WFEO

Mobility of Engineering Professionals

Up-dated Information paper on mobility prepared for WFEO Standing Committee on Education In Engineering (CEIE)

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Dedication

This work was initiated by the late Hisham A Malik Al-Shehaby, whose foresight and dedication to the profession and international cooperation were an example and an inspiration to us all.

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Summary

World Federation of Engineering Organisations (WFEO) in its pre-eminent position in the engineering profession has a key role to play in the understanding, around the world, of the formation and assessment of engineers. Representing its members to major international agencies, it is ideally placed to facilitate exchanges between:

1. The organisations that set the engineering-education standards for accreditation and the assessment of professional competence
2. The employers of engineers and users of engineering products and services and
3. Other organisations affected by the quality and number of professional engineers.

WFEO members want to understand the standards (quality marks) and the assessment (benchmarking) of engineers. They approved WFEO's policy on Accreditation and the Mobility of Engineering Professional in 2009, and confirmed WFEO's role in assisting its members in this matter.

This paper is about what engineering mobility means. It goes on to talk about the position WFEO has adopted taking account of its opportunities, responsibilities and resources. The late Hisham Shihabi initiated this work for the WFEO standing Committee on Education and Training (CET, now CEIE) This up-dated paper reports progress up to the August 2011. The importance the related work of other WFEO standing committees is also described.

Acting as a central information source and facilitator between international organisations, WFEO is taking a significant step towards achieving its goals by contributing to accreditation and mobility.

A simple model of the engineering profession is described and offered as a guide in considering aspects of an engineer's career.

The paper introduces the topic of professional engineering mobility with some suggestions about what sort of engineer in needed and describes the organisations around the world that are working to ensure such engineers are assessed to appropriate standards.

These major accreditation and assessment organisations have widened their memberships, reviewed standards, the European Accredited Engineer (EUR-ACE) qualification has been implemented and the organisations are cooperating to achieve equivalence.

The stakeholders in professional engineering mobility are very different and have widely varying needs. Individual engineers have many reasons for becoming recognised professionals, which can affect both users and providers of engineering products and services. Some will be interested in international employment, while others will remain in their own country or region. The

success of aid and loans for capacity building is often dependent on local or imported engineering expertise.

The Bologna Process in Europe intensified global discussion in organisations responsible for the:

1. Quality and standards of university programs and,
2. Impact on the assessment of engineers for independent practice.

These discussions will also have an impact on regional education of engineers. Engineering technologist and technician organisations are also monitoring the global debate.

Cooperation is very important among participants in these activities, including single-discipline institutions. Their learned society activities and publications are critical to the development and acquisition of knowledge. WFEO has its own central role to play. WFEO can add value to what other organisations are doing and ensure a voice for its members who want to improve their engineering capabilities and access to information.

Finally the paper revisits the question of life-long-learning and whole-of-career development. The debate so far only touches on the first quarter of an engineer's career. We need to spread the techniques and benefits of standards and assessment to the other three quarters.

Introduction

In 2009 WFEO approved a policy on the mobility of engineering professionals was prepared based an information paper written for a working group of the Committee on Education and Training.

In adopting the policy WFEO positioned itself to:

1. Publicise what the various regional and global accreditation and assessment organisations were doing
2. Cooperate with the organisations to facilitate WFEO member involvement and
3. Inform international agencies in its representative role.

Since material was gathered for that first information paper much progress has been made. Major changes have occurred in accreditation and assessment. WFEO members' interest has increased and most WFEO meetings and major engineering education congresses have had sections on mobility. During formal visits of the last two WFEO presidents mobility has been a critical topic.

WFEO members want more information to help work towards adopting international standards or against which to test their standards. And a need for regional standards has emerged.

Related work has also progressed. WFEO is revising its Code of Ethics. Its Committee on Anti-Corruption is firmly established and encouraging development of much needed material and training. The WFEO Committee on Capacity Building has produced Capacity Building Guidelines that cover physical infrastructure but also include institutional and intellectual capacity building.

The world has recently suffered more national and man-made disasters with increasing frequency and intensity. Climate change causes increasing concern about planning and mitigation. Disaster response and climate mitigation have become global initiatives involving many professionals including engineers. Professionals, including engineers, must be competent to deal with these problems or to go into disaster areas. Candidates holding internationally recognised certification can be assessed more easily and quickly, depending on jurisdiction, particularly in the case of disaster work.

Engineers are still in short supply in many countries. Many sectors including mining, energy and transport need mobile engineers. Geographic distribution of engineers is also affected by economic and conflict migration adding to the need for further recruitment, education and training and assessment.

The above factors continue to affect activities of the development banks and other international agencies like the World Trade Organisation. Good engineers are needed to satisfy all the above demands.

To produce these engineers we must have good educational institutions and training arrangements and some measures of performance. And because Engineering is a global profession — changing with time and place — we must be able to compare education and training in different locations. This needs to be done despite the on-going skills shortages in some countries and whether engineers are in plentiful or short supply.

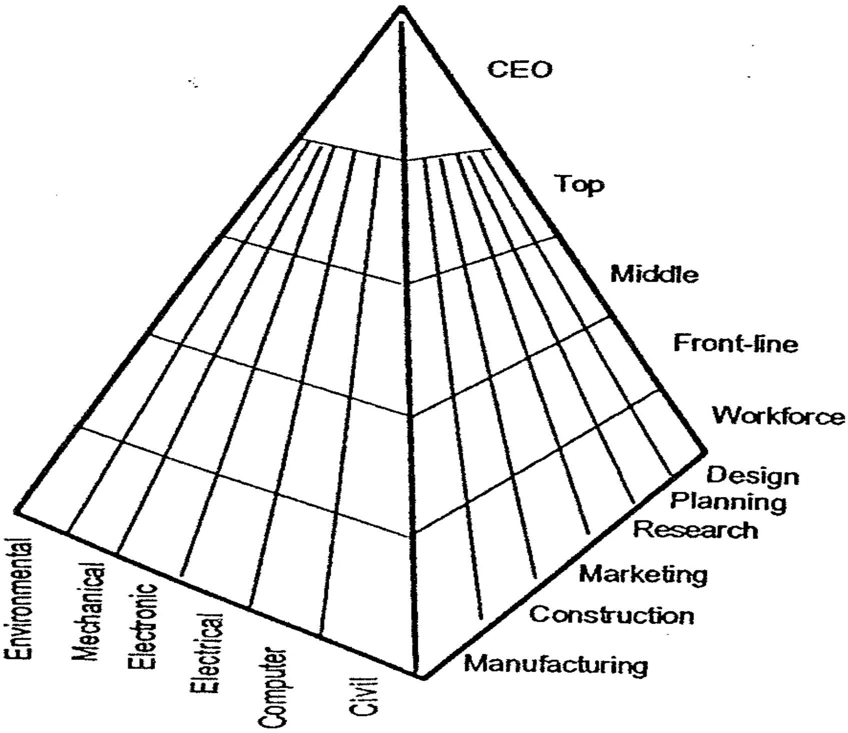
The first information paper, the mobility policy document and a paper on global professional engineering mobility presented last year in Buenos Aries formed the starting point for this up-date. Both papers are on the WFEO web site under the "Committee on Education in Engineering (CEIE)" formally CET.

What is an Engineer and why should they be assessed for professional practice.

Engineers must be well educated, well trained and practice competently — technically, ethically and without corruption. And this must continue over the whole of their engineering careers.

When discussing engineering education, training, CPD and life-long-learning it helps to have a picture in mind of the engineering environment in which the recipients will work.

The Engineering Pyramid



Note to diagram: The management categories up the far corner may include technical as well as general management, with leadership skills essential in both streams. See whole-of-career diagram in Life-long learning section.

The diagram is a traditional view of engineering showing the many engineering disciplines and industries. The disciplines are less relevant these days. Most engineers identify with their speciality.

Engineers generally work in teams, often multi disciplinary, with technologists and technicians and perhaps professions like medicine, science and the law.

Management structures still tend to be hierarchical. The trend is towards fewer levels and flatter organisation charts. New technologies and thinking may need other approaches especially in the increasing number of smaller organisations.

List of reasons why engineers want to achieve recognised professional standing, nationally or internationally

1. To become registered and capable of doing or signing-off particular engineering work, which is often covered by legislation. The main reasons for regulation via registration are where the engineering work affects public safety or where the recipient of the engineering work has little or no engineering knowledge. The latter reason is common to many professions and is sometimes called Asymmetry of Knowledge — the client knows much less than the professional and needs protection.

2. To do any work requiring an engineer in those countries where the title "engineer" in legally protected.
3. To use it in an immigration application for which an internationally recognised degree may be a pre-requisite for engineering work.
4. When individual engineers want the personal satisfaction of knowing they have achieved a certain standard. They also avoid having to assert their competence or having to justify it with each new employer or client.
5. Companies want to measure their engineers in an independent system.
6. Governments and companies can satisfy themselves that companies have the appropriate intellectual capital and human resources to complete engineering projects.
7. Development and funding agencies can satisfy themselves that the engineering-human-resource risk of funding engineering projects is acceptable.
8. Professional standing includes a commitment to practice ethically and competently.
9. Managers, banks and insurance companies want to reduce engineering risk.
10. Specific skills are indentified in professional recognition, which may not be clear from the engineer's qualification title or main discipline.
11. To work in disaster relief.
12. Work in certain industries like nuclear power engineering that are becoming more regulated.

The original list has grown, with conflicts and the engineering-skills crisis still affecting migration.

Accreditation and Mobility

In the context of this paper:

- Accreditation means the accreditation of university engineering courses or programs, the attributes of the graduates from the programs and the peer assessment of the equivalence of those programs internationally,
- Mobility means the movement around the world of engineering professionals, capable of independent practice having met the requirements for licensing or registration.

The major organisations leading the way on international accreditation and assessment for mobility at the moment are:

1. The International Engineering Alliance of several accords and forums (IEA), globally,
2. The European Federation of National Engineering Associations (FEANI), increasingly global and
3. The European Network for Accreditation of Engineering Education (ENAEE), which is the body responsible for operating the Accreditation of European Engineering Programs (EUR-ACE) Framework in Europe and neighbouring countries and now looking globally.

They are examples of multi-lateral agreements. Both IEA and FEANI have been involved for decades and ENAEE since 2004. Tables of the countries (or jurisdictions) are shown in Attachment 1.

Accreditation

The present measures of an internationally acceptable qualification for engineers are the standards set by:

1. IEA's Washington Accord (WA) accredited degree and
2. ENAEE's European Accredited Engineer (EUR-ACE) degree.

Other, regional, organisations have an interest in accreditation. Some are moving towards a system that will produce degrees to the Washington Accord or EUR-ACE standard.

Bigger countries, with perhaps a thousand universities, have difficulty achieving general quality control. Only a proportion of their universities may be accredited to an international standard. Washington Accord and ENAEE recognise programs or subsets of programs. They also guide and mentor countries working towards becoming signatories.

The Sydney and Dublin Accords — IEA members — benchmark and recognise qualifications for engineering technologists used by the Engineering Technologists Mobility Forum. In the future there may be a Forum for Engineering Technicians. Various groups including the Regional Council of Engineering Technology Organizations and other Caribbean associations are closely monitoring these arrangements.

Washington Accord

The Washington Accord, signed in 1989, is an international agreement among bodies responsible for accrediting engineering degree programs for entry to professional engineering practice. The accord recognizes the substantial equivalence of the graduate outcomes of programs accredited by those bodies, and of the accreditation processes used. Signatories agree to recognize graduates of programs accredited by the accreditation systems of the signatory bodies as having met the academic requirements for entry to the practice of engineering in their own jurisdiction. There are now fourteen signatories, with more than 6,300 accredited programs and six provisional signatories.

The Washington Accord emerged to badge good engineering graduate qualifications and improve the comparability between them. The Accord has led to an internationally-agreed qualification standard. The standard is expressed in outcome terms as a generic Graduate Attribute Exemplar, devised and agreed by the Accord signatories. Outcomes-based accreditation is consistent with contemporary higher education practice. The exemplar and its constituent attributes can be viewed on the IEA website.

First published in 2005, the exemplar was revised in 2009 to include higher expectations of knowledge, engineering-application ability and personal qualities. Engineering degrees that meet the exemplar are expected to be of four to five year's duration post secondary school, with most signatories currently accrediting degrees of four years duration.

Some individual Accord signatories have moved towards longer-duration programs, mostly with a master's level degree award, to meet the revised exemplar and local needs.

All the signatories have agreed to revise their accreditation systems to use the new exemplar and to fully implement the changes by 2019.

The Washington Accord and ENAEE (see below) have also started discussions to reach a common understanding of the similarities and differences between the IEA accreditation standards — expressed in the Graduate Attribute exemplar — and the EUR-ACE framework standards for both first- and second-cycle engineering awards. The main task to date has been to compile a common Glossary of Terms (in English) used in engineering accreditation and engineering education.

In comparing awards the emerging picture is complex. There is no single mapping of first- and second-cycle degrees, study durations, and award nomenclature amongst EUR-ACE authorised Agencies. There are similar variations amongst IEA members (noting that three of the seven EUR-ACE Agencies members are Washington Accord signatories and a further two are provisional members). Nevertheless, both the IEA Graduate Attribute Exemplar and the EUR-ACE Framework Standards allow individual jurisdictions to assess the level of their awards and accreditation systems.

Degree-program outcomes that describe what a graduate must know or be able to do, are the threshold level to be attained by a graduate.

The challenge in outcomes-based education and accreditation is to have clear statements that describe the outcomes, so that the statements for different programs and from different providers can be compared consistently in accreditation processes.

The Washington Accord might consider reviewing the extent and formality of industry involvement in setting standards and attributes. This is raised below in the ENAEE section.

European Network for Accreditation of Engineering Education (ENAEE) and the Bologna Process

The 1999 Bologna Declaration by the European Higher Education Ministers started the so-called "Bologna Process", covering all university disciplines. ENAEE activities and the EUR-ACE accreditation system can be considered an offspring of the Bologna Process: thus, the Bologna Process' effect on engineering education has been consolidated into an internationally-recognised accreditation system.

The first phase of the Bologna Process ended in 2010: the Budapest-Vienna Conference of HE Ministers recognized that the European Higher Education Area (EHEA) had been established in 47 countries, all parties to the European Cultural Convention, including the European Union (EU) countries. A new 10-year phase has begun which will see further developments and moves to extend and consolidate the objectives of the Bologna Process.

The Bologna Declaration in 1999 grew out of a:

1. Drive to increase the international competiveness of European System of higher education
2. Need to reach "a system of easily readable and comparable degrees" among the national HE systems, avoiding at the same time the "uniformity" of the historically different systems,
3. Need to improve quality control and
4. The ability of students to transfer between institutions.

Academic staff would also find it easier to move between institutions. Transferability would also be more attractive to students from outside the EU.

In this context, in 2004 the European Commission approved and supported the European Accredited Engineer (EUR-ACE) project proposed by ENAEE's predecessor. At the end of this project, ENAEE (European Network for Accreditation of Engineering Education) was formed in 2006 by 14 associations concerned with engineering education accreditation in Europe. The EUR-ACE project has been followed by other EC-supported projects: among them, EUR-ACE IMPLEMENTATION (2006-2008) and EUR-ACE SPREAD (2008-2010).

The EUR-ACE projects have developed a decentralized European system for accrediting engineering programs based on the EUR-ACE Framework Standards (EAFS) and the EUR-ACE quality label — a registered trademark owned by ENAEE. The EUR-ACE system is coordinated by ENAEE and includes countries outside the European Union (but in the EHEA).
In 1999 the prevailing international engineering first-degree course was four years long. In some countries this was a single program. In other countries the degree could have a duration from 3 to 5 years or more and even be split into two periods with two awards. The latter situation was common in continental Europe. At the same time accreditation agencies were moving from duration and content, to outputs based on the attributes expected of an engineering graduate.

The Bologna Process and EUR-ACE spurred the development of the European two-cycle model for engineering degrees. The first-cycle award is most often a three-year award followed by a two-year second-cycle award, which not all students will do. The model became a talking point around the world in discussions about reform in engineering degree programs. A key requirement is that the first-cycle award should have a useful occupational outcome and not be just a pathway to the second-cycle award.

The 3 + 2 model in particular has stimulated debate about what knowledge an engineer should have to be called an engineer, how long it should take for this to be taught (and learned?). Accreditation agencies began listing the attributes that an engineering graduate should have and some thought was given to what industry needed an engineer to do.

There was a perception that not enough was being taught therefore the program was too short. In industry there was confusion about the difference between education and training. And many of us kept hearing the easily said but rarely explained phrase “capable of hitting the ground running”. The direct involvement of industry written into the Bologna Processes should permit industry to help establish what engineers should know, when in their career is it needed, and program duration. Employers of engineering graduates should also have an opportunity to comment on the design and monitoring of degree programs.

In the EHEA, awards were defined in terms of two and now three cycles. At the end of each cycle the graduate emerges with a “First Cycle (Bachelor) Degree”, “Second Cycle (Master) Degree” or a Doctoral Degree. Typical durations are 3, 2 and 3 years respectively, but such durations are not prescribed (the requisites are output-based) and significant variations exist. The cycles are described in a table of descriptors, known as “Dublin Descriptors”, that can be found at the address in the website list. They are generic, covering all disciplines.
More detailed descriptors (or “attributes”) are emerging for individual disciplines: in particular for engineering the already quoted “EUR-ACE Framework Standards for the Accreditation of Engineering Programmes” (EAFS), available on the ENAEE website. (For details on the EAFS objectives, see also the ENAEE General Policy Statement on the same website.)

EUR-ACE accreditation is based on national accreditation agencies’ programs that meet national standards, compatible with legislation, and also the EUR-ACE Framework Standards (EAFS). The EUR-ACE label can then be awarded in addition to any national award or label: ENAEE authorizes appropriate Agencies to award the EUR-ACE labels at the First and/or Second Cycle level.

As of July 2011 there were nearly 800 programs (about 300 first cycle and 500 second cycle) EUR-ACE-accredited by agencies in seven countries participating in the Bologna Process. The plan is to include in the EUR-ACE system more EHEA countries as time and resources permit. At the time of writing (July 2011), ENAEE has received six new applications from Agencies seeking to be authorized to award the EUR-ACE labels.
The Bologna Process participants have a strategy to take the process worldwide. Keep in mind that the process covers all disciplines. The strategy is intended to facilitate mobility through the fair recognition of qualifications, strengthen cooperation based on partnerships, promote the attractiveness and competitiveness of European Higher education and improve communication.

ENAEE intends to follow a similar approach particularly with respect to the mobility and employment of European students and graduates. The approach will be broad including:

- The possibility of extending the EUR-ACE system to more countries or EUR-ACE-like accords outside the EHEA and
- Cooperation with other international initiatives such as the International Engineering Alliance and the Washington Accord, with which cooperation has already begun.

The possibility of mutual recognition between EUR-ACE and other degrees also seems to be within the scope of ENAEE's plans.

The ENAEE process is limited to engineering degrees at the moment compared with IEA's three accords covering the engineer-technologist-technical continuum.

Regional Accreditation Activities

Some regional groups are trying to set their own appropriate standards, which may not necessarily aspire to an international standard. In pursuing a WA/EUR-ACE standard others have difficulties perhaps more related to language and access barriers than their own standards and institutions. The international debate on whether or not to raise the standard or add further learning to programs has a further effect on regional groups. However, a very important reason for having international standards, applicable to some of the engineers working in a country, is to have some control over engineers coming into the country.

Engineering For the Americas (EftA)

(EftA) was created to promote economic and social development through quality engineering education and hemispheric collaboration. This movement was approved by the highest authorities in science and technology of the Americas in the *Lima Declaration*. See EftA website.

The Inter-American Development Bank (IADB) Regional Public Goods Initiative and other partners funded two engineering education programs:

(a) A Regional Program of Education for Development of Capacity in Innovation, Technology and Entrepreneurship in Faculties of Engineering, represents a significant shift in the formation of new engineering graduates. The Federal Deans Council of Argentina; the Association of Engineering Schools of Brazil; and the Council of Deans of Faculties of engineering of Chile and Uruguay are cooperating in this effort.

(b) A Caribbean project to develop and adopt a regional engineering-accreditation system for engineering programs called the Greater Caribbean Region Engineering Accreditation Scheme (GCREAS), with a view to:

- Developing a better qualified engineering and technical workforce,
- Facilitating mobility of both people and work,
- Encourage more cross-border activities,
- Enable the engagement of international companies, and
- Greatly enhancing the ability to attract foreign direct investment.

The imitative, involving several countries in the Greater Caribbean Basin was completed in 2007.

It is worthy of note, that there is a Caribbean Region of the World Federation of Technology Organisations (WFTO), which has an interest in articulation and cooperation with the IEA. The Caribbean Accreditation Council for Engineering Technology (CACET) already administers an accreditation system for engineering Technologists in the region.

The Federation of Engineering Institutions of Asia and the Pacific (FEIAP)
FEIAP is moving into the field of accreditation to help some of its members improve their standards.

FEIAP established a task force to help members countries set up or improve formal accreditation systems. A manual has been produced which may be transferable to other regions in similar circumstances. Member jurisdictions already have national engineering institutions.

North Korea
A small but interesting development project in quality control, reported in the Summer 2010 Issue of Prism, is notable. North Korea is reported to have good engineers in several heavy engineering disciplines but struggles with IT. Syracuse University in America and Kim Ch'eak University began in 2002and has included exchanges of staff, students and materials including a summary of Accreditation Board of Engineering and Technology (ABET) Standards. ABET advises on accreditation in many countries and is a signatory of the Washington Accord.

Union Panamericana de Asociaciones de Ingenieros (UPADI)
UPADI has members in North, Central and South America. Its activities include an interest in accreditation and mobility. UPADI provided the information above on Engineering for the Americas projects, which comes from Attachment 3 where there is more detail.

Cross borders/helpful neighbour
The Washington Accord has rules to allow a signatory to accredit a limited number of a neighbouring country's engineering programs under special circumstances. The rules apply to a country that has only a small number of universities and is unlikely to be able to establish an accreditation system for many years. A university that can demonstrate the international standing of its engineering programs may be accredited by the Washington Accord signatory and the programs listed on the signatory's website as being of Washington Accord standard.

Engineers Canada via the Canadian Engineering Accreditation Board (CEAB) carries out substantial equivalence evaluations of other countries accreditation systems. The American Accreditation Board for Engineering and Technology (ABET) has a broader international outreach program. There is more detail in

Attachment 3. Both Engineers Canada and ABET are Washington Accord members.

The EUR-ACE Process has similar but more formal and extensive plans to help countries in the European Higher Educational Area.

Mobility

Professional Assessment and Mobility

Types of regulation

National regulatory systems are the backdrop to assessment of professional engineers. There are three main types of regulation of the professions: Government regulation, Co-regulation and Self-regulation:

Government regulation is usually administered by government employees and may be apply to all engineers or to engineers in certain employment categories. Controlling boards may include members from the profession. Complaints and discipline may be administered independently or by government.

Co-regulation involves government and the profession in a partnership. Government is responsible for legislation, which is administered by the profession. Complaints and discipline may be provided independently. If legislation only covers part of engineering activity the profession will have complaints and disciplinary procedures for its members involved in the remaining activities. These procedures may be acceptable to government for the regulated activities.

Self-regulation also has government legislation but individual engineers or companies are themselves responsible for compliance, which is policed separately.

All three processes are subject to legislation but not necessarily funded by governments. The extent of government involvement in the accreditation and professional assessment processes varies significantly. The engineering profession experiences all three approaches around the world with variations around the three main themes. Governments may fund part of the processes, though in most jurisdictions the intellectual input comes from the members of engineering learned societies. Universities usually pay for the accreditation of their programs.

The arrangements for mobility present a similar picture to that of accreditation. The Engineers Mobility Forum (EMF), which is a non-government arrangement, and the Organisation for Asia Pacific Economic Cooperation (APEC) Engineer Forum are part of the IEA. The APEC Engineer Forum was established by governments and is managed on their behalf by the profession. FEANI, the organisation of European national engineering institutions, is a non-government organisation managed by member countries.

European Federation of National Engineering Associations (FEANI)

FEANI has 31 European member countries that meet the membership criteria. Each country is represented by either the major engineer organization or by a committee of several engineer organizations in that country. The organization IMI (Republic of Macedonia) is a Provisional Member since 2011 and has applied for full membership as of 2012 to the FEANI General Assembly that will take place on 9 September 2011.

In Europe FEANI operates its own European Register of engineers who have achieved the EUR ING title. The FEANI Register contains 31,343 European engineers (status July 2011). Within the European Union (EU) the competent authorities of the Member States administer the legal mobility arrangements. However, the European Commission recognises the FEANI Register as "as an excellent example of self-regulation by a profession at European level" providing "a model for other professional groups in the technical and scientific sector".

Entry to the Register is based on completion of an acceptable high-school course plus a minimum of seven years formation (education, training and experience). Formation must include a minimum of:

- Three years engineering education
- Two years relevant engineering experience and
- Two years may comprise a mixture of training, more education or more engineering experience.

The details including defined terms are explained in the Guide to the FEANI Register (see FEANI web site).

International (out of the FEANI area) engineering or maths and science qualifications may be accepted for registration provided the school and programme must be on the International Section of the FEANI INDEX or confirmed by a National Member to be officially recognised in the country as equivalent to a programme on the INDEX. More relevant engineering experience is also required.

Applicants without the necessary education qualifications considered above may be considered via a competency route provided they have 15 years experience, are at least 35 years old and complete a professional review.

Successful candidates can use the designation EUR ING and their names are included in the FEANI Register, which is administered by the FEANI Secretariat General.

A European Union Directive, 2005/36/EC, aims to make it easier to practice professionally within the EU. The Professional Card is emerging as the preferred way to recognise professional and educational qualifications. FEANI is seeking recognition for the so-called engineerING card to be used to facilitate the recognition of its holders as engineering professionals.

FEANI is also campaigning for a suitable framework for the introduction of the engineerING card to be included in a revision of Directive 2005. Implementation throughout Europe would include foreign qualifications and facilitate professional engineering mobility of engineers from Europe and abroad.

Engineers Mobility Forum (EMF)

EMF members have full rights of participation in the agreement; each operates a national section of the International Professional Engineer (IntPE) register; registrants on these national sections may receive credit when seeking registration or licensure in the jurisdiction of another member. There are fifteen full members with 10,198 registered engineers. Entry to the register requires a nine years experience and training, including two years in charge of significant engineering work and a Washington Accord or equivalent degree. Applicants are assessed against professional engineering competencies which can be seen on the IEA website with the degree attributes.

Provisional Forum Members have been identified as having competence-assessment systems developing towards equivalence to those of full Members; they do not operate national sections of the International Professional Engineer register. There is one provisional member.

IEA also has a forum for Engineering Technologists

APEC Engineer Agreement

Fourteen of the 21 countries and jurisdictions of the Asia and Pacific Economic Cooperation forum (APEC) agreement are members of the APEC Engineer agreement for the purpose of recognizing "substantial equivalence" of professional competence in engineers in their jurisdictions. APEC countries can apply to become members of the agreement by demonstrating that they have systems in place, which allow the competence of engineers to be assessed to the international standard set by the agreement.

APEC Engineers are assessed in their own jurisdiction as professional engineers eligible for independent practice, who have gained a minimum of seven years experience since graduation, and spent at least two years in responsible charge of significant engineering work.

Listing on the APEC Engineer register ensures that professional engineers have the opportunity to have their professional standing recognised within the APEC region thereby contributing to the globalisation of professional engineering services. This is of particular benefit to engineering firms that are providing services to other APEC economies but it also adds value to individuals who may wish, at some stage, to work in these economies. Each member economy of the APEC agreement has given an undertaking that the extra assessment required to be registered on the local professional engineering register will be minimised for those registered under the APEC Engineer agreement.

Members of the agreement have full rights of participation in the agreement; each operates either a national section of the APEC Engineer register or a national section of a combined APEC Engineer/International Professional Engineer (IntPE) register; registrants on these national sections may receive credit when seeking registration or licensure in the jurisdiction of another member.

There are fourteen authorised economies (the APEC Engineer Manual (2009) does not provide for provisional members), with 5,876 registered engineers. There are ten members in both EMF and APEC Engineer.

General observations

1. Data at mid-2011 shows that Engineers Ireland, which is not a member of APEC Engineer, has 6,650 engineers on its section of the IntPE register. Ireland actually reported 10 on its EMF IntPE section at International Engineering Meetings (IEAM) 2011
2. ECUK reports 66 IntPE (UK), 55% of whom live outside UK; and
3. ECSA reports 17 IntPE (ZA)
4. IESL reports 63 IntPE (SL)
5. IEIndia reports 35 IntPE (Ind)
6. IPE Japan has 500 engineers on the IntPE register and 2,589 engineers on the APEC Engineer register
7. New Zealand reports 1472 registrants on a combined EMF/APEC register
8. NCEEES (USA) reports 219 IntPE
9. Engineers Australia reports 400 on the APEC register

Thus it can be seen that the international registers are apparently most used by those countries where international mobility of engineers occurs most frequently. The IEA mobility agreements are currently (2011) investigating restructuring to achieve greater usefulness and better penetration.

It is worth noting that the main thrust of accreditation and mobility movements is to produce engineers who can market their skills internationally. Little if any evidence is available, but those involved think that only about 20% of engineering work internationally requires engineers to be registered. Data is needed to get a better understanding of the proportion.

At the extremes within the International Engineering Alliance,

1. Canada requires all engineers to be registered, including engineers in training
2. Engineers Australia operates a voluntary register that is recognised in some Australian jurisdictions. Registration is mandatory for engineers working unsupervised only in the state of Queensland.

Many Asian economies require independent consultants to be registered and may require registered engineers to be residents.

Eligibility for inclusion in forum registers

Formation is the preparation of an engineer for independent professional practice post secondary school comprising education, training and experience.

The three organisations described above have similar requirements for formation, personal recognition and registration. Applicants must meet educational, training and relevant professional engineering experience requirements. The table shows how candidates can meet the requirements. It is illustrative only. See organisation websites or papers in the bibliography for details.

Organisation	Degree:	Training or more U or E	Experience: Years	Total: Years	Competency route
APEC Eng	4U*		****	9	Yes
EMF	4U*		****	9	Yes
FEANI	3U** to 5U	***2	2E**	7	Yes, 15 E, >35 age

U, T, E represent one year of university, training and professional engineering experience respectively
* Washington Accord or equivalent, duration under review
** Minimum
*** Comprising: Two years of additional U, additional E or T
**** Must include 2 years in charge of significant engineering work.

The duration and content of degrees is being debated in the USA. The 4 year bachelor program seems to be favoured by a number of learned societies, while the National Council of Examiners for Engineering and Surveying (NCEES) favours a master degree or bachelor plus 30 additional hours “in keeping with the current thinking of the international licensure community”.

Although some countries are going to a five-year or master requirement the output based approach to degrees is retained and graduates must acquire the internationally accepted attributes of the accreditation accords. FEANI has so far retained the option of a three-year degree plus additional formal training/professional experience. The FEANI approach might also offer a solution to industry’s need for further content that is not necessarily provided in an engineering school.

The training and experience requirements are also similar, varying mainly in the number of years of experience or seniority.

Decisions are yet to be reached, but the organisations are seeking common ground from which might emerge a set of criteria that all organisation members can meet in their own way. Significant work was reported at the IEA 2011 meetings on a common glossary of terms that could be used to improve understanding between Europe and IEA. Turkey (MUDEK) reported analysis of criteria placing Washington Accord between EUR-ACE first and second cycle requirements of graduates.

All individuals need to be on the register of a member jurisdiction. EMF organizational membership is open to any jurisdiction that can meet its criteria. FEANI and the APEC register require organizational members to be part of their geographic regions.

Multi-lateral recognition agreements do not yet provide complete freedom of mobility. National requirements may prevail although even in those cases, listing on one of the three registers may satisfy most if not all requirements.

Reliance on bi-lateral mutual recognition agreements will therefore remain for a number of years until the special requirements of individual countries are minimised or removed. Mutual recognition agreements or mutual exemption agreements also help engineers seeking non-regulated engineering work even in a regulated environment.

Details of the organisations I have mentioned can be obtained from their websites, listed in the bibliography. Lists of members of the accords and forums are shown in Attachment 1.

Global activities

Cooperation

Most of the stakeholders with an interest in the mobility of professional engineers want to see the sort of professional engineers described here working around the world regardless of where they received their education and training. This will only happen with recognition and respect for the comparable assessment processes of different economies and jurisdictions working towards global mobility of professional engineers.

Every country reserves the right to accredit engineering programs and regulate engineering practice in its own way. Apart from national pride there are other reasons including the:

1. Population of engineers,
2. Stage of development of its education and training sector,
3. Volume of engineering work and the proportion to be regulated, which might affect a jurisdiction's choice of process and standard.

Globally we can benefit by making available examples of standards and processes for comparison and use by jurisdictions that wish to develop or improve. Differences are inevitable but they can be overcome by accepting different ways of reaching recognized educational outcomes and standards of competency in working towards mutual recognition.

There are many ways to cooperate in what is a costly and drawn out exercise. Some assistance may have to be charged but this should be separate from any assessment or regulation. It is also important to note that even in a commercial world, there is often a more widespread future benefit if organisations look beyond individual short-term gain.

Most importantly, we must remember that members of learned societies provide the majority of their work free, to help the cause of well-qualified mobile engineers.

Assessment of individual engineers by more than one accord, except in a minority of cases, is wasteful. Requiring engineers to join more than their national engineering society to register occurs even though it may not be the policy of stakeholder organisations. The practice has been an issue in some countries. It should be discontinued in the interest of maximising the benefits of international recognition and cooperation. Ensuring member understanding would help.

Role of learned societies

The scope of traditional learned-societies has evolved to include such activities as accrediting engineering courses. Societies provide expert members for teams accrediting engineering programs on behalf of the national accreditation authority. In most jurisdictions single-discipline societies are unlikely to be the national accrediting authority.

Any organisation that accredits a program across national boundaries, outside the accreditation agreement of the two countries, may undermine the overseas national accreditor's position with its government and universities. Even more worrying is that such an accreditation could leave the program with no international standing or its graduates may not be recognised and listed on the national register of either. Accreditation accords tend to have rules for cooperation across boundaries to avoid this sort of dilemma.

From time-to-time articles appear in international-single-discipline-societies' publications about wanting to be involved in accreditation or giving advice overseas. The articles I have read seem to lack knowledge of whether the society can play a role in the overseas jurisdiction's accrediting body or the society's possible adverse impact on the process.

Engineers Australia has internationally recognized and peer-reviewed accreditation processes. But in a few disciplines EA seeks benefit, for universities and their graduates, by involving overseas experts in its accreditation teams by mutual agreement. Aeronautical engineering is an example of such a discipline.

World Federation of Engineering Organisations (WFEO)

WFEO's role in mobility is described in a companion paper in this forum and on its website. Its policy involves:

1. Acting as a shop window for all mobility activity,
2. Representing national and other members' interests to world bodies and
3. Facilitating members' development through education and training, capacity building and ethical and anti-corruption practices.

Capacity building guideline 2010

This is an extract from a fuller version in Attachment 3.

At the very basis of the (Guidelines) philosophy is that there can be no sustainable infrastructure without the presence of sustainable engineering. Sustainable engineering in turn can be described as an environment in which (there are) six so-called pillars.

In terms of mobility, what (three of) the six pillars means, is basically as follows in terms of the local situation whether it be in a well developed developing country:

1. **Individual** - to ensure that the needs of the engineering practitioner are met in terms of education, training and personal career opportunities and satisfaction
2. **Institutional** – to ensure that there are educational, professional, technical, governance and statutory institutions and support structures in place, the institutions would be in both the public and private sectors.
3. **Technical** – to ensure that there are technical standards, codes of practice, technical literature, and guidance material and so forth to underpin and support ethical and appropriate engineering, technological and procurement procedures and practices.

The Guidebook is a compilation of advice supported by a compendium of programmes, initiatives, projects and examples to achieve outcomes that facilitate mobility. The mobility outcomes are not unduly competitive by nature and should build rather than break down the ability of countries to maintain an indigenous core of engineering needed to provide at least basic services for the country's citizens.

Anti-Corruption

Considerable global momentum is developing among professional engineers to be active leaders in preventing corruption. In particular, the engineering industry is beginning to accept that anti-corruption measures rank with safety, quality and environmental measures in an organisation's management system. For example:

1. International and regional professional engineering institutions, such as WFEO, World Council of Civil Engineers (WCCE) and the Union Panamericana de Asociaciones de Ingenieros (UPADI) have formed anti-corruption committees, are actively providing anti-corruption training and promoting anti-corruption programs.
2. WFEO's Anti-Corruption Standing Committee published an "Anti-Corruption Action Statement" in October 2010.
3. The Global Infrastructure Anti-Corruption Centre (GIACC) is working with WFEO, WCCE, UPADI and many other regional and national professional engineering institutions. The engineering institutions lead anti-corruption initiatives in their own territories and GIACC provides support, training materials and anti-corruption programmes.

4. The engineering institutions led Anti-Corruption Education and Training Global Project (ACET), has published an anti-corruption training DVD called "Ethicana".
5. The British Standards Institute (BSI), supported by the engineering sector, is developing BSI 10500, an anti-bribery management standard to be used with equivalent quality, safety and environmental standards.

The work that the Anti-Corruption Standing committee has done towards corruption prevention, with the Ethicana video and training package, will facilitate a common 'zero-tolerance' approach to corruption around the world.

Ethical Practice

The WFEO Code of ethics is also being modernized to make it more concise and a basis for member organisations to base their own Codes of Ethics on.

The Model Code will have three parts:

1. Simple Code of Ethics Statement with focused preamble and clear statement of ethical values engineers aspire to and
2. Guidelines setting out principles that underpin engineers' values and examples of practice issues,
3. Separate document to help member organisations structure and implement their ethics support programs.

A draft of Parts 1 and 2 are finished Part 3 will be produced shortly.

The work was presented at the Anti-Corruption Standing Committee meeting at WEC 2011, with a demonstration, using case studies from the Ethicana video, of state-of-the-art web based software for ethics education and reflection, Values Exchange.

Engineering is a global profession that must have a common set of ethical values. When member organisations develop consistent Codes of Ethics and ethics education programs, all stakeholders in the mobility of engineering professionals will benefit.

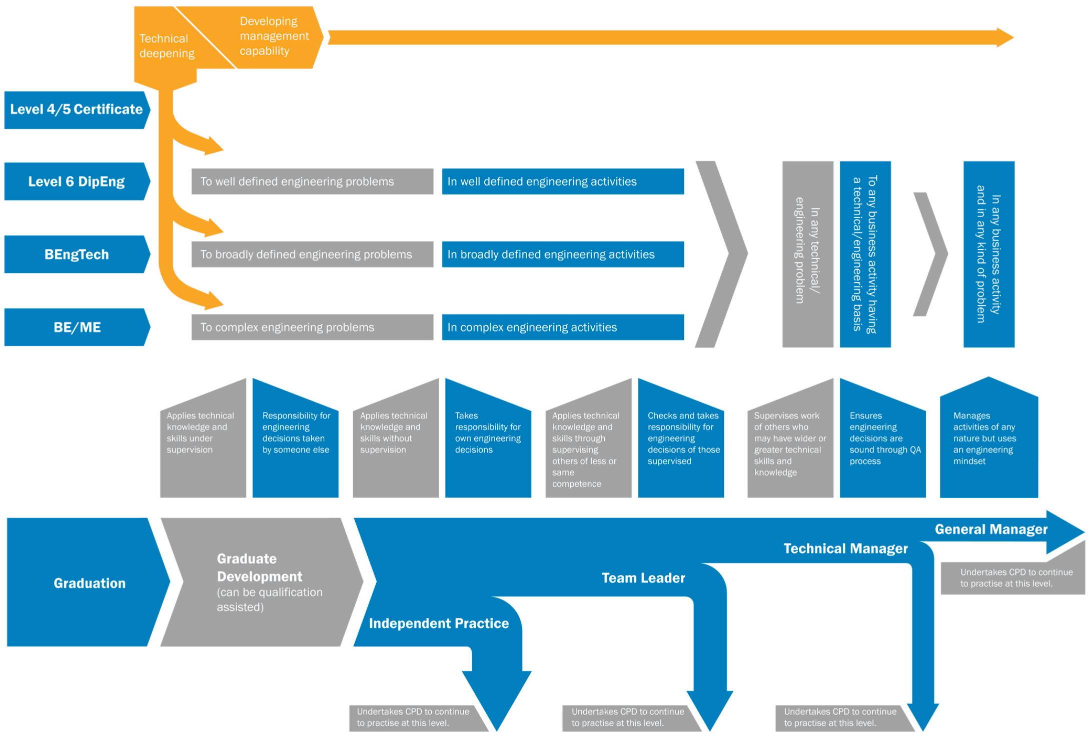
Life-long learning

It is pleasing to see that many mobility stakeholders are discussing and planning for life-long learning. A good degree provides the foundation for an engineering career. But Continuing Professional Development (CPD) is needed to maintain and evolve capabilities. To ensure this happens CPD outcomes must measured in a whole-of-career process.

The best representation I have seen of a whole-of-career process containing these ideas is shown in the diagram below from the Institution of Engineers New Zealand (IPENZ).

Whole-of-career process

This process is a good example for education, training and career planning



(Diagram courtesy of IPENZ, 28.6.11)

The diagram sets out 5 potential stages of an engineering career. The model makes a distinction between career development pathways that involve technical deepening (gaining more engineering knowledge so that more complex engineering problems can be tackled) and development of management capability (developing skills to take responsibility for more than one's own activities). The model makes it clear that technical deepening is not necessary to progress in management, but acknowledges that management and leadership skills are needed in both streams.

The five potential career stages can be generally described as follows:

Stage 1 – Graduate Development: Engineers in the period after entering the profession, who are developing competence for independent practice under supervision.

Stage 2 – Independent Practice: Engineers who are competent to practice independently. This is benchmarked against the relevant competence standard and evidenced by competence-based membership and registration.

Stage 3 – Team Leadership: Engineers taking overall responsibility for the work of a team in which they are the most expert.

Stage 4 – Technical Management: Engineers supervising the work of others who may have greater or wider competence.

Stage 5 – General Management: Engineers who are involved in management at an organisational level and may no longer directly involved with technical engineering activities.

To facilitate life-long-learning we need:

1. Certification of CPD and accredited advanced studies,
2. Whole-of-career attributes,
3. Recognition of the life cycle of engineering knowledge,
4. Labelling for unregulated as well as regulated professional engineers,
5. Better integration of company performance management, CPD and career planning,
6. Continuing improvement of off-campus access to education and training material,
7. Cooperation across language barriers and
8. A better understanding of plausible scenarios within which professional engineers will have to operate in the future.

What is certain is that current future planning scenarios may well not occur but if we don't develop cooperative forward-looking education and training plans for all concerned, we won't be able to respond to whatever scenarios do emerge.

Conclusions

Some conclusions emerge from the topics covered in the paper.

1. It is clear that improvements in engineering education and training are needed in the engineering sector. They should be implemented despite the continuing effects of Global Financial Crisis and the continuing skills shortages.
2. Key stakeholders continue to need well-qualified up-to-date competent professional engineers to provide engineering services and products across national boundaries.
3. We must recognise different needs in many jurisdiction and regions, encouraging aspirational goals and appropriate standards for accreditation and competence.
4. Northern hemisphere countries are involved and well served by mobility organisations. Cooperation and recognition of different approaches is in the best interest of all stakeholders and has been steadily improving. National and regional benefits in the Southern Hemisphere should now be the focus of attention. There is increasing interest from African institutions. But despite some national interest in South America access to information is difficult. Language is a problem particularly in relation to communications and web-site material.
5. Sufficient engineers are still not being trained. The problem is exacerbated by migration, leakage of graduates into other professions and demographic factors — the engineering workforce is aging and often retiring early. Natural leakage will always occur transferring some engineering knowledge, which could be seen as a positive. If leakage is due to negative aspects of the profession it should be examined and addressed.
6. In this context young engineers need to be offered a whole-of-career opportunity with the necessary standards and training available and labelled at each stage.
7. WFEO is making a valuable input:

   - Representing the profession globally to partner organisations and other key international agencies
   - Providing information and learning materials for all WFEO stakeholders
   - Providing a forum for discussion and participating in conference discussions through papers and invitations to speak.

If we can work to these ends, the profession will also make a bigger and better contribution to engineering activity across the globe helping to build capacity, balance economic development, respond to natural disasters, improve health and mitigate the impacts of climate change.

Attachments

1. Details of main accreditation accords and mobility forums

ENAEE (2011)

Full Members	
FEANI	Europe
Engineering Council	United Kingdom
CTI	Commission des Titres d'Ingénieur, France
ASIIN	Fachakkreditierungsagentur für Studiengänge der Ingenieurwissenschaften, der Informatik, der Naturwissenschaften und der Mathematik e.V. Germany
Ordem dos Engenheiros,	Portugal
CoPI	Conferenza dei Presidi delle Facolta' di Ingegneria Italiane, Italy
Engineers Ireland	
RAEE	Russian Association for Engineering Education
EUROCADRES	Conseil des Cadres Européens, Belgium
UNIFI	Universita degli Studi di Firenze, Italy
IDA	The Danish Society of Engineers
BBT	Bundesamt für Berufsbildung und Technologie, Switzerland
MÜDEK	Association for Evaluation and Accreditation of Engineering Programmes, Turkey
IGIP	International Society for Engineering, Austria
IIE	Instituto de la Ingenieria de Espana, Spain
ARACIS	The Romanian Agency for Quality Assurance in Higher Education
TEK	Finnish Association of Graduate Engineers
Associate Members	
SEFI	Société Européenne pour la Formation d'Ingénieurs, Belgium
CLAIU	Council of Associations of long-cycle Engineers of a University or Higher school of engineering of the European Union, Belgium

EUR-ACE authorized Agencies (2011)

ASIIN (Germany)
CTI (France)
Engineering Council (UK)
Engineers Ireland (Ireland)
Ordem dos Engenheiros (Portugal)
RAEE (Russia)
MÜDEK (Turkey)

Washington Accord Signatories

Australia (1989)	Canada (*1989*)
Chinese Taipei (2007)	Hong Kong China (1995)
Ireland (1989)	Japan (2005)
Korea (2007)	Malaysia (2009)
New Zealand (1989)	Singapore (2006)
South Africa (1999)	United Kingdom (1989)
United States (1989)	Turkey (2011)

Organisations with WA provisional status	
Germany	India
Pakistan	Russia
Sri Lanka	Bangladesh

EMF

Australia (1997)	Canada (1997)
Chinese Taipei (2009)	Hong Kong China (1997)
India (2009)	Ireland (1997)
Japan (1999)	Korea (2000)
Malaysia (1999)	New Zealand (1997)
Singapore (2007)	South Africa (1997)
Sri Lanka (2007)	United Kingdom (1997)
United States (1997)	
Provisional Member Economy	
Bangladesh - Represented by Bangladesh Professional Engineers, Registration Board	

APEC Engineer Member Economies & Number of Registered Engineer

Australia (2000)	400	Canada (2000)	16
Chinese Taipei (2005)	80	Hong Kong China (2000)	37
Indonesia (2001)	26	Japan (2000)	2,589
Korea (2000)	970	Malaysia (2000)	341
New Zealand (2000)	1,472	Philippines (2003)	51
Singapore (2005)	12	Thailand (2003)	37
United States (2001)	None Reported	Russia (2010)	33

FEANI

Reference	Name of the National Member
Austria	Österreichisches Nationalkomitee der FEANI
Belgium	Comité National Belge de la FEANI (CIBIC)
Bulgaria	Federation of Scientific Technical Unions in Bulgaria (FNTS)
Switzerland	Schweizer Nationalkomitee für FEANI
Cyprus	FEANI Cyprus National Committee
Czech Republic	Czech Association of Scientific and Technical Societies (CSVTS)
Germany	Deutsches Nationalkomitee der FEANI
Denmark	Ingeniørforeningen i Danmark (IDA)
Estonia	Estonian Association of Engineers
Spain	Comite Nacional Espanol de la FEANI
Finland	The Finnish National Committee for FEANI
France	Conseil National des Ingénieurs et des Scientifiques de France (CNISF)
United Kingdom	British National FEANI Committee
Greece	Comité National Hellénique de la FEANI
Croatia	Croatian Engineers Association (HIS)
Hungary	Hungarian National Committee for FEANI
Ireland	Engineers Ireland
Iceland	Association of Chartered Engineers of Iceland
Italy	Consiglio Nazionale Ingegneri (CNI)
Luxembourg	Association Luxembourgeoise des Ingénieurs (ALI)
Malta	Chamber of Engineers
Netherlands	Netherlands National FEANI Committee
Norway	Norwegian National Committee for FEANI
Poland	Polish Federation of Engineering Associations
Portugal	Ordem dos Engenheiros
Romania	The General Association of Engineers in Romania (AGIR)
Russia	Russian Union of Scientific and Engineering Associations (RUSEA)
Sweden	Swedish National Committee for FEANI
Serbia	The Union of Engineers and Technicians of Serbia (UETS)
Slovenia	Slovenian National Committee for FEANI
Slovakia	Slovak National Committee for FEANI (SNKF)

2. Accreditation of Engineering Programs in the Americas

North America

<u>Canada</u>

Canadian Engineering Accreditation Board – CEAB

Chair: Jacinta O'Brien, FEC, P.Eng.

Short introduction taken from its web page
http://www.engineerscanada.ca/e/pr_accreditation.cfm

"The Canadian Engineering Accreditation Board was established by Engineers Canada in 1965 to accredit undergraduate engineering programs that provide the academic requirements necessary for licensure as a professional engineer in Canada. The Accreditation Board also plays a key role in Engineers Canada's international activities by assessing the equivalency of the accreditation systems used in other nations relative to the Canadian system, and by monitoring the accreditation systems employed by the engineering bodies, which have entered into mutual recognition agreements with Engineers Canada. Through the Accreditation Board's activities, the Canadian criteria and procedures for accrediting undergraduate engineering programs are now recognized around the world. As a result, a number of engineering institutions in other countries have expressed an interest in having their engineering programs evaluated by the Accreditation Board using its accreditation criteria and procedures. These types of evaluations are completed by Accreditation Board members, using Accreditation Board criteria, are comparable, but not identical, to accreditation within Canada, and are called Substantial Equivalency Evaluations.

In addition to advising Engineers Canada on all matters related to engineering education, the Accreditation Board works closely with Canadian universities *to ensure that graduates of accredited engineering programs have the skills they need to become productive members of the profession. It also offers advice to universities developing new engineering programs, to help the universities ensure that those programs ultimately meet the criteria for accreditation by Engineers Canada. As part of this process, Engineers Canada produces an annual report outlining the accreditation criteria and procedures. The report lists the Canadian undergraduate engineering programs that are currently, or have ever been, accredited. It also describes the work and composition of the teams of volunteers who conduct program evaluation visits to Canadian universities on the Accreditation Board's behalf."*

USA

Accreditation Board for Engineering and Technology – ABET

Executive Director: Michael Milligan

Email: executive-director@abet.org
Short introduction taken from its web page www.abet.org

"ABET, Inc., the recognized accredit or for college and university programs in applied science, computing, engineering, and technology, is a federation of 30 professional and technical societies representing these fields. Among the most

respected accreditation organizations in the U.S., ABET has provided leadership and quality assurance in higher education for over 75 years.
ABET currently accredits some 2,900 programs at more than 600 colleges and universities nationwide. Over 1,500 dedicated volunteers participate annually in ABET activities.
ABET also provides leadership internationally through workshops, consultancies, memoranda of understanding, and mutual recognition agreements, such as the Washington Accord.
ABET is recognized by the Council for Higher Education Accreditation"
Mexico
Consejo de Acreditación de la Enseñanza de la Ingeniería - CACEI AC
Executive Director: Ing. Fernando Ocampo
Small introduction taken from its web page http://www.cacei.org/
Accreditation agencies began in Mexico since 1994, with the founding of the Consejo de Acreditación de la Enseñanza de la Ingeniería – CACEI. This is a civil association formed in the plural, as it involves various areas related to training and professional engineers.

In the fifteen years after its foundation, the CACEI has conducted an intensive and fruitful activity establishing the methodology for accreditation processes and applications to more than eight hundred programs in various branches of engineering, technical college and high school level. This gives us an idea of the important work of this partnership, contributing significantly to improving the quality of higher education and professional training more prepared, more competitive, more responsible and more committed, as we demand our country.

Central America

Consejo Centroamericano de Acreditación- CCA
(In Central America there is a second level agency that accredits the Central American Accreditation Agencies.)
Executive Director: Marianela Aguilar Arce. Web page: www.cca.ucr.ac.cr

The Council was created in order to establish regional mechanisms to harmonize, coordinate and integrate the efforts of various institutions and organizations in the Central area and give validity to international quality accreditation of higher education that takes place in different countries in the region.

Agencia Centroamericana de Acreditación de Programas de Arquitectura y de Ingeniería

Email: direccionejecutiva@acaai.org.pa
Short Introduction taken from its webpage: http://www.acaai.org.pa/

The Agencia Centroamericana de Acreditación de Programas de Arquitectura y de Ingeniería, ACAAI, is a regional non-profit organization, made up of the academic sector, public and private, professional governmental and employer of Central America (consisting of: Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica and Panama). The agency works granting accreditation of programs of architecture and related programs, engineering, its various specialties, and higher education institutions operating in each country or region.

The headquarters of the ACAAI and Technical Management are located in Panama City, Panama, at the Council of Rectors of Panama.

AUPRICA
Asociación de Universidades Privadas de Centroamérica y Panamá.
Director of accrediting commission: Msc. Mario Rodríguez Abud

Telefono: (505) 2480888 Celular: (505) 6032954
Email: mariorod04@hotmail.com Web page: www.auprica.org

This private organization works on Institutional Accreditation and by career. Every Central American country has its own accreditation agency. Some of them are agencies that work on various career programs, including engineering.

El Salvador
Consejo de Acreditación de la Calidad de la Educación Superior- CDA

Autonomous entity under the Ministry of Education of El Salvador
Web page:http://www.mined.gob.sv/cda/miembros_de_la_comision.htm

Costa Rica
Sistema Nacional de Acreditación de la Educación Superior- SINAES
President: Lic. Guillermo Vargas Salazar Web page: www.sinaes.ac.cr

SINAES is the official agency that is backed by law, to assess the accreditation of the academic quality of Costa Rican university courses and programs of public or private institutions, which voluntarily undergo the accreditation process. It is a public interest organization, with authority to determine its own organization. SINAES is the first accrediting agency in Central America and the Caribbean whose quality has been internationally certified with a distinction awarded by the American Council on Accreditation (CCA).

SINAES accredits all careers including engineering programs. Since 2004, it works jointly with the Colegio Federado de Ingenieros y de Arquitectos – CFIA in the accreditation of engineering and arquitecture programs.

Panama
Consejo Nacional de Evaluación y Acreditación Universitaria de Panamá-CONEAUPA
President S.E. Lucinda Molinar. Minister of Education

CONEAPA is an independent and decentralized assessment and accreditation agency. It is the representative of the different actors involved in the development of higher education in Panama.
www.coneaupa.edu.pa

Caribbean

Greater Caribbean Regional Engineering Accreditation System - GCREAS

Short introduction from its web page: www.caribengine.org

"The Greater Caribbean Engineering Accreditation System is constituted by institutions from several countries of the Greater Caribbean Basin, in the context of the OAS endorsed "Engineers for the Americas" initiative. Its formation was financed with the support of the Inter American Development Bank, IADB, through operation ATN/RG-10604-RG, and with additional sponsorship by private international entities such as the Hewlet-Packard Laboratories.

The purpose of this initiative is the development and adoption of a Regional Public Good that is a Regional Engineering Accreditation System for engineering programs for the Greater Caribbean Region, with a view to developing a better qualified engineering and technical workforce, facilitating mobility of both people and work and the possibilities for much higher cross-border activities, enabling the engagement of international companies, and greatly enhancing the ability to attract foreign direct investment."

Dominican Republic
Asociación Dominicana para el Autoestudio y la Acreditación – ADAAC
President: Dr. Gustavo Batista Vargas

Web page: http://adaac.org.do/index.php

The ADAAC is the accreditation agency of Dominican higher education. It is a private, non-profit, organization for public benefit (Law 122-05) which brings together institutions of higher education in the Dominican Republic that have decided to undertake initiatives and efforts to achieve a gradual improvement in the quality of university education.

South America

Colombia
Consejo Nacional de Acreditación República de Colombia - CNA
Coordinator: Jaime Eduardo Bernal Villegas

Web page: www.cna.gov.co

Organization of academic nature, which depends of the National Council of Higher Education (CESU). It is composed of individuals of the highest scientific and professional qualities, whose primary function is to promote and implement the accreditation policy adopted by the CESU and coordinate their respective processes.

The CNA, was created as an academic institution by Act N° 30 of 1992. The national accreditation board reviews the accreditation process, organizes it, monitors it, attests to its quality and ultimately recommends the Minister of Education accredit deserving programs and institutions.

Venezuela
Sistema de Evaluación Académica- SEA

http://www.riaces.net/index.php/acerca-de-riaces-ique-es-riaces/miembrosgroup1/miembros/75-venezuela.html

Brazil
Coordenaçao de Aperfeiçomento de Pessoal de Nivel Superior - CAPES
http://www.riaces.net/index.php/acerca-de-riaces-ique-es-riaces/miembrosgroup1/miembros/94-brasil.html

SINAES
http://sinaes.inep.gov.br:8080/sinaes),

Paraguay
Agencia Nacional de Evaluacion y Acreditación de la Educación Superior – ANEAES
President: Dra. Ana Campuzano de Rolón (por el MEC)

http://www.aneaes.gov.py/

Chile
Comisión Nacional Acreditación - CNA
Presidente: Eugenio Díaz Corvalán

www.cnachile.cl

Argentina
Comisión Nacional de Evaluación y Acreditación Universitaria- CONEAU
www.coneau.gov.ar

Perú
Instituto de Calidad y Acreditación de Carreras Profesionales de Ingeniería y Tecnología- ICACIT
President: José F. Valdez Calle

http://www.icacit.org.pe/

Ecuador
CONSEJO NACIONAL DE EVALUACIÓN Y ACREDITACIÓN DE LA EDUCACIÓN SUPERIOR DEL ECUADOR - CONEA
President: Dr. Arturo Villavicencio Vivar
www.conea.net

Contribution received with thanks from **UPADI**.

3. Capacity building guideline 2010, WFEO Committee on Engineering Capacity Building

One of the most popular definitions of capacity building is "The building of human, institutional, and infrastructure capacity to help societies develop secure, stable and sustainable economies, governments and other institutions through mentoring, training, education, physical projects, the infusion of financial and other resources, and, most importantly, the motivation and inspiration of people to improve their lives"

The committee on Capacity building was established in 2002 and spent the past years to develop an understanding of what Capacity building in engineering would be about and how it could be achieved.

The work on the Guideline in its present format was initiated in Brazil in 2008, when it was decided that the common understanding within the CECB could be translated into a document that could be used by not only the engineering profession, but also by anyone who is responsible for and interested in sustainable engineering and its principles.

The philosophy as developed by the WFEO committee was that enhancing and sharing of knowledge, sharing examples, aligning and integrating effort, providing information and promoting the principles of good governance should be the outcome of the initiative that would ultimately lead to informed decision making by all concerned with services and infrastructure across the world.

At the very basis of the philosophy is that there can be no sustainable infrastructure without the presence of sustainable engineering. Sustainable engineering in turn can be described as an environment in which six so-called pillars are each in harmony and in balance. If any of these prerequisites were not present in a society, community or country there would be great difficulty in establishing long-term sustainability.

In terms of mobility it would mean that these factors should be present if engineering equity is to be achieved and for each country to ultimately possess the basic engineering environment to sustain its population with basic services as described in various models of which the millennium development goals are one.

The description of what the six pillars mean, are basically as follows in terms the local situation whether it be in a well developed country or in a developing country

Individual - to ensure that the needs of the engineering practitioner are met in terms of education, training and personal career opportunities and satisfaction

Institutional – to ensure that there are educational, professional, technical, governance and statutory institutions and support structures in place> the institutions would be in both the public and private sectors, including stable, viable and responsible businesses, commercial enterprises and financial institutions that can support the provision, operation and maintaining of infrastructure and services

Technical – to ensure that there are technical standards, codes of practice, technical literature, and guidance material and so forth to underpin and support ethical and appropriate engineering, technological and procurement procedures and practices

Decision-making – to ensure that decision-makers have sufficient information and understanding as well as access to knowledge and skills to enable them to make informed, logical a and rational decisions

Funding – to ensure that adequate and affordable finance is available to enable sustainable solutions, and that financial practice is at all times responsible, including adequate revenue streams and where appropriate, even after external funders have withdrawn

Resources, equipment, tools and supplies – to ensure that there is access to appropriate, affordable and suitable materials, equipment, tools and supplies for building, implementing, operating of infrastructure and the provision of engineering services

The Guidebook is a compilation of advice and is supported by a compendium of programmes, initiatives, projects and examples on how to achieve sustainability in terms of the engineering capacity of each and every country and so to achieve mobility that is not unduly competitive by nature and that will rather build than break down the ability of countries to maintain an indigenous core of engineering needed to provide at least basic services for its citizens.

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- International Federation of Consulting Engineers (FIDIC), www1.fidic.org
- European Federation of National Engineering Associations (FEANI), www.feani.org
- Pan American Federation of Engineering Associations (UPADI), www.upadi.org.br
- Engineering for the Americas, http://www.efta.oas.org/english/cpo_sobre.asp
- Federation of Engineering Institutions of Asia and the Pacific (FEIAP), see www.hkie.org.hk
- European Society for Engineering Education (SEFI), www.sefi.be,aaa
- Washington Accord (WA), see IEA
- Organisation for Asia Pacific Economic Cooperation (APEC) Engineer forum, see IEA
- European Network for Accreditation of Engineering Education (ENAEE), www.enaee.eu
- EUR-ACE, www.enaee.eu/eur-ace/eur-ace_presentation.htm
- Bologna Process, http://www.ond.vlaanderen.be/hogeronderwijs/bologna/
- **RCETO**, Regional Council of Engineering Technology Organizations; e-mail: clydephillip@yahoo.com
- Summer 2010 Issue of Prism: Hammer, Brush and Sickle. Prism is the magazine of the American Society for Engineering Education, www.asee.org.
- Accreditation Board for Engineering and Technology (ABET), www.abet.org/the_basics.shtml
- IPENZ
- Engineers Australia (EA), re EngExec, www.engineersaustralia.org.au/professional-development/engineering-executive/engineering-executive_home.cfm

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Please accept my apologies if I have missed anyone from my list.