EUCEET Association Conference "New trends and challenges in civil engineering education" 24-25 November 2011 Patras, Greece

EUR-ACE[®]: the European system of accreditation of engineering education and its relevance for civil engineering

by Giuliano Augusti

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- In the last decades, globalization has stressed the international dimension of higher education.
- Employability of engineering graduates is more than ever dependent on the international acceptability of the skills and abilities that they have acquired.

Engineering is by its very nature an international profession. Engineering Education has a long history of transnational recognition.

In 1989, eight National organizations started the so-called Washington Accord

for the recognition of Education of Engineers. As of 2011, the WA has 14 signatories and 6 "provisional members"

In the Washington Accord,

"qualifications accredited or recognised by other signatories are recognised by each signatory as being substantially equivalent to accredited or recognised qualifications within its own jurisdiction"

The WA is now part of the International Engineering Alliance (IEA) together with the Sydney Accord (*Technologists*), the Dublin Accord (*Eng. Technicians*) and three "Mobility Forums" (mutual recognition of *professional qualifications*).

In Europe, up to 2004, no initiative analogous to WA or IEA. European engineering graduates encounter significant difficulties in recognition of academic and professional qualifications, and consequently in trans-national mobility.

They suffer the lack of a European accreditation system of engineering education accepted on the continental scale.

To fill this lack was (and is) the basic motivation of the whole EUR-ACE exercise, started in 2004: in these seven years significant results have been achieved.

They will be summarized in this lecture together with some suggestions for the future.



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In the meantime, higher education (HE) has seen a great increase in the application of quality assurance (QA) procedures, in that in Europe has been fostered by the "Bologna Process".

Main distinction between QA approaches: "institutional"

vs. "programme" (hence "subject-specific")

Comparisons summarized in the two following slides (EUR-ACE SPREAD Final Conference, October 2010).



Institutional vs. Programme oriented approaches to QA*

Institutional Approach

- assesses the internal monitoring and quality assurance arrangements
- Content of programmes are not thoroughly examined
- allows for more flexibility in terms of structure, content and implementation of study programmes
- emphasises the autonomy and the primary responsibility of the institutions for their quality

Programme Approach

- transversal comparison between subjects possible
- better information about programmes offered, recognition of joint degrees
- more resources needed (time and money), extra bureaucracy
- limited effect in improving the institution's management of teaching and learning quality

*ENQA workshop report *Programme-oriented and institutional-oriented approaches to quality assurance: new developments and mixed approaches*



STRONG UNIVERSITIES FOR EUROPE

The question of programme accreditation

- Main political imperative: robustness of European QA
- No discontinuity between institutional and programmes levels, where both are consistent with ESG
- Particularly relevant for disciplines relevant to public health and safety
- Cooperation between, and overlapping membership of, interested agencies
- The particular relevance of EUR-ACE criterion
 2.3...



From ENAEE's Mission (General Policy Statement, 2009)

- ENAEE strongly supports a field-specific approach and programme accreditation, considering it essential to fulfil the need of aligning the goals of educational programmes with the expectations of the relevant stakeholders and ensuring their relevance for the labour market.
- Programme accreditation does not exclude institutional accreditation: on the contrary, it may become easier if an overall system of QA authorizes only quality HEIs to deliver academic degrees.

In other words,

- while institutional accreditation may be significant to assure the quality of the teaching-learning process in each higher education Institution (HEI),
- only outcome-based programme accreditation can guarantee - to both the HEIs and the potential employers - that the graduates of a specific programme acquire the desired set of skills and abilities.



As you have noted, nowadays "accreditation" is a much used word. However, it has several similar but not identical meanings, and therefore needs to be appropriately defined and its role and practice be reconsidered.

In engineering, "accreditation" is connected not only with quality, but also with the professional relevance of the accredited programme/degree.

Consistently, Engineering Education is in many countries accredited by a "specialized" Agency or Body, different from the "general" QA Agency.

ENAEE/EUR-ACE adopt the following definition (consistent with many other Engineering Standards): Accreditation of an [Engineering] Education Programme

is the result of a process to ensure **suitability of** programme as entry route to the [*engineering*] profession, by means of

- Periodic assessment against accepted standards
- Peer review of written and oral information by trained and independent panels including academics and professionals



EUR-ACE is "programme accreditation"; to qualify it better, it can be called "pre-professional accreditation" 11 Accreditation of educational programmes as entry route to a profession (i.e. pre-professional accreditation) has been proved to be a powerful tool to improve at the same time academic quality and relevance for the job market.

At present, accreditation of engineering programmes is widespread throughout the world, but historically Europe has been in the forefront, although different words have been and are used....

Indeed, the word accreditation was not used in European specialized literature and documents until the late 1990s, when it came from American usage.

Today, accreditation of Engineering Education (whichever the word by which it is denoted) is in force in most European countries, but its significance and procedures vary greatly from one country to the other.

Within the EU recognition of **professional qualifications** is guaranteed since 1989 by "Directives" (= European laws): the current *Directive on Recognition of Professional Qualifications* was approved in September 2005.

The "Bologna process" is concerned with ensuring transparency, compatibility and quality of academic degrees, but not with "professional qualifications" nor with "pre-professional accreditation".



European Accreditation

of Engineering Programmes

EUR-ACE®

The EUR-ACE accreditation system was envisaged by the EU-supported EUR-ACE project (2004-06) to make up for the lack of a European accreditation system of engineering education accepted on the continental scale.

To implement the EUR-ACE system, the European Network for Accreditation of Engineering Education (ENAEE) www.enaee.eu was founded in February 2006 by 14 concerned Associations.



European Network for Accreditation of **Engineering Education**

KEY POINTS agreed during the EUR-ACE project:



- NOT an European "Directive"
- NOT an European Accreditation Board
- A bottom-up agreement towards a decentralized accreditation system in which National (or Regional) Agencies would play a major role
- EUR-ACE-accredited programmes would satisfy a common set of Standards (the "EUR-ACE Framework Standards ...").
- The EUR-ACE accreditation would distinguish between FIRST CYCLE and SECOND CYCLE DEGREES, in accord with the European Qualification Frameworks.



Two main outcomes of the EUR-ACE project:

a) a synthesis of existing national Standards:

EUR-ACE Framework Standards for the Accreditation of Engineering Programmes

b) a proposal for the Organization and Management of the EUR-ACE Accreditation System

You can find the EUR-ACE Standards and all other relevant documents on the site of ENAEE www.enaee.eu or www.eur-ace.eu





EUR-ACE[®] Framework Standards for the Accreditation of Engineering Programmes

The EUR-ACE Framework Standards specify the **Programme Outcomes** to be satisfied. They:

- Describe (in accord with the modern approach) the abilities that the graduates must achieve but not how they should be taught
- Are valid for all branches of engineering and all profiles
- Distinguish between First and Second Cycle programmes, as defined in the European Qualification Frameworks
- Are applicable also to "integrated programmes", i.e. programmes that lead directly to a Second Cycle degree
- Can accommodate national differences of educational and accreditation practice
- Can/should be complemented by specific requirements for different branches (and/or "profiles")

The EUR-ACE® Framework Standards identify 21 programme outcomes for First Cycle (FC) degrees and 23 for Second Cycle (SC) degrees, grouped under six headings, namely:

- Knowledge and Understanding
- Engineering Analysis
- Engineering Design
- Investigations
- Engineering Practice
- Transferable Skills



For each heading the Outcomes of **First Cycle** and **Second Cycle** degrees are specified. 18



Example of Programme Outcomes in the EUR-ACE Standards (1)

A short paragraph introduces the Programme Outcomes of each group:

Knowledge and Understanding

The underpinning knowledge and understanding of science, mathematics and engineering fundamentals are essential to satisfying the other programme outcomes.

Graduates should demonstrate their knowledge and understanding of their engineering specialisation, and also of the wider context of engineering.



Example of Programme Outcomes in the EUR-ACE Standards (2)

Knowledge and Understanding First cycle

- Knowledge and understanding of the scientific and mathematical principles underlying their branch of engineering.
- A systematic understanding of the key aspects and concepts of their branch of engineering.
- Coherent knowledge of their branch of engineering including some at the forefront of the branch.
- Awareness of the wider multidisciplinary context of engineering.

Second cycle

- An in-depth knowledge and understanding of the principles of their branch of engineering;
- A critical awareness of the forefront of their branch.

The EUR-ACE[®] Framework Standards require the assessment of a programme for Quality Assurance to consider not only the Programme Outcomes, but also all the following items:

- 1. Needs, Objectives and Outcomes;
- 2. Educational Process;
- 3. Resources and Partnerships;
- 4. Assessment of the Educational Process;
- 5. Management System

and for each item specify the criteria to be assessed.



Full text of EUR-ACE[®] Framework Standards on <u>www.enaee.eu</u> & <u>www.eur-ace.eu</u>

How does the EUR-ACE® accreditation system work?

- National (or Regional) Agencies accredit EE programmes;
- If the Agency fulfills appropriate Quality requirements, and verifies that the accredited engineering programmes satisfy the EUR-ACE Framework Standards, ENAEE authorizes the Agency to add the EUR-ACE[®] quality label to the national accreditation, thus giving it an international value.
- The EUR-ACE[®] label distinguishes between FIRST CYCLE and SECOND CYCLE DEGREES, in accord with the European Qualification Frameworks.
- "Integrated (long) Programmes" can be awarded the SC label



The EUR-ACE system is consistent with the"Bologna process" and can be defined"European Accreditation ..."22

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This is to certify that the xxx programme

Official name of the education programme in original language (and in English)

provided by

Name of Educational Institution, and Faculty or Department, (if applicable)

accredited by

(Accrediting Agency)

on (dd month yyyy) until (dd month yyyy)

satisfies the outcomes of Second Cycle programmes specified in the EUR-ACE Framework Standards for the Accreditation of Engineering Programmes, and therefore for the above period of accreditation is designated as a SECOND CYCLE EUROPEAN-A CCREDITED ENGINEERING PROGRAMME.



For the European Network for Logo Accreditation of Engineering Education (ENAEE)

The President Prof. Ing. Giuliano Augusti, Sc.D.

Brussels, xx Month 200x

For xxx

The xx x

xx xx Signature

xx, xx Month 200x



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Six Agencies [the relevant partners of the EUR-ACE project (2004/06)], were authorized to deliver the EUR-ACE Label (EUR-ACE-authorized) in November 2006 and confirmed in October 2008:

- ASIIN (Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics), Germany
- CTI (Commission des Titres d' Ingénieur), France
- Engineers Ireland
- **RAEE** (Russian Association for Engineering Education)
- Engineering Council, United Kingdom
- Ordem dos Engenheiros, Portugal

A seventh Agency was authorized in January 2009:

 MÜDEK (Association for Evaluation and Accreditation of Engineering Programs), Turkey



Awarded EUR-ACE labels as of December 2010:

Agency	Date accr/n	Countries oper.	FCD	SCD	Total
ASIIN	Nov.2006	DE, CH	134	111	245
CTI	"	FR, BE, BG, E	S	229	229
Eng.Irela	nd "	IE	70	24	94
RAEE	"	RU, KZ	9	39	48
EngC	"	UK	?	?	36
Ord.Eng	"	PT	0	4	4
MÜDEK	Jan.2009	TR	78		78
		Overa	ll tota	:	734

As of November 2011, overall total > 900



DE

CH

FR

BE

BG

ES

E

RU

UK

PT

TR

E

opean reditation ngineering	EUR	ACE labels listed by country					
UR-ACE®	(Dec.2010; approx.):						
Agency		FCD	SCD	Total			
ASIIN		101	86	187			
ASIIN		3	0	3			
CTI			207	207			
CTI			1	1			
CTI			3	3			
СТІ			1	1			
Eng.Ireland RAEE EC (Eng.C.)		72	21	93			
		5	30	35			
			36	36			
OE (Ordem)		0	4	4			
MÜDEK		78		78			

0

1

Outside **EHEA** CTI

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A graduate from a EUR-ACE-accredited programme can call himself either EUR-ACE[®] Bachelor or EUR-ACE[®] Master

To avoid misunderstandings, let it be clear that these titles have



no "legal" value: however, it is fair to say that their significance and weight are rapidly increasing.

FEANI (European Federation of National Engineers' Associations) includes automatically the EUR-ACE-accredited programmes in its INDEX of recognized engineering programmes.

The EUR-ACE label is recognized as the basic academic qualification in the engineerING card (a European Professional Card) formally launched by FEANI in October 2010 and already active in Germany and a few more countries.



Which Requirements Must Be Met?



¹ EUR-ACE = European Accredited Engineering

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The EUR-ACE[®] label was quoted in an official European Commission Report (September 2009) as an example of good practice in QA:



COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 21.9.2009 COM(2009) 487 final

REPORT FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Report on progress in quality assurance in higher education

Good practice

The <u>EUR-ACE label</u> in engineering exists at the bachelor and master level. Standards were defined at European level, but are applied through national quality assurance agencies that are authorised to issue EUR-ACE "labels" together with their national accreditation. Several hundred labels have already been awarded, but they are still available from only seven national agencies²³.

The EUR-ACE[®] label is quoted also in a EU publication issued for the "Bologna Anniversary Conference", March 2010:



page 8:

The Commission is supporting the development of a series of subjectspecific European quality labels, which could/may lend their standards to existing agencies or become agencies in their own right. Examples include the **EUR-ACE** label in engineering and the Eurobachelor, Euromaster and Eurodoctorate labels in chemistry.

The EUR-ACE[®] label is quoted also in a EU publication issued for the "Bologna Anniversary Conference", March 2010:



page 24:

EUR-ACE Implementation and the EUR-ACE Label

This project has elaborated a European system of accreditation of engineering programmes at the first and second cycle level. Training of international accreditation experts and the award of the EUR-ACE labels are among the project outcomes. EUR-ACE has gained attention throughout the world: e.g. in the WFEO "Information paper on mobility", summarized in an article published in the "Engineers Australia" magazine, October 2010:

WORLD VIEW



Peter Greenwood

Australian representative on the World Federation of Engineering Organisations' General Assembly and a member of its Executive Council.

Accreditation reaches milestone in Europe

everal European countries have adopted a new internationally recognised accreditation system for engineering education. They are now supporting a new European Accredited Engineer (EUR-ACE) degree certificate.

EUR-ACE accreditation is based on national accreditation agencies' programs that meet legal national standards first and then EUR-ACE Framework Standards (EAFS). As of June 2010 nearly 600 programs were accredited by agencies in seven countries. The EUR-ACE label can be awarded in addition to any national certificate or label.

The EUR-ACE project is sponsored and coordinated by the European Network

should have and some thought was given to what industry needed from engineers.

In the EHEA, 3 + 2 is defined in terms of two and now three cycles. At the end of each cycle the graduate emerges with either a bachelors (3 years), masters (2 years) or doctoral (3 years) award respectively.

The Bologna Process participants have a strategy to take the process worldwide. 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

Two immediately forthcoming initiatives:

EASPA (European Alliance for Subject-specific and Professional Accreditation and Quality Assurance): *to be founded in Düsseldorf on 29 November 2011.*

ENQA Seminar (within the INQAAHE/ENQA Seminar) *European Quality labels and Quality Assurance* Bruxelles, 2 December 2011:

"European Quality labels" presented: Eurobachelor (Chemistry) EUROInf (Informatics) Polifonia (Conservatoires) EFG, euro-ages (Geology) EUR-ACE (Engineering)

Currently, the EUR-ACE system includes seven countries [France, Germany, Ireland, Portugal, Russia, Turkey, UK]



European Accreditation of Engineering Programmes EUR-ACE®

with very different educational and professional systems.

Consequently, there is a great variety in the types of organizations participating (or about to enter) in the system:

- professional organizations (OE/PT, EngC, Engrs.Ireland),
- engineering education societies (RAEE),
- National accreditation bodies (CTI, MÜDEK)
- Subject-specific accreditation agencies (ASIIN)
- "General" QA/accreditation Agencies (SKVC, ARACIS, OAQ)

Although the seven countries are already a very significant sample of the 47 countries of the European Higher Education Area (EHEA), 5 within and 2 outside the EU, their number is limited, and **ENAEE is committed to increase them** !!!!



As of November 2011, a number of applications from other Agencies that want to be EUR-ACEauthorized have been received and are being considered:

- NVAO (Accreditation Organisation of Netherlands and Flanders)
- ARACIS, QA Agency, Romania (*)
- SKVC, QA Agency, Lithuania (*)
- OAQ, QA Agency, Switzerland
- KAUT, Accreditation Committee for Technical HE Institutions, Poland
- QUACING, Italy

(*) "Candidate Agency" (passed first evaluation)

Moreover:

- **CTI** (jointly with **AEQES**, the French-Belgian HE Accreditation Agency) will accredit engineering programmes in French-language Belgian HEIs;
- **FINHEEC**, Finnish HE Eval. Council, is preparing the application...

Summing up, ENAEE is creating a two-tier system of **European-accredited** engineering programmes.



The EUR-ACE[®] label is an "addition" to a national accreditation, and can be regarded as a quality guarantee of an accepted common basis to programmes providing an entry route to the engineering profession.

The experience of national accreditation bodies, old-established in several European countries, is fully exploited.

This approach and the essential distinction between FCD and SCD make the EUR-ACE system at the same time flexible and simple and would allow it to be spread world-wide.

Third Cycle (Doctoral) and Continuing Education are not (yet) considered.

EUR-ACE-accreditation and Engineering "Branches"

As already stated, the EUR-ACE labels do not distinguish between engineering "branches" nor "profiles". This does not mean that no distinction is made in accrediting a programme, e.g., verifying the graduates' "knowledge and understanding of their branch of engineering", as repeatedly quoted in the EUR-ACE Framework Standards.

Indeed, in this regard there are strong differences in accreditation practice between EHEA countries (and EUR-ACE Agencies): e.g.,

 - in France the CTI "habilitates" a unique title of engineer ("ingénieur");

 the contrary happens in the UK, whose tradition is based on accreditations by the "Institutions" of the different branches (now coordinated by the Engineering Council). 37

Consequently, there is an open discussion within ENAEE whether

a) to stick to the undifferentiated EUR-ACE labels (FC and SC) based on the EUR-ACE Framework Standards, and leave the differentiation among branches to each EUR-ACE-authorized Agency, in accord to its own practice, or

b) to introduce differentiated labels that could exploit also the branch-level descriptors developed by relevant Technical Associations, like e.g. EUCEET in the Civil Engineering field and the European Federation of Chemical Engineering.

The following are my personal ideas and opinions

In my opinion:

The main awards by ENAEE should continue to be the undifferentiated **EUR-ACE®** labels (based on undifferentiated Standards), testifying that the programme leads to a graduate in "engineering", at either FC ("Bachelor") or SC ("Master") level.

In addition or in parallel, ENAEE might elaborate and award branch-differentiated labels, in accord to branch-level descriptors like those developed by relevant Technical Associations, e.g. EUCEET (Civil Engineering) and the European Federation of Chemical Engineering, or specific projects, e.g. ERABEE (Agricultural and Bio-system Engineering) and ISEKI (Food Engineering).

Such "branch labels" and how they should be dealt with and run should be defined in close collaboration with the relevant Association/project...³⁹

To finish, a few considerations on Civil Engineering (by an "old" graduate in Civil Engineering)

EUCEET does not like the 3+2 approach.

I understand the motivations: the ability to **design a Civil** Engineering "product" may be better acquired in a long-cycle course, or at least in 4 (not 3) years.

- No problem here with EUR-ACE: the SC label can be awarded to "long" programmes (as CTI does).
- However, short-cycle graduates in CE are needed for site supervision, check of materials, details of design, etc. etc.

I would call them "Bachelors of Civil Engineering" or "Technical Engineers", and accept education both in "parallel" and in "series": if you do not like, do not use these terms and favour separate educational programmes and/or "profiles", but do not deny their importance for the Construction Industry !!! 40

Thank you for your attention! I hope I have given sufficient (and sufficiently provocative) inputs for a lively discussion



If afterwards you want up-to-date information on EUR-ACE and ENAEE, application forms, etc., visit www.enaee.eu or www.eur-ace.eu

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