



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

HELLENIC REPUBLIC

Α.ΔΙ.Π.

H.Q.A.A.

ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΠΟΙΟΤΗΤΑΣ

HELLENIC QUALITY ASSURANCE AGENCY

ΑΝΩΤΑΤΗΣ ΕΚΠΑΙΔΕΥΣΗΣ

FOR HIGHER EDUCATION

EXTERNAL EVALUATION REPORT

**DEPARTMENT OF ENVIRONMENTAL ENGINEERING,
TECHNICAL UNIVERSITY OF CRETE**

November 12, 2011

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External Evaluation Committee

The Committee responsible for the External Evaluation of the Department of Environmental Engineering, Technical University of Crete consisted of the following three (3) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. Professor Angelos M. Efstathiou, Coordinator
University of Cyprus (Cyprus)
2. Professor Filippos Tsikalas
Eni E&P (Italy) & University of Oslo (Norway)
3. Adjunct Professor Christos Katopodis
University of Alberta
Formerly of the Freshwater Institute (Canada)

Introduction

I. The External Evaluation Procedure

- Dates of the site visit

The visit was carried out from 6 pm on 7/11/2011 until 4 pm on 9/11/2011.

- Whom did the Committee meet?

Day 1, Monday, November 7, 2011:

At the beginning of the evaluation process the External Evaluation Committee (EEC) members met at the Department premises with the Vice Rector of Academic Affairs, the Chairman of the Department, and members of the Internal Evaluation Committee (OMEA). A general discussion was held on the state of academic and research affairs of the Department and the University. In particular, the history of the Department and the issue relating to the professional practice of the Department's graduates.

Following this meeting, the EEC met with most of the academic staff of the three different departmental sections. Prof. N. Kalogerakis presented the research activities of the entire Department. He highlighted:

- the structure of both the undergraduate and graduate curricula and some current issues (e.g., high number of graduates, courses and exam periods)
- the academic staff and their achievements consisting of national and international collaborations, external funding, membership in various international research evaluation panels, and scientific outputs (publications, citations and h-index, awards, patents)
- the current issues with supporting personnel of the various teaching laboratories, and
- some space allocation issues, which will be resolved once the construction of the new Departmental facilities will be completed.

Day 2- Tuesday, November 8, 2011

On the second day, the EEC met with the academic staff members of the Department who gave an overview of the undergraduate and graduate curricula structure, and an outline of the vision for the future restructuring of the Department based on the new law for Higher Education. Furthermore, the EEC conducted interviews with administrative staff, special teaching personnel, representatives of postdoctoral and graduate students, and members of the non-permanent academic staff. At the end of the day, the EEC started visiting departmental laboratories and research facilities.

Day 3- Wednesday November 9, 2011

On Wednesday November 9, EEC met with the University Rector at his office in the presence of the Chair of the Department. The Rector outlined the role and importance of the Department within the University, and requested the EEC's impressions.

EEC visited the University library facilities, and had discussions with the chief librarian. Also, EEC was made aware and toured non academic facilities within the campus.

The on-site visit by EEC continued with additional departmental laboratories and research facilities. EEC also interviewed one departmental graduate who is currently employed by industry. Furthermore, EEC met with some undergraduate students of the Department. At the end of the site-visit, EEC met with the Chair of the Department and the members of the OMEA.

In the afternoon of Day 3, EEC members returned to Athens.

Day 4 - Thursday November 10, 2011

The EEC members worked on the final draft of the EER at facilities provided by the HQAA.

Day 5 - Friday November 11, 2011

The EEC members continued working on the final draft of the EER.

Day 6 - Saturday November 12, 2011

The EEC members continued working on the final draft and submission of a first draft of the EER. The EEC members departed from Athens.

Summary: The Department of Environmental Engineering managed to prepare a program that allowed meetings and discussions with all divisions of the Department and the University authorities. Faculty readily accommodated additional requests by the EEC (e.g. contacted graduate students for interview). In these meetings all members of the teaching staff were present. Furthermore, EEC had the opportunity to speak to most laboratory instructors, visit all teaching and research laboratories, computing facilities, and the core teaching and research instrumentation used. EEC also met and had discussions with representatives of students (undergraduate, MS and PhD students, and a graduate working for a commercial enterprise). EEC visited the central University library, and non-academic facilities within the campus.

II. The Internal Evaluation Procedure

- *Appropriateness of sources and documentation used*

The EEC members had at their disposal prior and during the evaluation process the following documentation: (i) reports of teaching and research activities of the Department in the period 2006-2011, (ii) Internal Evaluation Reports for the periods 2006-2008 and 2009-2010, and (iii) External Evaluation Reports for the period 2004-2006. These documents included detailed information on the structure of the Department, the building facilities and a short introduction of the organisational structure of the University. Additional documents concerning several research aspects and activities (see above) were received during the visit.

- *Quality and completeness of evidence reviewed and provided*

The furnished reports reflect the current situation (up to 2011). They clearly describe the structure, organisation, and facilities of the Department. The excellent effort made by the Department to provide a complete picture of teaching and research activities, as well as administrative and laboratory facilities was highly appreciated by the EEC committee.

- *To what extent have the objectives of the internal evaluation process been met by the Department?*

Overall, the Internal Evaluation Reports met the objectives of the evaluation process.

A1. Undergraduate Curriculum

APPROACH

Goals and objectives of the Undergraduate Curriculum (UGC)

The goal of the UGC is to provide students with basic and specific knowledge in both theoretical and applied topics to equip them with exceptional technical and communication skills, raise their awareness of global environmental issues, and enable them with leadership abilities in environmental management, in order to practice as professional Environmental Engineers.

The objectives of the UGC are to offer courses relevant to the Environmental Engineering science; to enable the analysis of data and design of systems related to the environment; the development of basic capabilities related to synthesis, rational system integration, experimentation, and collaboration; the integration of social, economic and cultural issues in the educational program in problem solving by targeting optimal solutions in resource management decisions.

This is a relatively new program (initiated in 1997) which shows signs of maturity. In spite of this, the Department has been successful in educating undergraduate students, both for employment and postgraduate studies. Upon graduation, students are well received by industry, as well as academic/research institutions (Europe, North America). The major criterion of their success is their good training.

- *What is the plan for achieving excellence?*

The structure of the curriculum is similar to the ones used successfully by internationally recognized and very good Environmental Engineering Departments in Europe and North America. Student attendance in lectures, as usual in Hellenic academic institutions, is not mandatory, and is considered not satisfactory by both the academic staff and the EEC. The undergraduate laboratory training is mandatory and very successful. In this rapidly evolving engineering field, it is very important to update the material used in the classroom and the laboratory regularly. The Department has been successful in keeping the curriculum current and very effective.

- *How were the objectives decided? Which factors were taken into account?*

Undergraduate instruction is transparent and the methods used in the classroom concerning teaching and testing are determined by the instructors. A committee in charge of the undergraduate program within the Department evaluates the objectives and updates the curriculum to reflect the current state-of-the-art. The majority of academic staff who teach the undergraduate courses had education and academic experience in Universities outside Greece (North America and Europe). Consequently, the operation of the undergraduate program reflects the past experience of the faculty. The European/American influence in the course study-guides is apparent. The high level of undergraduates who matriculate under this Departmental curriculum is evidenced by the successful performance of a number of these students in post-graduate studies in Europe and North America.

Technical training with commercial enterprises is mandatory for the undergraduate students. The EEC applauds the policy of the Department to keep the Diploma Thesis mandatory within the curriculum. These practices have been successful and should continue.

IMPLEMENTATION

- *How effectively is the Department's goal implemented by the curriculum?*

The Department has designed the undergraduate curriculum in stages, adjusting it periodically as permanent staff was hired, and the discipline evolved towards innovative areas which the academic staff contributed to. The current curriculum emulates those of the best internationally recognized universities in Europe (European Credit Transfer System, ECTS) and North America. As such, the training of undergraduate students produces environmental engineers who adequately meet the needs of Hellenic and International academic institutions and industry related to the environment.

- *How does the curriculum compare with appropriate, universally accepted standards for the specific area of study?*

As stated previously, the curriculum compares very well.

- *Is the structure of the curriculum rational and clearly articulated?*

Yes, as shown by the orderly operation of the classroom and laboratory instruction and availability of study guides, based on syllabi. However, some improvements should be made as indicated below.

- *Is the curriculum coherent and functional?*

The EEC notes that the academic staff recognises that as the curriculum evolved the number of courses accumulated was too high. Starting this academic year (2011/2012), the number of courses is already reduced and further reductions may result from additional reviews. The EEC fully agrees with this approach. Furthermore, the EEC notes that the experimental versus theoretical content of the courses offered could be higher.

- *Is the material for each course appropriate and the time offered sufficient?*

Generally yes, although the EEC notes that some of the lab exercise notes should include the essential part of the experiment. The time offered for the experimental part in some courses should be increased. The EEC believes that this is a consequence of the high number of students accepted in the program.

- *Does the Department have the necessary resources and appropriately qualified and trained staff to implement the curriculum?*

The departmental facilities provide classrooms and laboratories of a very good quality; some of them are of excellent quality. The same is also true for the necessary instrumentation, library and study halls. A group of highly qualified instructors that supervise the laboratories, have been in the Department for many years, enjoy their duties and are very effective. This is apparent by the fact that instructors are held in high esteem within the faculty. The EEC is impressed by the strong effort of the laboratory staff. Although they are often overqualified (have Ph.D. degrees), they help teach the undergraduates and ensure good and safe working practices in the laboratory.

Recommendation 1: Consider offering complete experimental courses covering material from several theoretical principles within specific areas (e.g., physical chemistry, mass and heat transport, chemical and biochemical processes).

Recommendation 2: Increase the experimental portion of the ECTS lab load without increasing the overall ECTS of the curriculum.

Recommendation 3: Reduce by at least 10% the current number of courses offered in the curriculum. In achieving this, consider adjusting some of the courses offered with more specialised sections (e.g., cost benefit analysis, sustainable development in environmental engineering, etc).

Recommendation 4: Strengthen specific renewable energy technologies and their environmental implications and solutions (e.g., power production through biomass conversion).

RESULTS

- *How well is the implementation achieving the Department's predefined goals and objectives?*

The current curriculum includes high quality core courses that meet or exceed the Department's predefined goals and objectives. Implementation of the above Recommendations 1-4 will further improve the curriculum.

- *If not, why is it so? How is this problem dealt with?*

N/A

- *Does the Department understand why and how it achieved or failed to achieve these results?*

The Department fully understands the strength and weaknesses of the curriculum, and has already started to implement measures to improve it (e.g., reduction in courses, introduction of new renewable and sustainable energy technologies).

IMPROVEMENT

- *Does the Department know how the Curriculum should be improved?*

The Department has made several positive suggestions on the improvement of the curriculum in their Internal Evaluation Report (see page 52, IER 2009-2010), which the EEC fully agrees with. Based on this report and the site visit of the EEC, the following recommendations are made:

Recommendation 5: Currently, a lack of fellowships exists for non-permanent teaching assistants who can support the instructive work of the professors during their laboratory courses. Funding and provision of these teaching fellowships by the State and/or the University is necessary and urgently recommended, on a priority basis.

Recommendation 6: Currently, a lack of technical staff exists to maintain and run the instrumentation of the Department that is a basic requirement of the curriculum. The EEC recommends the employment of technical staff.

Recommendation 7: The EEC strongly recommends the implementation of homework assignments, group projects, and mid-term examinations. In addition to the final exams, these items should contribute to the final grade. This will largely improve the quality of the educational experience.

Recommendation 8: The implementation of required prerequisite courses ("chain system" of instruction) is essential for the more effective development of the curriculum and the quality of the educational experience.

A2. Postgraduate Curriculum

APPROACH AND IMPROVEMENT RECOMMENDATIONS

Goals and objectives of the Postgraduate Program (PGP)

The PGP consists of two directions that may be followed sequentially (A and B) or in the case of A be a final destination.

- A) Post graduate Diploma of specialization (Master of Science; MSc thesis is mandatory)
- B) Ph.D. Diploma

The current MSc curriculum was established in 2007, and offers one departmental MSc degree entitled “Environmental and Health Engineering” that represents two specific specializations, namely, “Environment and Health” and “Management of Water Resources and Coastal Areas” (IER, pages 19-27). In addition, there is an interdepartmental PhD program established in 2001 entitled “Quality Control and Environmental Management”. All postgraduate diplomas are driven by research and industrial practice.

The extensive number of publications, in high-impact international journals, attests to the high level of achievement of the academic staff and graduate students (see section C). The MSc diploma offered satisfies most of the needs of the Hellenic industry at present, which in many cases does not need the sophistication of the Ph.D. degree. The latter is more appropriate for preparation of supervisory and managerial industrial positions, academic positions or post-Ph.D. research positions. The success of both programs is evidenced by their effective continuation for several years.

Recommendation 9: The EEC recommends that the structure of the MSc program should emphasise core courses in addition to elective ones. In addition, EEC notes that the “Health” component is not presently supported by courses, and perhaps the title of the program should be limited to “Environmental Engineering”.

Recommendation 10: The EEC recommends that more emphasis be placed on applied aspects of Environmental Engineering and further collaboration with industry. For example, cost benefit analysis and guest lectures from industry accompanied by complete project assignments. This will facilitate employment opportunities for graduates.

Recommendation 11: Additional instrumentation and technical staff are needed for training and laboratory exercises.

B. Teaching

APPROACH

The overarching principle of the teaching philosophy of the Department is to provide sufficient knowledge in Environmental Engineering through core and elective courses, as well as applied projects towards undergraduate and graduate (MSc and PhD) degrees.

- *Teaching methods used, course updates, student participation, grades, and average duration for the undergraduate degree*

Teaching methods employ the traditional classroom lectures based on white board and projection facilities. The content of the courses was updated through several external critical assessments (2004, 2006, and 2008) of the teaching program with full faculty participation. Faculty members of the Department of Environmental Engineering have published their own textbooks or are using translated popular modern textbooks in several core areas. Most course lectures, notes, homework assignments and solutions are made available in hard copies or through the use of Web resources and multimedia. The combination of these methods reflects the high quality and teaching expertise of the academic staff. The teaching staff members for course work and laboratory work are available to the students not only through regularly scheduled office hours but also on demand at any requested time by the students.

- *Teaching staff/student ratio, interactions of faculty and students, and faculty teaching hours per week*

The ratio of the overall teaching staff to the number of undergraduate students (5 years of study) is $19/302 = 1/15.9$. Taking into account the 112 additional undergraduate students attending between 5-10 years, the overall number of undergraduate student ratio becomes $19/414 = 1/21.8$. The faculty have on average a teaching load of 6 h/week. This assignment seems to be appropriate taking into consideration the examination load of the instructors and the extensive time the instructors have to invest in teaching laboratory courses due to the lack of teaching fellowships for students and limited technical staff.

- *Teacher/student collaboration*

The interviews conducted with the students demonstrated that there is a high level of collaboration between students, lab instructors, and academic staff.

- *Adequacy of means and infrastructure resources*

The Department of Environmental Engineering is very well equipped. A number of the facilities and research instruments are state-of-the-art. The classrooms are properly equipped and with significant efforts are kept in good shape. Also, the teaching laboratories are kept in good shape through strong commitment and collaborative efforts. The Department has access to a well-maintained central university library with wireless internet available.

- *Use of information technologies*

Computer equipment and internet resources are widely used, including online bibliographic databases, electronic books and wireless internet access (e-class). Dedicated computational facilities with several personal computers are available to the students within the Department. Dedicated infrastructure for online access to satellite data is also available.

- *Examination system and assessment of course work by the students*

Assessing the performance of students in each class is carried out through written final exams. At the discretion of the instructor, in certain classes/laboratories the final grade is a combination of lab assignments, written reports and oral presentations. Some faculty members use a student questionnaire for the assessment of the quality of their courses.

Recommendation 12: The EEC highly recommends that either the Department or the University review the existing voluntary student questionnaires and develop and administer a uniform questionnaire approved by the University which has to be mandatory for all courses. The results of these questionnaires should be used by the Department to improve teaching effectiveness. This evaluation process should be done via access to a secure internet University site at which each student will provide his/her comments anonymously.

IMPLEMENTATION

- *Quality of teaching procedures*

The teaching methods are highly commended and this reflects the experience, flexibility and dedication of the teaching staff. This was also reflected by the postgraduate students during the interview.

- *Quality and adequacy of teaching materials and resources.*

The EEC notes that in this rapidly evolving field of environmental engineering the teaching material and instrumentation are appropriate and updated frequently.

- *Quality of course material. Is it brought up to date?*

The lectures in all courses are reviewed and updated frequently, while the quality of the course material is considered very good.

- *Linking of research with teaching*

The Department has implemented a mandatory Diploma Thesis in the undergraduate curriculum during the last academic semester. The latter provides the students with a first-hand research experience which may also link with industry. For those students that enter the MSc program, the link between experimental research and teaching is clearer, and as a result of this it provides a better opportunity for industrial employment and professional career development.

- *Mobility of academic staff and students*

Within the ERASMUS program, the Department is collaborating with several other European Universities. This program has given a lot of students the opportunity to spend 1-2 academic semesters abroad. The Department also participates in several research collaborations with other Universities and Institutes. These efforts should be maintained and further increased in the future.

- *Evaluation by the students of (a) the teaching and (b) the course content and study material/resources*

The evaluation by the postgraduate students during the interview was very positive on both aspects. However, further improvements in the feedback provided by the students could be made through unified questionnaires (see Recommendation 12).

Recommendation 13: It is suggested that the undergraduate and MS students create awards for the best teachers annually, where the nomination, assessment and selection process is exclusively student-controlled.

RESULTS

- *Efficacy of teaching*

The EEC, as well as the academic staff, noted the tendency towards uniformly high grades (9-10) for Diploma Theses, and for higher objectivity in marking this must be avoided (see Recommendation 16).

- *Differences between students in (a) the time to graduation, and (b) final degree grades*

There is a distribution in the final degree grades of the undergraduate students with a maximum (75% of all students) of between 7 and 8.4. The average grade of the undergraduate degree is 7.2/10 for the year 2009-2010, whereas for the period 2008-2009 the average was 7.25/10. Time to graduation averages 5.7 years (academic years 2004-2010) which is more than the expected 5 years.

- *Whether the Department understands the reasons of such positive or negative results?*

The reason of the current length of graduation time is due to: (a) the indefinite number of repetitions following failure in examinations; (b) the need of certain students to support their educational expenses by working; and (c) the lack of fellowships in support of education.

IMPROVEMENT

- *Does the Department propose methods and ways for improvement?*

The Department is eager to introduce modern methods and other ways of improving teaching. The Department has made several positive suggestions in their Internal Evaluation Report (see page 52, IER 2009-2010), which the EEC fully agrees with, and include: (a) reduction in the number of students admitted; (b) reduction in the total ECTS units of the undergraduate program; (c) certification of student's acquired knowledge.

- *What initiatives does it take in this direction?*

The Department has undertaken several important initiatives and made specific suggestions in their Internal Evaluation Report (see pages 52-53, IER 2009-2010), which the EEC fully agrees with.

Recommendation 14: The EEC strongly recommends that the recognition by the Hellenic Republic of the professional rights stemming from the curriculum and the Engineering Diploma granted be fully accepted.

Recommendation 15: The EEC strongly recommends that the Department should expend considerable effort to find effective ways of increasing classroom attendance for the undergraduate students. For example, classroom assignments will only be handed to those attending and would need to be completed before a student is allowed to conduct the experimental part of the course.

Recommendation 16: The EEC recommends that uniformly high grades for the Diploma Thesis be avoided, and instead a more objective and wider grading scale range be used. In addition, the supervisor's percentage contribution towards the final grade for the Diploma Thesis should be increased substantially.

C. Research

APPROACH

- *What is the Department's policy and main objective in research?*

The Department's research policy aims to conduct pioneering research in managing natural resources in sustainable ways contributing to enhancing the environment, social cohesion and economic activity and growth. The Department's strategic goal is to become a Centre of Excellence.

The Department has presently 19 faculty members. Active areas of research include: Environmental Management, Design and Development of Environmental Processes, and Environmental Hydraulics and Geoenvironmental Engineering. More specialised areas include: Liquid and solid wastes management and treatment; Management of toxic wastes and their impact on human health; modelling of environmental systems; environmental chemistry; food technology; environmental geochemistry; sustainable energy systems; air pollution; soil remediation technologies; integrated water resources management.

- *Has the Department set internal standards for assessing research?*

The Department has set internal evaluation procedures (see Internal Evaluation Reports for the periods 2006-2008 and 2009-2010) for assessing all aspects of research activity including external reviews undertaken on their own initiative (see External Evaluation Reports for the period 2004-2006). An internal committee (OMEA) was established for the evaluation of the scientific work and the presentation of the most important results. This committee was very responsive to all EEC requests for additional information or arrangements. The internal evaluation process used common international standards for the assessment of the scientific work, such as the number of publications and citations, the impact factor of journals, in which the results have been published, the h-index (ISI Web of Science), the number of invited talks on conferences, and the recognition of faculty members with domestic/national or international awards.

IMPLEMENTATION

- *How does the Department promote and support research?*

The Department has initiated multiple actions to promote research: a) several research collaborations have been set up with Environmental Engineering Departments in European and North American countries, many of them with distinguished researchers; b) faculty members participate in several national and international funding programs; c) several faculty members have initiated collaborations with industry; d) several faculty members arrange for graduate student exchanges; e) several faculty members accommodate each other's research by sharing laboratory space and equipment when critical needs appear; f) several national and international symposia have been organized by the Department at the University.

- *Quality and adequacy of research infrastructure and support*

The research infrastructure of the Department was rather impressive with state-of-the-art instrumentation in many cases. This is a credit to the initiatives of faculty members who have been able to acquire specialized equipment through competitive national and European funding sources. It is worth noting though that the infrastructure (e.g., lab space) is not quite completed yet and equipment maintenance and technical support is still a concern. Furthermore, the limited available State funds for fellowships for M.Sc. and Ph.D. students are noted. There may be a risk that this could jeopardise the high quality of research and contribute to brain drain for Greece in the near future. The Department has set up a prioritized equipment list to be purchased. The EEC members fully support this, and urge the State and/or the University to contribute towards this need.

Recommendation 17: The EEC fully supports the prioritized equipment list set up by the Department. As the highest priority, EEC members suggest the purchase of the following equipment: (1) Electrophoresis system; (2) Nano SMPS (sub-micron solid particle analyser); (3) Spectrophotometers in the UV/visible/near IR; (4) System for synthesis and qualitative analysis of bio-fuels; and (5) Confocal microscopy. The other instruments cited on the list, which has been already approved by the Department and the University, should be purchased soon afterwards as money become available.

- *Scientific publications*

The Department is very active in research as evidenced by: a) the large number of publications in peer-reviewed journals, b) the fact that several faculty members have published their own books in English, c) the appreciable number of contributions to books and participation in conferences (invited talks, keynote and plenary lectures), d) the invitation of faculty members to act as guest editors for special issues, e) the number of patents, and f) several international awards. An increasing number of publications in journals with an impact factor >3.0 during the last five years indicates the overall increasing quality of the scientific work carried out. The impact nationally and internationally of the research results and achievements of faculty members are noteworthy as indicated by the following two measures: a) the annual average number of publications per faculty member of the Department of Environmental Engineering is 4.5, which is considerably higher than other University Departments in Greece (average of 1.0); b) the average h-index (quantitative and qualitative research output index) for the Department is 19.7, which is much higher than the average in many University Departments and Research Institutes in Greece and more importantly in Germany and USA.

According to the Internal Evaluation Report, during the period 2006-2010 the Academic Staff of the Department has published 405 papers in peer reviewed academic journals and had almost 8,000 citations. More than 250 of these publications have appeared in scientific journals of high Impact Factor (>3.0). Moreover, during these years, the faculty members of the Department participated in more than 500 presentations in international scientific meetings. It is noted that in recent years an increase of the number of publications and citations is observed. Specifically, in 2010 the faculty members of the Department have produced about 100 publications and received over 2,200 citations, which is an impressive result.

- *Research projects*

The Department has been successfully involved in several competitive research projects that for the period 2009-2010 amounting to approximately 6.9 MEuros (28% of the research budget for the Technical University of Crete, which includes 6 Departments). This includes 56 research projects (24% of the number of research projects for the Technical University of Crete which includes 6 Departments). The EEC members note that most of this support has come through competitive European Union projects rather than domestic sources.

- *Research collaborations*

It is noteworthy that the Department has had and continues to have numerous research collaborations with domestic and international academic and research institutions, as well as industrial partners and local authorities. The internal evaluation report provides an extensive list of collaborating institutions, including specific information on the nature of each collaborative effort.

RESULTS

- *How successfully were the Department's research objectives implemented?*

The departmental objective of excellence in research is attained to a high degree (see above). The participation of faculty members in several national and international funding programs have attracted significant amounts of research funds in the form of contracts and competitive grants, which led to a current state-of-the-art infrastructure. The research initiatives and achievements in specific areas, such as photo-voltaic systems, climate change, contaminant remediation through biochemical means, novel laboratory methodologies for measurements and sample treatment, are remarkable. Several faculty members of the Department have also initiated collaborations with industry that led to patents.

- *Scientific publications*

See comments in the IMPLEMENTATION section above. The EEC considers several members of this group of researchers as international leaders in their respective fields of expertise and highly productive.

- *Research projects*

See comments in the IMPLEMENTATION section above. In the EEC's opinion the quality and the number of research projects is outstanding and compares very well with comparable top Environmental Engineering teams in Europe and North America. Therefore, the EEC strongly believes that the Department is fully capable of becoming a Centre of Excellence in this field.

- *Research collaborations*

See comments in the IMPLEMENTATION section above. In the EEC's opinion the number of national and international collaborations is impressive.

- *Efficacy of research work. Applied results and patents*

The efficacy and applied results of the Department research activities are evident by the high productivity in publications, numerous invited presentations, awards and patents.

- *Is the Department's research acknowledged and visible outside the Department? Rewards and awards*

The international recognition and visibility of several faculty members are evident by the invitations to act as Guest Editors in peer-reviewed journals/books, journal reviewers, keynotes and international awards. In addition, several faculty members act as Coordinators and reviewers/evaluators for European funded research projects.

IMPROVEMENT

- *Improvements in research proposed by the Department, if necessary.*

The Department is commended for its high level of teaching and research effort in spite of the limited resources available within the Hellenic Republic. The Department has made specific suggestions in their Internal Evaluation Report (see pages 52-53, IER 2009-2010), which the EEC fully agrees with.

- *Initiatives in this direction undertaken by the Department*

The faculty have made significant efforts to maintain and improve their high research level. External factors, such as legal and financial hurdles, seem to be the main limitation for the Department to reach its full potential.

Recommendation 18: The EEC recommends that the Department offers graduate courses, as well as the opportunity to submit the MSc Thesis and PhD Dissertation in English. The EEC anticipates that this will attract a higher calibre of students, as well as students from other countries, and increase international research collaboration even further.

Recommendation 19: The EEC strongly recommends that start-up funding for the Lectures should be provided by the University soon after their appointment. This measure will largely enhance participation in competitive grants and excellence in research by young researchers.

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D. All Other Services

APPROACH

- *How does the Department view the various services provided to the members of the academic community (teaching staff, students).*
- *Does the Department have a policy to simplify administrative procedures? Are most procedures processed electronically?*

The Department views that the various kinds of administrative and technical services provided by the Department and the Technical University of Crete to the academic community is satisfactory to very satisfactory. When compared to other countries (panel member's impressions), the current Department of Environmental Engineering at the Technical University of Crete appears to have a larger proportion of happy staff members.

Student admissions and the recording of course grades are handled by the capable secretarial staff of the Department. By comparison, in many other foreign universities these duties are handled by the central administration. In addition, it appears that there is a lack of support by the central university students' welfare office for those students who face severe financial needs and academic performance problems.

Recommendation 21: The University should create a centralized e-system to handle student admissions, student grades and other student-related inquiries. This will alleviate the heavy load currently handled by the Department secretarial staff. The grades for a given course should be available on line through a secure internet site to address student inquiries.

IMPLEMENTATION

- *Organization and infrastructure of the Department's administration (e.g. secretariat of the Department).*

The Department of Environmental Engineering is composed of three major sections on the basis of teaching and research responsibilities. The administration staff is mainly available for administrative duties imposed on the Department. The EEC noted that the procedures relating to purchases for the Department's research and teaching needs are largely performed by the post-graduate students and members of the teaching personnel responsible for the laboratories. The administration staff appears to have little or no involvement. The EEC members suggest that assessment of the secretariat staff must include a personal interview by a committee set by the University, in which the Head of the Department participates.

Technical support is needed by the University to address specific safety issues and improve safety in general and in particular in the laboratories of the Environmental Engineering Department.

Recommendation 22: The EEC recommends that among the responsibilities of the secretariat of the Department should be the organization and execution of all necessary procedures for the purchase of consumables and equipment for the teaching and research needs of the Department in close collaboration with the technical staff of the Department.

- *Form and function of academic services and infrastructure for students (e.g. library, PCs and free internet access, student counseling, athletic- cultural activity etc.).*

The student secretariat is quite efficient and the library is well organized. Good sport facilities are available within the university campus. However, there is a lack of student counseling by the university students welfare office for those students who face severe financial and academic performance problems.

Recommendation 23: The EEC recommends that the administrative services of the Technical University of Crete should provide counseling to those students facing severe financial needs and academic performance problems.

RESULTS

- *Are administrative and other services adequate and functional?*

See comments above.

IMPROVEMENTS

- *Initiatives undertaken by the Department to improve the services provided*

The Department provides support to students exhibiting low academic performance through extra individualized instruction.

Collaboration with social, cultural and commercial organizations

Since 1997, when the first students were admitted, the Department has developed substantial collaboration with local and national commercial enterprises such as co-operatives, industrial and private sector companies. The majority of the members of the Department of Environmental Engineering participated in a large number of joint projects which relate to the specific needs of such enterprises. Members of these enterprises participate in the educational process by giving seminars, supervising two compulsory “field project” courses and as instructors (PhDs) or members of Diploma Thesis Committees. In addition, members of the Department present various public lectures related to Environmental Engineering, and write articles in local and national newspapers and magazines on their research topics, which are of the interest to the public. The Department recently organized a workshop on the occasion of its 10 years in operation, where representatives from several social, cultural and industrial organizations participated.

A number of faculty members actively participate in various Hellenic and international scientific union councils, and as expert evaluators of national and international scientific programs.

E. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors

- *Potential inhibiting factors at State, Institutional and Departmental level, and proposals on ways to overcome them*

Inhibiting factors noted by the EEC are:

(a) the lack of funding opportunities and negligible support from the Ministry of Education and the General Secretariat of Research and Technology of the Hellenic Republic. The lack of fellowships and teaching assistantships for the MS and Ph.D. programs is of particular concern and duly noted;

(b) the small number of technical staff;

(c) the long delays in the approval and hiring process for new faculty;

(d) the lack of a startup granting system for new faculty members, and bare minimum state funding to cover absolutely basic necessities for research consumables and equipment.

(e) the lack of clear criteria for the promotion of faculty members and the lengthy tenure needed in early ranks;

(f) the non-introduction of transparent metrics for the distribution of funds from the senate of the University; distribution of funds needs to reflect (i) the high quality of research and teaching programs, (ii) the documented excellence and recognition in research, and (iii) the continuation and enhancement of fine examples of excellent work which keep Departmental staff competitive with their peers at the international level.

(g) the lack of appropriate support for securing intellectual property rights through patents;

(h) the apparent de- motivation for change attributed to inertia in Hellenic Universities, even by those who functioned well for many years in North American Universities before joining the Technical University of Crete.

Recommendation 24: It will be necessary to replace all soon to become vacant academic positions in a particular area with experts from the same area.

Recommendation 25: The Department should formulate internal transparent and measurable guidelines for the timely promotion and tenure of staff, based on excellence in both research and teaching.

Recommendation 26: The introduction of criteria based on excellence at the University- and Departmental-level for the distribution of funds for educational and research needs.

Recommendation 27: The State should introduce a committee to evaluate the administration of the entire University.

- *Short-, medium and long-terms goals/plan and actions for improvement by the Department/long-term actions proposed by the Department*

The short-, medium- and long-terms goals and action plan for improvements are outlined by the Department in the Internal Evaluation Report. Some of these items were discussed briefly during the site visit. These are considered well thought out and are steps in the right

direction to improve education and research within the Department. In particular, given the continuing economic crisis, the EEC is of the strong opinion that the number of incoming students per year must decrease to the level of about 30 in both undergraduate and postgraduate levels considering the present and near future needs of the Greek economy in this specialized field.

Recommendation 28: The State and the University should agree to reduce the number of incoming students to about 30 in both undergraduate and postgraduate levels.

- *Long-term actions proposed by the Department*

The recently enacted law by the Hellenic Republic for higher education, long-term strategic plans will have to be reconsidered within the new Academic Unit (School).

F. Final Conclusions and Recommendations of the EEC

Conclusions:

The Department of Environmental Engineering of the Technical University of Crete has established a high quality research and teaching program that is commensurate with international standards. The Faculty, although well-grounded on the realities of Hellenic Universities, has identified improvements, has a realistic vision for the future, is well-equipped to implement changes and is encouraged by the EEC to do so.

- The great majority of faculty members have active and very successful research programs.
- The group of young faculty members (albeit small in number), lead vibrant research initiatives.
- Most faculty members pursue creative and modern teaching initiatives.
- To conduct state-of-the-art research and teaching, State/University funding is absolutely necessary for personnel, instrumentation and technical infrastructure.

In summary, the strengths of the Department are the broad areas of teaching and research covered and the presence of active and devoted faculty members. The main weaknesses are the lack of fellowships for students at the M.Sc. and Ph.D. programs, the limited number of technical staff, the very limited financial support provided by the State/University and the poor student attendance particularly at the undergraduate courses.

Recommendations:

The EEC members make the following recommendations to enhance the future development of the Department. Some of these recommendations are intended for the Department, while others are directed at the University and State authorities:

Education:

Recommendation 1: Consider offering complete experimental courses covering material from several theoretical principles within specific areas (e.g., physical chemistry, mass and heat transport, chemical and biochemical processes).

Recommendation 2: Increase the experimental portion of the ECTS lab load without increasing the overall ECTS of the curriculum.

Recommendation 3: Reduce by at least 10% the current number of courses offered in the curriculum. In achieving this, consider adjusting some of the courses offered with more specialised sections (e.g., cost benefit analysis, sustainable development in environmental engineering, etc).

Recommendation 4: Strengthen specific renewable energy technologies and their environmental implications and solutions (e.g., power production through biomass conversion).

Recommendation 5: Currently, a lack of fellowships exists for non-permanent teaching assistants who can support the instructive work of the professors during their laboratory courses. Funding and provision of these teaching fellowships by the State and/or the University is necessary and urgently recommended, on a priority basis.

Recommendation 6: Currently, a lack of technical staff exists to maintain and run the instrumentation of the Department that is a basic requirement of the curriculum. The EEC recommends the employment of technical staff.

Recommendation 7: The EEC strongly recommends the implementation of homework assignments, group projects, and mid-term examinations. In addition to the final exams these items should contribute to the final grade. This will largely improve the quality of the educational experience.

Recommendation 8: The implementation of required prerequisite courses (“chain system” of instruction) is essential for the more effective development of the curriculum and the quality of the educational experience.

Recommendation 9: The EEC recommends that the structure of the MSc program should emphasise core courses in addition to elective ones. In addition, EEC notes that the “Health” component is not presently supported by courses, and perhaps the title of the program should be limited to “Environmental Engineering”.

Recommendation 10: The EEC recommends that more emphasis be placed on applied aspects of Environmental Engineering and further collaboration with industry. For example, cost benefit analysis and guest lectures from industry accompanied by complete project assignments. This will facilitate employment opportunities for graduates.

Recommendation 11: Additional instrumentation and technical staff are needed for training and laboratory exercises.

Recommendation 12: The EEC highly recommends that either the Department or the University review the existing voluntary student questionnaires and develop and administer a uniform questionnaire approved by the University which has to be mandatory for all courses. The results of these questionnaires should be used by the Department to improve teaching effectiveness. This evaluation process should be done via access to a secure internet University site at which each student will provide his/her comments anonymously.

Recommendation 13: It is suggested that the undergraduate and MS students create awards for the best teachers annually, where the nomination, assessment and selection process is exclusively student-controlled.

Recommendation 14: The EEC strongly recommends that the recognition by the Hellenic Republic of the professional rights stemming from the curriculum and the Engineering Diploma granted be fully accepted.

Recommendation 15: The EEC strongly recommends that the Department should expend considerable effort to find effective ways of increasing classroom attendance for the undergraduate students. For example, classroom assignments will only be handed to those attending and would need to be completed before a student is allowed to conduct the experimental part of the course.

Recommendation 16: The EEC recommends that uniformly high grades for the Diploma Thesis be avoided, and instead a more objective and wider grading scale range be used. In addition, the supervisor’s percentage contribution towards the final grade for the Diploma Thesis should be increased substantially.

Research:

Recommendation 17: The EEC fully supports the prioritized equipment list set up by the Department. As the highest priority, EEC members suggest the purchase of the following

equipment: (1) Electrophoresis system; (2) Nano SMPS (sub-micron solid particle analyser); (3) Spectrophotometers in the UV/visible/near IR; (4) System for synthesis and qualitative analysis of bio-fuels; and (5) Confocal microscopy. The other instruments cited on the list, which has been already approved by the Department and the University, should be purchased soon afterwards as money become available.

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The Members of the Committee

Name and Surname	Signature
1. Professor Angelos M. Efstathiou, Coordinator University of Cyprus (Cyprus)	
2. Professor Filippos Tsikalas Eni E&P (Italy) & University of Oslo (Norway)	
3. Adjunct Professor Christos Katopodis University of Alberta Formerly of the Freshwater Institute (Canada)	