

**NEW “MARKETS” FOR EUR-ACE:  
a Central Asia project and a proposal for the Mediterranean Basin**

**Giuliano Augusti**  
**Agenzia QUACING, Rome, Italy.**  
[giuliano.augusti@gmail.com](mailto:giuliano.augusti@gmail.com)

**Claudio Borri,**  
**School of Engineering, University of Florence.**  
[dir-criaciv@dicea.unifi.it](mailto:dir-criaciv@dicea.unifi.it)

**Michele Betti, Elisa Guberti**  
**School of Engineering, University of Florence.**  
[michele.betti@unifi.it](mailto:michele.betti@unifi.it); [elisa.guberti@unifi.it](mailto:elisa.guberti@unifi.it)

**Summary**

After a brief summary of the EUR-ACE Engineering Accreditation System, this paper presents the main expected outcomes of the Tempus project QUEECA (Quality of Engineering Education in Central Asia; 2012-2015), that aims at setting up and implementing a system of Quality Assurance (QA) of Engineering Education (EE) in Central Asia countries, finalized to the pre-professional accreditation of engineering programmes (i.e. accreditation of educational programmes as entry route to the engineering profession). The accredited programmes should satisfy the same pre-requisites for the award of the EUR-ACE quality label, i.e. the EUR-ACE Framework Standards (EAFS) and the European Standards and Guidelines for Quality Assurance in Higher Education (ESG). In addition, taking profit from the experiences being developed within the above mentioned QUEECA, another forward looking at a new possible strengthening of the EUR-ACE system outside the European borders, in the Mediterranean Basin (North Africa), is discussed.

**Keywords**

Accreditation of engineering education; Curriculum development; Diversity in engineering education; Quality assurance engineering education

**Dedication**

*Gratefully dedicated to the memory of our colleague and friend, Prof. Francesco Maffioli, for his enthusiasm and for his strategic pan-European vision of Engineering Education.*

**1. Introduction**

The growing worldwide globalization of both productions and services requires, in the sector of the engineering professions, a concomitant globalization of the engineering curricula. Nowadays engineers are increasingly engaged in international projects; they should be able to work on multinational teams all around the globe collaborating on a common project through real-time electronic communication. Successful and effective collaboration requires not only the ability of participants to communicate in a common language, but also the assurance of a common level of technical understanding. Such issues are not trivial, given the global diversity of systems for educating engineers, for different goals in skills, for quality control of their education, and for their professional practice regulation. Consequently from the engineering education perspective the accreditation and

the assessment of academic programmes is critical in order to maintain the quality and the status of engineering graduates, and hence the technical workforce.

In this respect the Europe-based EUR-ACE system, started in 2007 and run by ENAEE (European Network for Accreditation of Engineering Education), represents an effective framework and accreditation system able to satisfy the above requirements. On the basis of a common set of standards (EUR-ACE<sup>®</sup> Framework Standards) it identifies high quality engineering degree programmes by recognizing them as “entry routes to the engineering profession” (pre-professional accreditation). Thus, EUR-ACE represents a systematic and shared global model of engineering accreditation that can be used to assess global professional skills and attributes of engineering graduates.

This paper, after a brief description of the EUR-ACE system, presents the main expected outcomes of the Tempus project QUEECA (Quality of Engineering Education in Central Asia; 2012-2015) led by the University of Florence, School of Engineering, under the leadership of Prof. Claudio Borri. The project aims at setting up and implementing a system of Quality Assurance (QA) of Engineering Education (EE) in Central Asia countries, finalized to the pre-professional accreditation of engineering programmes, within the framework of the EUR-ACE Standards (EAFS) and of the European Standards and Guidelines for Quality Assurance in Higher Education (ESG).

Eventually, an idea for a further development of the EUR-ACE System outside the European borders in the Mediterranean Basin (North Africa), taking profit from the experiences being developed within the above mentioned QUEECA project, is also briefly introduced.

## **2. The EUR-ACE Accreditation System**

Unlike the old national rules that prescribed inputs in term of subject areas and teaching loads, the EUR-ACE Framework follows the trend of the most recent Standards, and define and require “learning outcomes”. This approach has several direct advantages, like:

- a. it respects the many existing traditions and methods of engineering education in Europe;
- b. it can accommodate developments and innovation in teaching methods and practices (Borri and Tesi, 2009);
- c. it encourages the sharing of good practice among the different traditions and methods;
- d. it can accommodate the development of new branches of engineering (Borri and Maffioli, 2007).

The very beginning of the EUR-ACE system should be dated back in 2004 when the “European Standing Observatory for the Engineering Profession and Education” (ESOEPE) promoted a specific project (EUR-ACE - EUROpean ACcredited Engineer; 2004-2006) that formulated European Standards for the accreditation of engineering programmes and indicated the main lines of a decentralized accreditation system in which a common European quality label (the EUR-ACE<sup>®</sup> label) is added to the accreditation awarded by a national Agency. In order to run this system, ESOEPE was transformed in 2006 into the international not-for-profit association ENAEE (European Network for Accreditation of Engineering Education).

The EUR-ACE<sup>®</sup> label encompasses all engineering disciplines and profiles, is internationally recognised and facilitates both academic and professional mobility; moreover it gives international value and recognition to engineering qualifications. Thus, EUR-ACE has created a quality system for accredited engineering degree programmes that

share common objectives and outlooks (Borri and Tesi, 2009). Among others, several target groups are potentially interested by the award of EUR-ACE<sup>®</sup> labels, namely:

- a. employers, that are guaranteed of the quality of graduates from an EUR-ACE-accredited programme, without the necessity of direct knowledge of the contents and outcomes of the educational programme the graduates have followed;
- b. HEIs, that can advertise their EUR-ACE-accredited programmes stating that their learning outcomes have been recognized as satisfactory from both the academic and the professional viewpoint;
- c. students, that are guaranteed of the quality and professional relevance of their degree, if EUR-ACE-accredited;
- d. engineers' professional organizations, that can be satisfied about the educational requirements of the EUR-ACE graduates who want to enter into their registers.

The EUR-ACE system has been quoted as an example of good practice of QA in Engineering Education in an official report by the European Commission (2009) and in a publication issued on the occasion of the March 2010 “Bologna Anniversary Conference” (European Commission, 2010).

Going back to the roots of the whole EUR-ACE adventure it must not be forgotten that the original motivation behind EUR-ACE was, and still is, to establish a pan-European accreditation system of quality engineering education, extensively accepted by the broad engineering stakeholders community: indeed, the lack of such a system still involves great difficulties in trans-national recognition and mobility of European engineering students and graduates, that EUR-ACE is trying to overcome.

Initially, in November 2006, ENAEE assessed six Accreditation Agencies (the French CTI, the British EngC; the German ASIIN; the Engineers Ireland; the Portuguese Ordem dos Engenheiros; the Russian RAEE, now AEER), all active partners of the EUR-ACE project, already fulfilling the requirements set by the Framework Standards. These Accreditation Agencies were authorized to award the EUR-ACE<sup>®</sup> label for a period of two years, and their authorization was renewed in 2008 after a rigorous re-assessment process including site visits by multi-agency teams.

The effort to spread the EUR-ACE system into other countries, initially helped by an EC-supported project with the self-explanatory name of EUR-ACE SPREAD (2008-2010), is continuing today with appreciable success (Augusti, 2012). Impulse and concrete contributions to the spreading of the EUR-ACE system were received from the Academic Network EUGENE (Borri et al. 2011; Borri and Guberti, 2011), that devoted to these actions a full Activity Line led by Giuliano Augusti.

At the time of writing (June 2013) three more Agencies have been authorized to deliver the EUR-ACE<sup>®</sup> label in addition to the original six, namely MÜDEK (TR), ARACIS (RO) and QUACING (IT), while KAUT (PL) and OAQ (CH) have obtained the status of “candidate Agency” and will most probably be authorized in September. Note that ARACIS and OAQ are “general” QA Agency while previously only specialized “engineering” accreditation Agencies had been EUR-ACE-authorized.

Thus, at present the EUR-ACE accreditation system is systematically applied in 11 countries within the European Higher Education Area (EHEA) but initiatives, exploiting its added value as a European best practice example, are open to spread it to several other countries. Therefore, although the main aim of ENAEE is and will be to strengthen and spread EUR-ACE within the EHEA, it is also active in several projects on the global scene.

### **3. The Global Context**

In principle, the EUR-ACE<sup>®</sup> label may also be awarded outside the EHEA: signals of interest for this possibility have already been heard from several sources (e.g. in 2010 the Institute of Engineering Education Taiwan invited one of the authors of this paper to present the EUR-ACE system). A few EUR-ACE<sup>®</sup> labels have indeed been awarded (e.g. in China, Vietnam, Peru, Australia and in other countries not formally included in the EUR-ACE system) by EUR-ACE-authorized Agencies (namely ASIIN, CTI, AEER) that accredit also outside their home country.

Thus ENAEE, although focussing obviously its attention on Europe, has taken some initiatives on the global scene. Perhaps the most relevant is the TEMPUS project “Quality of Engineering Education in Central Asia” (QUEECA; 2012-2015) which will be dealt in the following Sections.

The main actor to confront the global scene is the Washington Accord (WA), an international agreement originally signed in 1989 by national bodies that accredited engineering programmes in countries following a system of the Anglo-American type (a first cycle [Bachelor] degree after three or four years of study and a second cycle [Master] degree after one or two additional years), joined over the years by other countries (“jurisdictions”, as they are called in WA documents). At present, full members of the WA are agencies operating in USA (ABET), UK, Ireland, Canada, Australia, New Zealand, South Africa, Japan, Hong Kong China, Chinese Taipei, Korea, Turkey, Russia. Four of the eleven EUR-ACE-authorized Agencies are members of the WA, namely EngC, Engineers Ireland, MÚDEK and AEER.

The WA recognizes the substantial equivalency of programmes accredited by the signatory bodies and recommends that graduates of programmes accredited by any of them be recognized in the other countries. The WA has analogies with the EUR-ACE system: however, the latter awards a common label based on shared standards and procedures (the EUR-ACE Framework Standards) while the WA relies on comparable accreditation procedures, independently applied by the participating agencies.

In most WA jurisdictions one degree (Bachelor) is the academic basis for entry into the engineering profession: therefore, the WA recognizes only the Bachelor degree, for which at least four years of study are prescribed. In parallel, standards have been developed for three- and two-year programmes, leading respectively to “engineering technology” degrees and “engineering technicians” qualifications that are recognized within the so-called Sydney and Dublin Accords. The three Accords are coordinated by the International Engineering Alliance (IEA): IEA and ENAEE have now frequent contacts and exchanges.

### **4. The Quality of EE in Central Asia: the Tempus QUEECA project**

Let’s now return to the QUEECA Tempus project, that has received a grant from the European Commission for the period 2013-2015, towards the objective of promoting and implementing in Central Asia countries (namely Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) a system of QA and accreditation of EE analogous to EUR-ACE ([www.queeca.eu](http://www.queeca.eu))

In Central Asia (CA) countries, the need for international recognition of engineering degrees is becoming more and more important at several levels. Two types of accreditation of education are actually taking place for example in Kazakhstan: i) institutional - for an estimation of activity of the Higher Education Institutions (HEIs) and ii) specialized - for a quality estimation of curricula. Institutional accreditation is organized by the Ministry of Education and Sciences and carried out by National Accreditation Centres. The specialized accreditation is carried out by international accreditation agencies or accreditation

organizations created by (or strongly connected with) professional associations. The CA governments are interested in creating and developing internationally recognized systems of educational and professional qualifications: in particular, the creation of accreditation organizations belonging to international networks is an urgent need. Kazakhstan, and the other CA countries, have declared their priority interest in the implementation of their Engineering and Technical programmes in analogy to the European Qualification Frameworks (EQF). However, international recognition of qualifications and programmes can only happen if the fulfilment of shared qualification standard is assessed through a periodic evaluation of study programmes by both internal QA and peer review processes. To fulfil this growing interest towards the internalization of CA engineering degrees, the assessment procedure of the EUR-ACE system seems the natural answer: this is the basic motivation of the QUEECA project.

## **5. The QUEECA Project Rationale**

The QUEECA project, opened by a Kick-Off meeting in November 2012, aims - as already hinted - at setting up and implementing a system of Quality Assurance of Engineering Education (EE) in four Central Asia countries (Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan), finalized to the pre-professional accreditation of engineering programmes (i.e. accreditation of educational programmes as entry route to the engineering profession).

In April 2013 the first QUEECA Forum took place in Almaty (KZ) at al-Farabi National University. The Forum covered regional cooperation, national and transnational recognition issues, and the establishment and development of national accreditation procedures compatible with the EQF and EUR-ACE. During the Forum the project partners confirmed not only their full engagement towards the QUEECA goals but also the relevance of the EUR-ACE System with respect to the CA peculiarities.

The Forum allowed the identification of common requirements between partners and lays the first milestone for the subsequent creation of a network of National QA Accreditation Agencies able to accredit engineering programmes and authorized by ENAEE to award the EUR-ACE<sup>®</sup> quality label.

According to QUEECA project, the accredited programmes should satisfy the same pre-requisites as for the award of the EUR-ACE<sup>®</sup> quality label, i.e. the EUR-ACE Framework Standards (EAFS) and the European Standards and Guidelines for Quality Assurance in Higher Education (ESG) (Borri et al. 2012). This should be achieved thanks to the creation of a network of National QA Accreditation Agencies (and possibly a Regional Federation) able to accredit engineering programmes and authorized by ENAEE to award the EUR-ACE quality label, through the following steps:

- a. create a National EE Society where it does not exist (in Kazakhstan, strengthen the existing KazSEE) and a CA Federation of EE Societies, partnered with SEFI and IFEES;
- b. adapt the EAFS and formulate analogous CA Standards (CAEAS) in Russian and English;
- c. create Accreditation Centres in each CA country (with a Regional coordination); train the relevant “accreditors“;
- d. run a series of Trial Accreditations with intern. teams to test the draft CAEAS and the local accreditors;
- e. taking into account the Trial Accreditations results, formulate the final version of CAEAS;

- f. Conduct a first run of pilot accreditation of engineering programs and award the first EUR-ACE labels in CA;
- g. Formulate a self-supporting financial plan for carrying out accreditation after the project closure.

In synthesis, the main aim of the QUEECA project is to promote the adoption of the EUR-ACE system in the partner countries, thus increasing the impact and attractiveness of Bologna principles among Engineering and Technology higher education institutions: the achievement of objectives for QUEECA will give a significant contribution to the implementation of the Bologna process among the involved partner countries and region and thus facilitate the trans-national recognition of educational and professional qualifications of engineer graduates.

## **6. A proposal to strengthen the EUR-ACE system in the Mediterranean Basin**

After the start and the initial experiences of the QUEECA project, new possible “markets” for the spreading of the EUR-ACE system are being considered. The North Africa (NA) regions seem a natural area for this, taking into account the relevance of the North Africa regions in the Mediterranean Basin.

Indeed, among the priorities of North African development strategies, the capacity-building in Higher Education (HE) and its upgrading certainly evoke the need for international recognition of engineering degrees as a critical measure at several levels. This is due to various factors, such as the increasing trend of the internationalization and globalization of higher and technical education, the growing number of student enrolment and the emergence of a multicultural workspace. Yet, there are actually no agencies for quality assurance or accreditation of engineering programmes in NA; rather, national and regional councils (or committees), supervised by HE ministries, are responsible for the approval of curricula. The NA governments are interested in creating and developing internationally recognized systems of educational and professional qualifications, hence the creation of accreditation organizations belonging to international networks is an urgent need. All NA countries have declared their priority interest in the implementation of their Engineering and Technical programmes in analogy to the European Qualification Frameworks (EQF). However, international recognition of qualifications and programmes can only happen if the fulfilment of shared qualification standard is assessed through a periodic evaluation of study programmes by both internal NA and peer review processes.

This fulfilment will definitely allow Engineering Education (EE) in NA countries to be fully integrated within the Bologna standards, i.e. a very important step forward in the way of creating a "Mediterranean HE area".

The EUR-ACE system seems the natural answer to these emerging requirements.

As already stressed, great attention is paid on the EUR-ACE System by different engineering societies in the world such as Engineers Australia and IFEES. Harmonisation according to EUR-ACE will constitute a very important challenge to increase employment and trans-national mobility of engineers by facilitated cross-recognition of degrees in Europe, NA and worldwide, responding to the 2006 communication by the European Parliament on “Modernisation Agenda for University”.

The creation of a “Mediterranean HE area”, through the adoption of the EUR-ACE system in the NA countries (such as Morocco, Algeria, Libya and Tunisia) might increase both the impact and the attractiveness of Bologna principles among Technical HEIs and would be a significant spreading of the Bologna process.

## 7. Conclusions

As our society is facing many grand-challenges and threats, such as the current economic crisis, environmental sustainability, climate change and demographic ageing, these are obviously having different impacts on Higher Education. Therefore Higher Education Institutions should, or better have to contribute to identify the ways out. Universities play a key role and should be involved in providing a cutting edge and effective platform for communication and collaboration among all stakeholders in engineering education that share the same interest.

Experience has proven the importance of cooperation in the European and trans-European policy context of the Lifelong Learning Programme and TEMPUS and it is precisely this activity that should be promoted in the future. The key theme is now the necessity of collaboration in engineering education in the future and how this must contribute to creating and promoting creative and competitive education in the engineering sector and how future engineers should be assured with the necessary skill requirements and subsequently an employment. The methodology to adopt is welcoming contributions and inputs from all actors in engineering education, from students, researchers, teachers, professionals and industry, since the basis of collaboration is to include and not to exclude.

In this framework the QUEECA TEMPUS project appear to be an important asset for the European Accreditation System as it significantly contributes to its spreading also behind the European Higher Education Area (EHEA). In this respect also the North Africa region can offer a significant field for spreading the EUR-ACE system, and eventually start the creation of a "Mediterranean HE area".

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#### **Appendix: Main Acronyms used in the paper**

AEER:	Association for Engineering Education of Russia
ARACIS:	Romanian Agency for Quality Assurance in Higher Education
ASIIN:	Accreditation Agency for Degree Programmes in Engineering, Informatics, the Natural Sciences and Mathematics (DE)
CA:	Central Asia
CAEAS:	Central Asia Engineering Accreditation Standards
CTI:	(France) Commission des Titres d'Ingénieur
EAFS:	EUR-ACE Framework Standards
EE:	Engineering Education
EC:	European Commission
EHEA:	European Higher Education Area Education.
ENAEE:	European Network for Accreditation of Engineering Education
EngC:	Engineering Council (UK)
EQF:	European Qualification Framework
ESG:	European Standards and Guidelines for Quality Assurance in Higher Education
ESOEPE:	European Standing Observatory for the Engineering Profession and Education
EU:	European Union
EUR-ACE:	EUROpean ACcredited Engineer
FINHEEC:	Finnish Higher Education Evaluation Council
HE:	Higher Education
HEI:	HE Institution (e.g. University)
IEA:	International Engineering Alliance
KAUT:	Accreditation Commission of Universities of Technology [Komisja Akredytacyjna Uczelni Technicznych]
MÜDEK:	(Turkish) Association for Evaluation and Accreditation of Engineering Programs
OAQ:	Swiss Center of Accreditation and Quality Assurance in Higher Education [Organ für Akkreditierung und Qualitätssicherung der Schweizerischen Hochschulen]
QA:	Quality Assurance
QUACING:	(Italian) Agency for QA and EUR-ACE accreditation of engineering programmes
QUEECA	Quality of Engineering Education in Central Asia, <a href="http://www.queeca.eu">www.queeca.eu</a>
RAEE:	Russian Association for Engineering Education (now AEER: Association for Engineering Education of Russia)
WA:	Washington Accord.