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HELLENIC REPUBLIC

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HELLENIC QUALITY ASSURANCE AGENCY

ΑΝΩΤΑΤΗΣ ΕΚΠΑΙΔΕΥΣΗΣ

FOR HIGHER EDUCATION

## **EXTERNAL EVALUATION REPORT**

**DEPARTMENT of Pollution Control Technologies**

**Technological Educational Institute of Western Macedonia  
(Kozani)**

**18 February 2011**

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**N.B.** The structure of the “Template” proposed for the External Evaluation Report mirrors the requirements of Law 3374/2005 and corresponds overall to the structure of the Internal Evaluation Report submitted by the Department.

The length of text in each box is free. Questions included in each box are not exclusive nor should they always be answered separately; they are meant to provide a general outline of matters that should be addressed by the Committee when formulating its comments.

## **Introduction**

### **I. The External Evaluation Procedure**

The External Evaluation Committee (EEC) met from January 24<sup>th</sup> to January 29<sup>th</sup> 2011 to assess and evaluate the Department of Pollution Control Technologies (TE.AN.) of the Technological Educational Institute of Western Macedonia (TEI-WM) according to the guidelines of the Hellenic Quality Assurance Agency (HQAA). The evaluation is based primarily on the Internal Evaluation Report (IER) compiled by the Department. An important and integral part of the evaluation procedure was the site visit at the Department performed from January 24<sup>th</sup> till January 26<sup>th</sup> 2011.

The site visit was organized by the Head of the Department in close collaboration with HQAA. The EEC met the President of TEI-WM, the Vice President for Academic Affairs, the Vice President for Financial Affairs, and the members of the Committee who prepared the IER report on the evening of January 24<sup>th</sup>. January 25<sup>th</sup> was devoted to formal presentations of the various activities (general presentation of the Department, curriculum, teaching, research, technological services, career opportunities, administrative support and infrastructure) by the permanent academic staff of the department. The EEC visited the various laboratories and the buildings that house the Department, and it met with alumni, student representatives, and the temporary academic and laboratory staff. The Committee addressed several questions and carried out extensive discussions. The EEC requested and met also with three industrial supervisors of students during their placement conducted during the last semester (8<sup>th</sup>) of their studies.

On January 26<sup>th</sup> 2011 the EEC examined the academic content of the courses offered, required course textbooks, questionnaires students had compiled to evaluate teaching and course content, graded exams, and student theses dissertations. Members of the Committee visited the Institute’s central library. The visit concluded with an extensive discussion of the EEC with the authors of the IER.

The documents, reports, and other data examined by the Committee were:

- Internal Evaluation Report (30/12/2010)
- Course Guide (Academic year 2002-2003)
- Subject curricula
- Samples of student theses
- Samples of graded student examinations
- Samples of course textbooks
- Copies of oral presentations given during the site visit

- Selected publications of academic staff
- Curriculum vitae of the permanent academic staff
- Numerous leaflets and brochures describing the Department and the Institute.

In addition, the EEC visited:

- The Laboratory of Alternative Fuels and Environmental Catalysis (TE.AN.)
- The Laboratory of Environmental Chemistry and Processing of Wastewater (TE.AN.)
- The Laboratory of Technologies for the Management of Waters (TE.AN.)
- The Laboratory of Soil Mechanics at the Department of Geotechnology and the Environment
- The TEI's Central Library
- The Departmental computer facilities
- Teaching halls and offices
- Two Mechanical Engineering laboratories in Fluids and Thermodynamics.

## **II. The Internal Evaluation Procedure**

The EEC examined carefully the Internal Evaluation Report (IER) before and after the site visit at the Department. The committee feels that the documents and sources used were partially appropriate. For example, there was a lack of the following elements:

- (a) comparative research quality indicators with other similar in subject Departments among the Greek Universities and Technological Educational Institutions,
- (b) incomplete information on students employment,
- (c) incomplete information on the postgraduate programme application (M.Sc. level),
- (d) lack of information on the existence of an atmospheric pollution and environmental physics laboratory in the Department of Geotechnology and the Environment of the same Institution, and of any developed synergy, and
- (e) lack of information regarding amounts of research grants received.

The EEC feels that overall the Internal Evaluation Report was very informative. However, some points could have been explored in more detail. For example, relations between resources available to certain areas, the implementation of the proposed collaborative M.Sc. programme, and existing synergies among other Departments of the same Institution. The latter is considered of a great importance at School or TEI level.

## **A. Curriculum**

*To be filled separately for each undergraduate, graduate and doctoral programme.*

### **APPROACH**

The programme of studies and the actual curriculum that evolved were part of the response of a group of staff of TEI of Western Macedonia in 1999 to the challenge facing the engineering community in environmental problems, and in particular, environmental pollution. One of the objectives was to educate personnel specializing in the evaluation of various forms of environmental pollution as well as to provide experts in methods of assessment and evaluation of data leading to suggestions or methods for solution. The use of renewable energy systems was included in the curriculum as appropriate for a programme of this nature, and to a lesser degree noise pollution. Environmental law and industrial policy and its relation to the environment were also included. What the planning team envisaged was a programme of studies that would equip their graduates to seek successful employment and to contribute in the particular area of environmental pollution and management both at local and international level. In this context, it is noted that approximately 75% of the total electric power provision of Greece is produced in this area through lignite power stations (themselves a major pollution source).

At the start, the programme team reviewed other similar programmes in Europe and North America and Greece (no actual university/institutions names were given). However, in this case there was particular emphasis on practical application and evaluation of the technologies that relate to pollution control technologies. It must be noted that due to the specialist nature of the course, it was difficult to find similar courses in Greece or abroad for an actual benchmarking of the particular subject modules designed.

The programme of studies consists of eight semesters with each semester having five to six modules. A typical semester is valued at 30 ECTS with the final dissertation carried out in the eighth semester, worth 15 ECTS – total for the programme is 240 ECTS. The programme includes industrial placement of one semester, **which the committee considers a particular strength of the programme**. In total, there are 40 modules of which 29 are compulsory, 11 are elective (total electives offered: 20). Also, there are three (3) additional non-mandatory language modules (English, French and Spanish). The first semesters are used to teach fundamental subjects (e.g., basic chemistry, mathematics, and computers). This is of course appropriate because it can correct/improve knowledge deficiencies in these fundamental areas and allow effective delivery of the more specialist subjects.

The summary above indicates that the programme of study responds to a great extent to the initial objectives set by the team. However, following detailed discussions with staff it was clear that further revisions are necessary. In fact, the programme has not been revised since first established in 2000. In general, a mechanism has to be established at TEI level which will provide guidance for new proposed programmes of study and major revisions as in this case. This could involve **a programme coordinator** working with the teaching staff to propose the new version. In the case of a new programme or major revisions, a panel including Departmental/School staff as well as an external expert member is suggested. The EEC received a proposal for a revision on the second day of the site visit. This needs to be considered carefully and at length to ensure that it captures developments and trends in this area both locally/nationally and internationally.

**Recommendation 1**

*The committee recommends that the Department appoints a Programme Coordinator (other than the head of the department). He/she will have both the academic and the day-to-day responsibility of the undergraduate programme.*

**Recommendation 2**

*The committee recommends that the department establishes a “Board of Studies”. This will be chaired by the programme coordinator. All the teaching staff (permanent, temporary, and members from other departments) will be members of the board. Students will be represented – thus the students will appreciate more the educational process - and their presence in the Board will help improve staff-student relations. The Board should meet twice a year and it can recommend changes to the programme to the Departmental Board/School.*

**Recommendation 3**

*The Department, led by the head of department, should establish an Industrial Advisory Panel. This consists of members of the local companies with interest in this area. This panel meets with the departmental staff once a year and, among others, will review the curriculum and ensure industrial relevance of the subject matter.*

**IMPLEMENTATION**

The Department has been taking a decreasing number of new students starting with 182 (2000-2001) and 50 students on the average in the years 2006-2010. For the current academic year (2010-2011), the number of new students has risen again to 183. Currently, the Department has 1010 students registered at all levels of study, including those for the 2010-2011 academic year. It appears from extensive statistical data provided by the Department that the student attendance and the actual number of students taking examinations at the end of each semester are very low, thus the success rate is very low. They are below internationally accepted standards. The committee heard the views of the staff on this issue which of course includes that this phenomenon is a national rather than a local trend, and the fact that the academic qualifications of the students entering TEI and the Department are low, particularly in mathematics or chemistry. The discussion also focused on pre-requisite modules. It appears that the abolition of some prerequisites was causing particular problems in coherency/functionality of the programme.

Furthermore, time to graduate is excessively long. The Department noted that external factors, e.g., unlimited duration of studies, inability to implement the requirement to register, limit their options. Given these constraints, departmental efforts are concentrated on personal encouragement and the general friendly and positive atmosphere within the Department.

**Recommendation 4**

*The re-examination of the prerequisites so that they do not allow progression to the next stage unless a student successfully passes the lower stage. Re-examination of a failed module should be mandatory at the first available examination opportunity.*



**Recommendation 5**

*The establishment of staff-student focus groups, meeting twice a year. The minutes of these meetings should be made available to the Board of Studies.*

**Recommendation 6**

*The Department should establish a programme of annual monitoring process. This could consider among others, the critical evaluation of the student attendance per module, pass rates per module/semester, student comments/satisfaction/feedback, delivery, and staffing issues. This should include a member of another Department. The Committee believes also that the Department should invest more time and effort to ensure student participation in lectures.*

**RESULTS**

The Department is new and hence has no long term history of the employability of its graduates. It was estimated by the TE.AN. staff that there is about 30% unemployment of their graduates but no indications were given of the type of work that the ones in employment are doing (graduate, specialist or not).

Three industrial partners were interviewed by the committee. They reported high level of satisfaction with the quality of graduates they employed from the department (during the placement period). They were willing to offer or have offered permanent employment to these students.

The committee also interviewed a good number of graduates. They were very complementary of their teaching and learning experiences, and considered their teachers friendly, knowledgeable and easily approachable. This included the temporary staff employed by the Department.

The committee also interviewed current students who expressed very similar positive comments as the graduates.

Areas of concern remain the actual participation of students to the theoretical subjects, and the high overall failure rates and length of studies. Having said that, current students seem to be more engaged with the educational process and feel the need to complete their studies within a more reasonable period.

**Recommendation 7**

*The Department/School/TEI should collect data on student destination (employment and type of employment). Such data could publicize the good work/output of the Department and should be made available to students.*

**Recommendation 8**

*Involve past students successfully employed in industry with the teaching process in the form of guest lectures.*

**Recommendation 9**

*The programme coordinator and the Board of Studies should follow closely the failure rates and openly discuss these -with student participation-, recommending necessary remedial action (e.g., continuous assessment, mid-semester tests).*

During the discussions the TE.AN. staff presented a proposal for an M.Sc. in Engineering and Environmental Management in collaboration with the Technical University of Catalonia (Spain). This has already been approved by the TEI of Western Macedonia (TEI-WM) and it has been submitted to the Ministry of Education for final approval.

**IMPROVEMENT**

As mentioned above, the staff of the Department have already considered the necessary improvements to the programme and proposed an initial provisional scheme. Within the next year they plan to re-examine the programme bearing in mind developments in this area, and the revised programme will be completed for a 2012-2013 academic year entry.

**Recommendation 10**

It is recommended that during this process the teaching team considers the following:

- (i) *Seek the input of an industrial panel and other external academic experts, who will consider the proposed changes before final submission.*
- (ii) *Seek the cooperation of other colleagues/departments in devising and subsequently delivering some fundamental and specialist modules.*
- (iii) *Examine the national/international tertiary educational sector provisions in this area.*
- (iv) *Consider in discussion with the School the resources available (staff and laboratories). This can dictate the choice of new modules that can be introduced. The committee feels that the current state of departmental facilities - including number of staff - may limit major changes to the current programme.*
- (v) *Take the opportunity to introduce zero credit tutorial support in the first year to help students with a weak background in basic subjects (e.g., mathematics, chemistry or computers).*

## **B. Teaching**

### **APPROACH, IMPLEMENTATION, RESULTS and IMPROVEMENT**

The evaluation of the teaching methodology at the Department was based on the following facts and parameters:

1. The programme of studies 2002 – 2003.
2. The Internal Evaluation Report 2008-2009, and 2009-2010 (30 Dec. 2010).
3. Additional information from the oral presentations during the site visit of the 24-26 January 2011.
4. Further collection of facts and figures during the site visit.

The EEC would like to note that there was no opportunity for classroom or laboratory observation since the site visit coincided with the students' examination period.

The teaching approach of the theoretical subjects supported by modern facilities is considered adequate by the committee.

The teaching approach that concerns the practical aspects of the subject matter is illustrated as follows:

- (i) The fact that the laboratory exercises are combined with the theoretical part is considered very positive.
- (ii) It should be noted that the programme of practical work on soil (contamination/remediation) is inadequate and needs improvement.

#### **Recommendation 11**

*Completion of the laboratory infrastructure enabling the study of contaminated soil remediation, e.g., a study of water and soil pollution according to EU standards, particularly using modern technologies for in-situ fluid-flow work.*

*Based on the information provided during the meeting, the committee has the opinion that the soil mechanics laboratory (Department of Geotechnology and the Environment) should be upgraded further for use in the measurement of processes for final-year dissertations, as well as for use as a research and service laboratory at the consent of its Director and the heads of both involved Departments.*

#### **Recommendation 12**

*Extend the practical exercises to include work on soil sampling and subsequent analysis including permeability tests using up to date equipment.*

#### **Recommendation 13**

*Based on the information provided during the meeting, the committee feels that collaboration with the Department of Geotechnology and the Environment should be maintained and enhanced further.*

**General comments**

The committee feels that it is imperative that both the TE.AN. and Geotechnology and the Environment Departments fully utilize personnel and laboratory resources.

The committee notes that the number of temporary staff is high (9 permanent compared to 40 temporary). It is noted that the temporary staff reviewed during the site visit were well qualified and motivated, and they received excellent comments from the students and colleagues.

The teaching load of the junior permanent staff - up to 16 hours per week - is considered high and impedes staff development in postgraduate and research areas.

**Recommendation 14**

*The committee strongly recommends an attempt to resolve the situation by filling permanent vacancies. This is the only way to ensure continuity of the educational work of acceptable quality.*

**C. Research**

*For each particular matter, please distinguish between under- and post-graduate levels, if necessary.*

**Undergraduate Level Work****APPROACH, IMPLEMENTATION and IMPROVEMENT**

The Department's policy and main objective in research at the undergraduate level is to expose the students into the basics of design, performance and evaluation of research regarding their special degree in Pollution Control Technologies to be obtained. This task is implemented during the 3<sup>rd</sup>-4<sup>th</sup> year period of students programme of studies through the following educational tools:

- Homework assignments in specialty courses which require the use of Greek and English literature.
- Designed courses, e.g., "Seminar – Team Work" related to various pollution control subjects, where students are taught research methodologies and the extensive use of literature (Greek and English) and statistical data.
- Diploma Thesis (15/240 ECTS) as a prerequisite for the obtainment of the B.Sc. degree.
- Participation of students in research programs at the postgraduate level.
- Mobility through EU programmes, e.g. ERASMUS.

Based on the original material provided, and all the information acquired by the Committee during its 2-days site visit at the Department, the EEC feels that the following measures should be taken which will improve significantly the Department's objectives in research related work at the Undergraduate level.

**Recommendation 15**

*Substantial increase in the percentage of Diploma Thesis subjects based on original experimental and modelling work given to the students by the faculty members compared to those based on bibliographical analysis and presentation.*

This approach is consistent to the content of the subject of studies. The Committee feels that since all present faculty members are involved in the four established research labs, the suggested improvement can be implemented from the next academic year.

**Recommendation 16**

*The Department should issue written guidelines on the style of writing and formatting of Diploma thesis and its rules of evaluation.*

The EEC notes that in several cases the grade of 10/10 was given to diploma theses of measurable difference in quality and extent of work, which is something that does not promote the quality of studies. The Department should consider the improvement of this process - appointment of two markers and the assignment of a moderator to resolve any issues in marking -, for example, if the markers disagree by let's say more than 15%.

The Committee notes that several of the examined Diploma theses were of high quality, equivalent to that found in many academic departments in Greek and foreign Universities.

The Department's participation in Erasmus during the last 5 years is considered overall as very good considering its size in both students and faculty. There were 5 outgoing students, 18 incoming students, and 14 outgoing faculty members to European Universities. The Department has signed 7 Bilateral Agreements with European Universities. The Department, however, pointed out that improvements are needed to be done in administrative issues (e.g., lack of appropriate support personnel in the "Office of European Programmes") within their Institution.

**Postgraduate Level Work****APPROACH**

The Department's policy in research is bound by the recent Greek state legislature (N. 3685 of July 2008 and N. 3653 of March 2008) regarding Postgraduate studies and research and technology, and is governed also by the policy of Technological Educational Institute of Western Macedonia through internal regulations set by the Committee for Education and Research, a flexible instrument for the management of research funds, and which is targeting the design and implementation of research projects in close collaboration with local industry and other Universities or Research Centres in Greece or abroad.

All members of the Department have participated in various competitive research programmes (national or European) and have published their research results in peer reviewed international journals and conference proceedings.

Since the Department given the existing legislation (see above) is not allowed to develop postgraduate programmes at the Doctoral level, and only recently has applied for its first joint postgraduate programme at the Master level, no internal standards for assessing research have yet been established. Nevertheless, academic staff members in the department co-supervise PhD students who are often supported by externally funded projects (e.g.,

Regional Poles of Innovation, Archimedes). These students are formally registered at the PhD level in other collaborating Greek and foreign Universities.

## **IMPLEMENTATION**

### (a) Promotion and support of research

The Department does not have yet any approved graduate programme leading to the Master degree. The promotion and support of research by the Department is based exclusively on the personal efforts of the faculty members to participate in competitive research programmes funded by Greek agencies or the European Union, and to a limited degree on internal resources (e.g. University budget).

### (b) Quality and adequacy of research infrastructure and support

The Department has not yet programmed the purchase of common research infrastructure, namely, large instruments, the use of which is shared among the faculty. The existing research infrastructure is under the exclusive responsibility of a faculty member. This was acquired through individual grants and allocated money by the Institution. The quality of the present infrastructure varies. There is infrastructure of high quality similar to that encountered in other Greek university departments, and in some cases the infrastructure is considered not adequate to allow high quality research output.

In general, the adequacy of the research infrastructure is judged as being satisfactory for the present needs set by the faculty members.

### **Recommendation 17**

*If the department should become in the near future competitive in research, the upgrading of its present infrastructure is considered crucial.*

### (c) Scientific publications

The publication record of the nine (9) faculty members of the Department within the last 5 years (2006-2010) is considered very good given the available research infrastructure and support provided by the Institution. During this period the Department produced approximately 1.3 scientific publications in peer reviewed international journals/faculty member/year, which is considered as good number for University researchers in technical scientific fields on an international basis.

Also, the number of publications in international and Greek conference proceedings (peer reviewed) is considerable (~2.3/faculty member/year), pointing out the quality of work performed but also the willingness and interest of the faculty to expose themselves in the national and international scientific communities.

The total citations (excluding self-citations) of the Department during the period of 2006-2010 appear to be close to 1000. This figure, based on statistical data provided by the National Documentation Center is considered about 10 times larger than the average number resulted from all the Technological Educational Institutions of the country. It is to be pointed out also that several recent publications appear in good scientific journals, which are expected to further raise in the near future the Citation Index of the Department.

Based on the information provided by the Department and obtained through the National Documentation Center during the Committee's on-site visit, the figure of scientific

publications (59) in peer reviewed international journals is 50% of the total publications produced by all the faculty members of TEI of Western Macedonia. **The Committee feels that this is an impressive achievement.**

(d) Research projects

Thirty three (33) research programmes and small projects in total (national and European) successfully materialized in the Department or are still in progress *during the last five years*, with a total budget of 1.3 MEuros (referred to the participation of the faculty). This figure corresponds on the average 3.7 projects/faculty, which is a very good result.

It is important to be stressed that in many of these projects faculty members appear as coordinators and in several projects foreign Universities or Research Centers appear as collaborators.

(e) Research collaborations

The members of the Department have developed collaborations with other faculty members within their own School of Technological Applications, but also, and more importantly, with research laboratories of 7 other Greek Universities, 5 research centers within Greece, and 8 foreign Universities, to mention Technical University of Denmark, University of Nottingham, University of Edinburgh, and the GSF research center (Germany).

## RESULTS

*(a) Implementation of Department's research objectives*

The implementation of Department's research objectives as described above regarding

(i) Scientific publications, (ii) Research projects, and (iii) Research collaborations as a whole is considered very satisfactory.

The committee feels that the research profile of the Department as expressed through the various normalized indices mentioned above appears to be unevenly distributed within the same academic rank.

### Recommendation 18

*The Department should establish the mentoring system where the head of the department would be responsible to discuss with the academic staff the achievement of given criteria for academic performance at a given rank before an application for promotion is submitted.*

*(b) Efficacy of research work towards industrial product development*

Besides the publication record of the Department which is an important measure of the efficacy of the undertaken research, part of the research activity of a member of the department has found practical applications in the area of sewage sludge treatment (ΔΙΑΔΥΜΑ ΑΕ, Greece; an organization active and interested in Solid Waste Management).

### Recommendation 19

*The EEC strongly recommends that the faculty members should also focus their future research efforts in finding practical solutions to various environmental problems*

*encountered by regional industries according to their expertise.*

**(c) Visibility/Acknowledgement of Department**

Research acknowledgement and visibility is best evaluated and described today by several indices, to mention the Citation Index (e.g., ISI Web of Knowledge, Thomson Reuters), the h-index (Hirsch index) and the Impact Factor (IF) of scientific journals, besides the successful participation of academic researchers in competitive research programs or other similar activities.

The Committee feels that it is important that the Department of Pollution Control Technologies of TEI of Western Macedonia be compared with similar in activity and nature departments within the Institution and other Universities in Greece. For example, the current Department on the level of Assistant and Associate Professors presents an average h-index (Hirsch index) and total citations which are significantly higher than those corresponding to several other Departments of TEI of Western Macedonia. Based on the same indices, the Department of Pollution Control Technologies appears to be relatively close to the Departments of Environmental Engineering located in Crete and Xanthi.

It should also be noted that members of the Department serve as reviewers in international scientific journals, fact that reflects acknowledgement and expertise in their field of research.

**IMPROVEMENT**

**Recommendation 20**

*The Committee feels that at this point of the Department's development, great emphasis and effort should be given by each faculty member to the creation of various strong collaborations with existing high quality research labs in Greece and abroad.*

The synergy proposed will allow the improvement of the research profile of faculty to the extent which will allow them in the future to participate in various European and national programmes with good prospects of success. The latter will result in a significant improvement of existing research infrastructure and activity, in general. The Committee would like to note that members of the Department have already moved into this direction.

**Recommendation 21**

*The council of the Institution should examine the lack of necessary space and technical support for the near-future research development of the Department, given a successful outcome of pending research proposals and others to be submitted.*

**Recommendation 22**

*The committee strongly suggests the undertaking of appropriate measures by the Institute in order to reduce the teaching hours per faculty member since it appears as a serious obstacle for the development of a desirable good quality of research activity.*



## **D. All Other Services**

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

The provision of Departmental services supporting teaching and research activities is conditioned by the structure of the Department, i.e., the high ratio of temporary to permanent staff and its structure as a non-autonomous Department. These services include Information Technology (IT) support, administrative support, laboratory technical support, student counseling, teaching and research infrastructure. Some of them are provided centrally by the Institute, others depend on the volunteer contribution of temporary staff, raising severe questions about their future implementation, maintenance, and upgrading.

Departmental IT support is provided on a volunteer basis by temporary staff. The recently updated departmental Web page, a consequence of the Internal Evaluation process and of the ongoing effort of the Department to improve its administrative procedures, is informative, well structured, and user friendly. Information on the Department and e-class is included, and simplified, paper-less administrative procedures are described and implemented in TEI online. The Committee believes that the resulting simplification of administrative procedures and its contribution to the public image of the Department is very important.

### **Recommendation 23**

*The task of maintaining and upgrading information on the Web, and the provision of local IT support, should be assigned to an additional permanent staff member who should be shared with other Departments of the School.*

Administrative support is provided by an efficient Departmental secretariat in conjunction with information and procedures described on the Web. Neither complaints, nor suggestions for improvement were raised by the teaching staff (permanent, temporary) or the students. The Committee notes that teaching staff and students are well integrated and in friendly terms, a situation that allows problem resolution in the absence of well defined administrative and hierarchical procedures. Nevertheless, the Committee believes that there are cases of conflict that require the establishment of clear administrative procedures.

### **Recommendation 24**

*A well defined administrative procedure should be established at School level to resolve cases of conflict of grading of student exams.*

Experimental infrastructure seems adequate for the current academic curriculum, albeit the technical staff is temporary and, although highly qualified, possibly not sufficient in number.

### **Recommendation 25**

*The Committee notes that computers used in IT courses are antiquated and it recommends their upgrade.*

The Committee commends the Department for the adequate maintenance of the buildings that house the Department. Whereas allocated building space is adequate (the laboratories, teaching rooms and some offices are located in a dedicated building), any future expansion of the Department would certainly require additional space.

Given the on-going curriculum review and the increased emphasis on research activities, an expansion of the experimental infrastructure is envisioned. The Committee believes that

such an expansion should be planned and co-funded in close collaboration with other Departments within the School or Institute or with the neighboring University of Western Macedonia. Sharing of equipment would render their Departmental cost lower, and it will ensure their most efficient and effective use.

#### **Recommendation 26**

*The planning and purchase of additional research equipment, especially expensive state-of-the-art, should be performed in close collaboration with other Departments or even neighboring Universities. The Committee supports strongly their sharing of costs, maintenance, and use as a means of their efficient and cost-effective use.*

The Department uses the central library that serves the whole Institute, including Departments detached to other campuses. The Institute library is functional and staffed by four permanent members, and it provides adequate IT support. The Committee notes that opening hours are very limited: closed on weekends, closed two afternoons per week. These could be expanded via, likely, hiring students.

A number of important student services, including career planning and counseling and student mobility, are provided by the Institute. The responsible office, which in addition provided information on alumni progress, has been recently re-established, a decision supported by the Committee. The Committee believes that such functions are very important and specific to be delegated to the Institute.

#### **Recommendation 27**

*A permanent staff member should be nominated the Departmental Student Counselor.*

Student participation in mobility programmes, e.g., ERASMUS, should be actively encouraged. The recently established alumni association is highly appreciated and a close collaboration with the Department is encouraged. The Committee notes that even in the collegiate atmosphere of a small department, more care should be exercised on issues of student privacy.

The Department's efforts to ensure increased student presence on campus are based on the established collegiate atmosphere between students and teaching staff.

### **Collaboration with social, cultural and production organizations**

Collaboration with production organizations is implemented via the required student "stage" during the fourth year and via projects with local and national public and private bodies. All permanent staff members have been involved, as well as numerous students either as part of their stage or as scientific collaborators. One laboratory is ISO 17025 certified which is an almost unique distinction for a TEI laboratory. These activities provide an important source of income and public recognition. They are considered satisfactory, especially given the limited number of staff. More effort should be invested to obtain European Commission funding.

According to the Internal Evaluation Report, considerable effort is invested by the Department in presenting its teaching and research activities to local organizations,

secondary schools, and Institutions. Some faculty members are active in local and national environmental organizations. The Department's social and cultural activities are considered effective and adequate, and their continuation is strongly recommended.

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

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

Environmental protection has a high development potential throughout Europe. The environmental pollution problems in Greece are the result of an almost complete disregard for environmental protection measures since the rapid industrial growth occurred in the 1970s.

Until now little has been done and the problem remains, while the economic crisis will add new delays. On the other hand, the employment potential in this scientific and technical field will be increasing in the coming years, simply because environmental regulations and measures to be taken will be severe, and will also be extended in a larger number of areas. This employment potential appears to be high in the European Union and it should be considered as a good opportunity for Greek young scientists majored in Environmental Sciences. This can be realized if graduate students from Greek Universities in this field have minimum acceptable scientific knowledge and technical skills.

In the field of Environmental Engineering, there are three well identified undergraduate programmes in the Greek Universities, namely: (i) at the Technical University of Crete (10 semesters), which is focused on Environmental Management, Environmental Process Design and Analysis, and Environmental Hydraulics & Geoenvironment Engineering, (ii) at the Democritus University of Thrace (Xanthi) (10 semesters), which is focused on Process Design, and (iii) at the TEI of Western Macedonia (TE.AN. Kozani) (8 semesters), which is focused on Pollution Control Technologies. Among the three programmes it appears that at large there is no overlap.

#### **(a) Curriculum**

The Department of TE.AN. even though is new in the area of environmental protection, it managed to establish well equipped laboratories, which however are largely oriented toward the knowledge and application of various analytical chemistry techniques. With this in mind it appears that TEAN's graduate students may face strong competition from many other graduate students from the Greek and foreign Universities with major in Chemistry.

As already mentioned, an acceptable scientific and technical level is necessary to give the opportunity to the graduate students to be employed in Greece and other EU countries. To this end, the curriculum which has not been revised since the establishment of the Department should be re-evaluated for several improvements (***see Recommendations 1-13***). In particular, the re-organization of the programme studies, including re-examination of prerequisites, which are very important for the coherence and the functionality of the programme, and the introduction of more targeted laboratories towards the acquisition of skills by the students on the environmental engineering processes as such and not only on the analyses of their positive effects on the environment. Thus, competition with Analytical Chemists should be avoided.

Air pollution control in the region of Kozani is of great importance, due to the presence of lignite-based power stations, resulting in a significant employment potential for pollution control engineers for many years to come. As already mentioned in section B, the Geotechnology and the Environment Department in the same School/TEI has air monitoring facilities which must be shared for use by both Departments. A good synergy between the two Departments must be developed with the purpose of fully utilizing personnel and laboratory resources for the establishment of an advanced experimental laboratory comprising a lab-scale power station with the analysis and treatment of pollutant emissions. The latter will provide TE.AN.'s graduates with good skills in all the three areas (air, liquid, and solid wastes) of environmental pollution control.

### **(b) Teaching**

Currently, the number of offered positions (around 180) by the Greek state to perform studies at the TE.AN. Department is considered high compared to the number of positions offered by the Greek labour market. It is suggested that this number be reduced and re-considered periodically according to the future needs based primarily on the Greek labour market.

The student attendance and the actual number of students taking examinations at the end of each semester when compared to the total number of registered students appear to be very low. They are below internationally accepted standards. The Department must take measures to significantly improve this situation. For example, re-examination of prerequisites courses, improvements of curriculum towards the attraction of better quality students, and others.

The validation system of modules is inadequate for sciences and engineering education, and incompatible with training leading to professional degrees. This poses insurmountable problems, as prerequisites are essential to all scientific and technical training. As an example, students can complete their training without having practically the basic notions of mathematics necessary to other important subject material taught. Thus, the Department should confront with this problem and re-examine the context of such basic important courses for its degree offered.

The EEC strongly recommends the establishment of a continuous control system for the academic performance of students. For example, the establishment of compulsory homework assignments for most of the modules. This will improve the extent of understanding of material taught and at the same time the participation of students in the classroom. The effort should be addressed primarily at the theoretical teaching. Furthermore, if we consider EU as an opportunity for Greek University graduate students, the teaching of English language should be compulsory, which is something missing from the current curriculum of TE.AN. This is an important issue since it will determine the mobility of students to other EU Universities, which is a very positive measure for the integration of Greek graduate students in the EU system.

The number of academic staff has not yet reached the critical number for the fulfillment of its goals in the undergraduate and the proposed postgraduate (M.Sc. level) programmes. It should be noted the recent departure of a Full Professor with important contributions in the establishment of the Department, where the current number (eight) of faculty members is considered low compared to that of temporary staff (40 instructors). The teaching load of the junior permanent staff - up to 16 hours per week - is considered high which impedes staff career development and that of the Department in various research areas. A related problem to this situation is the fact that the mobility of permanent staff is considered very poor, at

least during the last three years.

Regarding the temporary staff, the situation is worst. The lack of career opportunities and of stable employment creates feelings of bitterness and exclusion. It is noted that the temporary staff reviewed were well-qualified and motivated personnel and received excellent comments from the students and their colleagues (permanent staff). The EEC recommends an attempt to resolve the situation by filling permanent vacancies for which the temporary staff could apply for. Details of all relevant Recommendations regarding Teaching were given in Section B (*see Recommendations 11-14*).

### **(c) Research**

Research activity is very important for permanent and temporary staff affecting directly their professional and academic career advancement. It is emphasized again that the teaching load is considered high and incompatible with the pursuit of a competitive research activity of high quality and expectations. Since the number of permanent staff is low, the accomplishment of this task is very difficult and depends to a large degree on their good will and tenacity. This is exactly reflected in the research activities outcome of TEAN's staff in the framework of National and European programmes. Nevertheless, the level of funding and participation in research programmes related to the Department and the quality of research of its members are considered very satisfactory given the size of the Department and its life-time. It should be pointed out the multitude of services offered, mainly in the area of chemical analysis of effluent streams from environmental protection processes provided locally, fact that demonstrates that TE.AN. is well integrated into the local society.

The committee strongly suggests the undertaking of appropriate measures to reduce the teaching load depending on available sources. Several recommendations are found in Section C (*see Recommendations 15-22*) and these are intended to improve the functioning and performance of the research staff.

The committee discussed the development of a postgraduate programme (M.Sc. level) in detail with permanent faculty members of the Department and the Head of the School. The committee strongly supports the application of the Department for a joint M.Sc. programme (see Section B). However, before a final decision is reached, careful examination of all the aspects of such collaborative effort should be made. In addition, the success of this programme should require also support for administrative and additional resources, including laboratories equipment, and IT facilities and software.

### **(d) Other**

The provision of Departmental services supporting teaching and research activities is conditioned by the structure of the Department, i.e., the high ratio of temporary to permanent staff.

Administrative support is provided by a very efficient Departmental secretariat in conjunction with information and procedures described on the Web. Departmental IT support of good quality is provided on a volunteer basis by temporary staff.

The Institute library is functional and staffed by four permanent members, and it provides adequate IT support. The Committee notes that opening hours are very limited: closed on weekends, and closed two afternoons per week.

Several recommendations in section D (*see Recommendations 23-27*) are intended to increase student presence on campus, establish collegiate atmosphere between students and teaching staff but also to improve the participation of students in lectures and exams.

## ***F. Final Conclusions and recommendations of the EEC***

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

### **Conclusions and recommendations of the EEC on:**

- (i) The development of the Department to this date and its present situation, including explicit comments on good practices and weaknesses identified through the External Evaluation process and recommendations for improvement.***

The Department of Pollution Control Technologies of TEI of Western Macedonia (TEI-WM) received its first undergraduate students in October 2000. According to the information provided by the department, the number of incoming students during the period of 2005-2010 presented a significant decrease. In the 2005-2006 academic year, the department received 192 students, whereas in the following years this number was between 39 and 55.

The department consists now of eight academic personnel, where very recently the ninth faculty member at the rank of full professor moved to another TEI in Greece. The department's needs in teaching at the undergraduate level are covered by the employment on a temporal basis of 40 additional instructors, where many of them hold a Ph.D degree. The department's needs in technical and secretarial personnel are now covered by three members of staff. A recommendation of EEC for the better management and performance in laboratory courses is the employment of one (1) technical personnel with good background in environmental chemistry. After the development of the M.Sc. programme, the Department is likely to need additional secretarial personnel.

The Department at present does not have any postgraduate programme. However, it has applied for a joint M.Sc. programme with another department of the same Institution and a foreign university in the area of Engineering and Environmental Management.

The main conclusions regarding the necessary steps and decisions to be taken for improving the development of the Department in order to fulfil the targets of its existence are as follows:

- (a) Within the next five (5) years the academic personnel should be increased in number. At least one of these appointments must be in the rank of Associate or Full Professor in the area of the recently resigned faculty member (Prof. Petros Samaras). Other positions must include staff in the areas of air and soil pollution control technologies.
- (b) The department cannot accept more than 60 incoming students per year given its present resources and the unemployment in the general field of environmental engineering, in order to keep the necessary quality of studies.
- (c) Within the next five (5) years the Department must acquire two (2) additional technicians for its needs in the smooth operation of all present undergraduate and M.Sc. level (expected) teaching and research laboratories.

All good practices and weaknesses of the Department's activities (teaching and research) and several recommendations to be considered have been explicitly provided in the relevant sections of this report.

***(ii) The Department's readiness and capability to change/improve***

The Department has recognized the need to improve and it has taken numerous initiatives. It has designed a modified curriculum that, following planned revisions it could become effective the academic year 2012-2013, it has established more transparent administrative practices, and it has applied to establish a joint M.Sc. programme. The Committee supports these initiatives as long as they are implemented as described in this Report, e.g., the establishment of a Programme Coordinator, a Board of Studies, and an Industrial Panel. Further improvements should be implemented via closer collaboration with other Departments in the School, in particular the Department of Geotechnology and the Environment, and via increased emphasis in the curriculum on pollution-control processes rather than analytical-chemistry techniques. The advice of external academic or industrial experts should become an integral part of future revisions of the curriculum. The Committee notes, however, that if the Department is to remain competitive in research its present infrastructure should be upgraded.

***(iii) The Department's quality assurance***

The Department's quality assurance processes need to be assessed carefully. This need may not be uncommon if one examines other Departments in the tertiary educational sector of Greece. Recommendations were made in relevant sections above. The Committee believes that these should be considered not only by the TE.AN staff but also by the School and TEI management.

**The Members of the Committee**

Name and Surname	Signature
1. Angelos M EFSTATHIOU	
2. Simeon CAVADIAS	
3. Tassos KARAYIANNIS	
4. Ioannis DROSSINOS	
5. Andreas KOMODROMOS	