that has at least **three years** experience in engineering appropriate to the occupational category.

**Stage 2** competency is the combination of Stage 1 competency with practice relevant to a field of engineering and an occupational category. Stage 2 competency has to be demonstrated to achieve **Chartered** status.

**Canada:** Engineering is regulated by self-governing professional licensing bodies. Only a Professional Engineer (P. Eng., <http://www.peng.ca>) is licensed to practise engineering. According to the **Canadian Council of Professional Engineers**, <http://www.ccpe.ca/e/index.cfm>, the license requires three steps:

1. Obtaining a Degree From an Accredited Engineering Program
2. Registering as an engineer-in-training. Upon registration, newcomers will be known as an *Engineer-in-Training (EIT)* or *Member-in-Training (MIT)*.
3. On-the-job experience in the form of an internship. Minimum two to four years.
4. Taking the *professional practice exam* or *professional examination*. There is a National Professional Practice Exam.

**Japan:** Engineering education in universities provides fundamental training needed for entry-level engineers. An accreditation system, <http://www.jabee.org/english>, JABEE, was established in 1999 as a non-governmental organization to conduct accreditation processes of engineering programs with the close cooperation of relevant engineering societies. Introducing domestic professional qualification compatible with international standards, there is a new Law which defines procedures to obtain and maintain the qualification of Professional Engineer. The procedures consist of Primary Examination, at least four years of training and practice (IPD), Final Examination, registration of PE, and requirement for Continuing Professional Development, CPD. Graduates of accredited engineering programs are exempt from Primary Examination, since the fundamental capability as an entry-level engineer is assured by the program itself. The requirements and procedures are compatible with international engineering qualifications such as APEC Engineer or IMF International Engineer.

**New Zealand:** The Chartered Professional Engineers (CPEng) Register was established in 2002. It lists engineers regarded as currently competent for professional engineering practice in New Zealand. Competence standards are established on the basis of many years' experience and are benchmarked to international best practice. On behalf of the engineering profession, the Institution of **Professional Engineers New Zealand**, IPENZ, <http://www.ipenz.org.nz>, is the professional body which represents professional engineers from all disciplines. IPENZ uses a range of tools to assess competence, including peer review, to assess applicants' achievement of the competence required for each listing on any particular register. It is necessary to be a CPEng to fulfil the requirements of the Government regulations for certain types of work.

Registration as a CPEng enables the use of the title Chartered Professional. To become a CPEng, applicants must hold an IPENZ accredited qualification, a qualification recognised by an engineering educational agreement or an engineering qualification otherwise recognised by IPENZ. They also need to have 4-5 years experience working as an engineer or technologist, in which they have developed engineering competency.

**USA:** In the United States, each individual State licenses or registers engineers, and through that registration or licensing, it is the State that regulates and controls engineering practice. Each States' laws typically include a statement of the purpose of that regulation and control, similar to the following: ". . . to safeguard life, health, property, and public welfare. The National Society for Professional Engineers <http://www.nspe.org/> (NSPE) is a not-for-profit, private professional organization that acts on behalf of its members. Not all practicing engineers are members of the NSPE, and no State requires NSPE membership as a condition of being registered or licensed, or as a requirement for practicing engineering. The same is true of other private professional organizations, such as the ASCE for the civil engineer disciplines, ASME for the mechanical engineering disciplines, or the AIA for architects. Members of NSPE are Engineer Interns (EI)/Engineers in Training (EIT) or graduates of an engineering program accredited by the Accreditation Board for Engineering and Technology, ABET, or international equivalent. ABET, Inc., <http://www.abet.org>, the recognized accrediting body for college and university programs in applied science, computing, engineering, and technology, is a federation of 30 professional and technical societies representing these fields. ABET accredits some 2,500 programs at over 550 colleges and universities nationwide. In 1997, following nearly a decade of development, ABET adopted Engineering Criteria 2000 (EC2000), a new approach to accreditation criteria focused on what is learned rather than what is taught.

The profession regulates the professional engineer (P.E.) practice, and by law, many jurisdictions require engineers to be licensed as P.E. in order to practice. In general, there is a four-step process required to obtain engineering licensure:

1. Graduating from an ABET-accredited engineering program.
2. Passing the first exam, the Fundamentals of Engineering (FE).
3. Gaining engineering experience.
4. Passing the second exam, the Principles and Practice of Engineering (PE) .

Once granted licensure, the holder may use the distinguished designation "professional engineer," or P.E.

## **International Engineering Agreements <http://www.ieagreements.org>**

There are six international agreements governing mutual recognition of engineering qualifications and professional competence. The body making application must verify that it is the appropriate representative body for that country/economy.

### **Agreements covering tertiary qualifications in engineering**

*Washington Accord* <http://www.washingtonaccord.org>: The first in establishing that graduates of programs (normally of four years) accredited by each member nation are prepared to practice engineering at the entry level. Signatory Organizations: Institution of Engineers, Australia 1989, Canadian Engineering Accreditation Board 1989, Hong Kong Institution of Engineers 1995, Institution of Engineers of Ireland 1989, IPENZ,

New Zealand 1989, Engineering Council of South Africa 1999, UK Engineering Council 1989, ABET, 1989, USA.

*Sydney Accord* <http://www.ieagreements.org/Sydney/default.cfm>

Signed in 2001 by the national engineering organisations of Ireland, UK, Canada, South Africa, Hong Kong, Australia and New Zealand., this agreement provides joint recognition of academic programmes (normally of three years) accredited at Incorporated Engineer level. It operates in a similar way to the Washington Accord.

*Dublin Accord* <http://www.ieagreements.org/Dublin/default.cfm>

Signed in May 2002 by the national engineering organisations of UK, Ireland, South Africa and Canada for substantial equivalence in the accreditation of tertiary qualifications in technician engineering (normally of two years).

### **Agreements covering competence standards for practising engineers**

The other three agreements cover recognition of equivalence at the practising engineer level i.e. it is individual people, not qualifications that are seen to meet the benchmark standard. The concept of these agreements is that a person recognised in one country as reaching the agreed international standard of competence should only be minimally assessed prior to obtaining registration in another country that is party to the agreement.

*APEC Engineer agreement* <http://www.ieagreements.org/APEC/default.cfm>,

In place since 1999 among a number of Asia-Pacific Cooperation Countries, APEC countries for the purposes of recognising “substantial equivalence” of professional competence in engineering. APEC countries can apply to become members of the agreement by demonstrating that they have in place systems which allow the competence of engineers to be assessed to the agreed international standard set by the APEC Engineer agreement. The economies which have been assessed as having the systems in place to operate an APEC Engineer Register include New Zealand, Australia, the United States, Malaysia, Hong Kong (China), Japan, Korea, Canada and Indonesia.

The representative organization in each economy creates a "register" of those engineers wishing to be recognised as meeting the generic international standard. Other economies should give credit when such an engineer seeks to have his or her competence recognised. The Agreement is largely administered between engineering bodies.

*Engineers Mobility Forum agreement:* It operates since 2001 the same competence standard as the APEC Engineer agreement but any country/economy may join. The parties to the agreement are largely engineering bodies. There are intentions to draw EMF and APEC closer together. <http://www.ieagreements.com/EMF/default.cfm>

*Engineering Technologist Mobility Forum:* signed by participating economies/countries in 2003, which have agreed to commence establishing a mutual recognition scheme for engineering technologists. <http://www.ieagreements.com/ETMF/default.cfm> was.

### **International Register of Professional Engineers**

This Register is governed by the Engineers' Mobility Forum, which consists of the

national engineering organisations of Australia, Canada, Hong Kong, Ireland, Japan, Korea, Malaysia, New Zealand, South Africa, UK and USA. Entry to the Register, which began operation in 2002 is open to engineers who, been assessed within their own economy as eligible for independent practice:

have an academic qualification equivalent to an accredited degree

have seven years post-graduation experience

have spent at least two years in responsible charge of significant engineering work

are maintaining relevant continuing professional development at a satisfactory level.