

*Development of the Master Program in Industrial  
Ecology in  
Bosnia and Herzegovina  
- Progress of the Project*

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Neum, May 2007

The goal of the Project

The goal can be reached by fulfilling the following main actions:

- Development of Bologna-compliant MSc program in Industrial Ecology;
- Creation of the Centers on Environmental Studies at partner Universities;
- Retraining of teachers of BH;
- Dissemination of the project results.

## Members of the Reference Team

At the very beginning of the project the Reference Team was created, consisting of representatives of:

### **The Universities:**

- Rajfa Musemić, US-MEF – Reference Team coordinator
- Ante Mišković, SM-MEF
- Salko Čosić, UT-MEF

### **The Chamber of Economy of the Federation of BH:**

- Nafija Šehić-Mušić

### **The Industry:**

- Ante Rezić (Aluminum d.d. Mostar)
- Rasim Pirić (Institute of Metallurgy Tuzla)

### **Project Expert:**

- Kemal Hanjalić - TU Delft

3

## Members of the Reference Team

**The Team has been created to ensure that the new Master program:**

- is relevant to the labor market
- covers environmental problems in BH and
- meets requirements of the partner universities

**The Team role and responsibilities are defined in:**

- quality control
- establishing cooperation between created centers on environmental studies and
- partners in society - industry, local authorities, NGOs, and dissemination of project results

4

## Expert Group for support of using ECTS

- The Expert Group for support of using ECTS workload-based credit methodology for curricula design and networking of US-MEF, UT-MEF, SM-MEF with European universities:
  - Šefko Šikalo – US-MEF, Sead Delalić – UT-MEF, Vlado Majstorović – SM-MEF, Kemal Hanjalić – TU Delft, M. Eugenia Esbri – UPC; Lennart Johansson – Senior Expert, External Relations at KTH; Victor Kordas – Director, KTH-International Education
- the EU members of the project Expert Group will organise seminars on ECTS and Quality Assurance in the participating EU countries: Sweden/KTH, Spain and in particular UPC, TU Delft (by the expert)
- In addition to this, US-MEF together with KTH and QFM Uni. Nuremberg-Erlangen completed a SCM Tempus project with the main subject of introducing ECTS in technical education in BH. The results of this project can also be used as a starting point for the development of MSc courses in Industrial Ecology

5

## Expert Group for support of using ECTS

- The project team from BH analyzed curricula and syllabuses of KTH, and plans to implement their experience in BH education system
- The higher education system in BH is in the phase of transition from former diploma/dipl. ing. to the bachelor/master program according to the Bologna process, which has to follow prescribed legislation
- During the visit of BH team to KTH (Nov 26-Dec 3 2006), the decision was made that the entire curricula of the master study will be developed at the Faculty of Mechanical Engineering Sarajevo, while some courses will be implemented at UT-MEF and SM-MEF
- It was also agreed that all partner universities of BH should find possibilities to offer some special courses to some governmental agencies, which are dealing with environmental protection issues

6

## Expert Group for support of using ECTS

- The possibility for distance learning mode of teaching was also analysed
- The following courses have been chosen for distance learning mode of teaching:
  - Environmental Modelling
  - Sustainable Development in Theory and Practice
- There is a distance learning room at US-MEF

7

## Study visits of BH administrative staff and the project Expert Group – KTH Stockholm

- Six members of the staff from US-MEF, UT-MEF, SM-MEF went to KTH for one week, from Nov 26 to Dec 3 2006:
  - Šefko Šikalo, Rajfa Musemić, Nijaz Delalić, Ibrahim Busuladžić (US-MEF); Sead Delalić (UT-MEF), and Adisa Vučina (SM-MEF)
- During their visit to Stockholm they attended some lecturers at the IE Department:
  - Ms. Monika Ohlsson (Waste management), Mr. Jan Findler (Risk management), Mr. Lenart Nilson (Cleaner production, Environmental management), Mr. Fredric Grondahl (Global Environmental problems)

8

### Study visits of BH administrative staff and the project Expert Group – KTH Stockholm

- The teachers from BH visited a plant for the treatment of an industrial waste water "Kappala Plant" near Stockholm, KTH labs and IVL labs.
- They also visited Glashuset and KTH library.
- The staff worked on project discussion with the project coordinator Ms. Olga Kordas in details. In addition, they had meetings with Mr. Mats Hanson, Vice Rector of KTH and Ms. Éva Engstrom, Director of Studies/ITM school. The meetings were useful. The main topics for development of Master study and the current joint project implementation were considered.
- The teachers were provided with important information about Master course in Industrial Ecology in KTH and they also received some teaching materials.

9

### Study visits of BH administrative staff and the project Expert Group – UPC Barcelona

- Another group of the Project Team from BH
  - [Rajfa Musemić, Sulejman Redžić, Mujo Hebibović – Uni. Sarajevo; Zora Pilić – Uni. Mostar; Salko Ćosić – Uni. Tuzla, Lejla Sadiković – The Chamber of Economy](#) , visited UPC Barcelona, from 16 to 23 March 2007
- During the visit to Barcelona, all of them participated at the AGS annual meeting from March 18th to March 21st, 2007
- The AGS is advancing the scientific understanding of global environmental challenges, development of technology and policy tools to help societies reconcile ecological and economic concerns and by educating a new generation of leaders committed to meet the challenges of sustainable development

10

## Study visits of BH administrative staff and the project Expert Group – UPC Barcelona

They received some answers to the key questions:

- **Energy** – What are the key technologies and systems for pathways to sustainable energy systems? What are the political actions and decisions, both nationally and internationally, that will be required for different pathways? What are the possibilities and obstacles for different pathways to be accepted by society?
- **Food and water** – Which social and technical innovations can promote pathways to a nourished world? How will the needs and demands of the global population affect near-term pathways (5-15 years)? What are the global food and water ecosystem services, where are they located and what are the limiting factors?
- The Group also visited UPC, CIMNE centre at UPC, and University Library. They collected useful information and teaching materials, which will help in the course preparation

11

## Design of Bologna - compliant curricula and syllabus

- The curriculum for the Master program based on ECTS has been developed
- As assumed, it consists of three modules:
  - **Tools and Methods of Industrial Ecology**
  - **Environmental Management and**
  - **Cleaner Production**
- It discusses the proposed curriculum with the Reference group in order to ensure its relevance for the needs of the local labour market

12

## Development of the obligatory and optional courses

The course package is in the phase of development for each course and it consists of the following:

- course description (Aims, Syllabus, Prerequisites, Requirements),
- content of the course: lectures, seminars, laboratory work, case studies, group assignments, projects
- required literature
- examination forms
- course evaluation forms

The obligatory and optional courses were selected and adjusted to the proposal of the Project

13

## Development of the obligatory and optional courses

The curriculum for Master program:  
60 ECTS (48 mandatory courses and 12 free choose) plus thesis 30 ECTS

COMPULSORY Courses				OPTIONAL Courses			
		Period		Name	ECTS	Start	Across
Name	ECTS	Start	Across				
Introduction Industrial Ecology	6	1	1	Environmental Modeling: Chem. and Phys. Fundamentals	7,5	3	3
Environmental Management	6	1	1	Sustainable Energy Technology	6	3	3
Waste Management Advanced Course	6	4	4	Scenario Methods with Conflict Management	6	4	4
Ecology	6	3	3+4	Environmental Technology	6	4	4
Cleaner Production	6	3	3	Distance Learning Courses			
Environmental System Analysis	6	3	3	Environmental Modeling	6	4	4
Risk Management	6	3	3	Sustainable Development in Theory and Practice	6	4	4

14

## Teachers

### Obligatory courses:

1	Ecology – Advanced course	Prof. Redzic S. (Sa) <a href="#">Prof. Fredrik Gröndahl, KTH</a>	ECTS 6, Lect. 21h, Tutor. 4h, Field work 8h
2	Introduction Industrial Ecology	Assist. Prof. Sikalo S. (Sa) Assist. Prof. Pilic Z. (Mo) <a href="#">Prof. Nils Brandt, KTH</a>	ECTS 6, Lect. 24h, Tutor. 8h, Seminar 8h, Proj. 12h
3	Risk Management:	Prof. Knezevic A. (Sa) <a href="#">Prof. Ronald Wennersten, KTH</a>	ECTS 6, Lect. 16h, Tutor. 30h
4	Environmental system analysis	Prof. Delalic Sead (Tu) Prof. Begic S. (Tu) <a href="#">Prof. Ronald Wennersten, KTH</a>	ECTS 6, Lect. 24h, Tutor. 24h, Study visit 4h
5	Environmental Management	Dr. Busuladzic I. (Sa) <a href="#">Prof. Lennart Nilson, KTH</a>	ECTS 6, Lect. 10h, Seminar 8h
6	Cleaner production	Prof. Dr. Smajevic I. Prof. Dzaferovic E. (Sa) Assist. Prof. Pilic Z. (Mo) <a href="#">Prof. Lennart Nilson, KTH</a>	ECTS 6, Lect. 24h, Tutor. 24h, Study visit 4h
7	Waste management	Assist. Prof. Adisa Vucina Assist. Prof. Cohodar M. (Sa) <a href="#">Prof. Monika Ohlsson, KTH</a>	ECTS 6, Lect. 18h, Proj. Study visit

15

## Teachers

### Optional courses (student choice):

1	Sustainable Energy Technology	Prof. Hebibovic M. (Sa) Lect. Delalic Nijaz (Sa) <a href="#">Prof. Ronald Wennersten, KTH</a>	ECTS 6, Lect. 10h, Tutor. 10h, Study visit 4h
2	Environmental Modelling – Chemical and Physical Fundamentals	Prof. Musemic R. (Sa) Lect. Sapcanin Aida (Sa) <a href="#">Prof. Maria Malmström, KTH</a>	ECTS 6, Lect. 24h, Tutor. 24h, Study visit 4h
3	Scenario Methods	Prof. Smajevic I.	ECTS 6, Lect. 24h, Tutor. 24h
4	<b>Environmental Technology, Advanced Course</b>	Assist. Prof. Sikalo S. <a href="#">Prof. Per Olof Persson, KTH</a>	ECTS 6, Lect. 36h, Tutor. 6h,

### Distance learning courses:

1	Sustainable Development in Theory and Practice	<a href="#">Prof. Nils Brandt, KTH</a>	ECTS 6, Lect. 10h, Tutor. 6h,
2	Environmental Modelling	<a href="#">Prof. Maria Malmström, KTH</a>	

16

## Development of the obligatory and optional courses

- Universities from BH will develop specialised training courses for industry, in [cooperation with the Chamber of Economy](#)
- The Chamber of Economy will manage the process of the courses selection, customer needs and other connection between a university and governmental agencies or other target group
- For this purpose, the material of master courses will be used as the basic material
- The first courses will be given by the IE Department from KTH in the Chamber of Economy of F BH in Sarajevo with the following topics:
  - [Waste management in food production /wrapping material/](#) and
  - [Waste management of computers equipment](#)

17

## Development and publishing of teaching tutorials

- Teachers from BH are preparing teaching materials in accordance with the lectures at KTH in order to adjust them to the local conditions
- Adaptation of the existing materials (textbooks, manuals, multimedia materials etc) to the local conditions and elaboration of new tutorials for each course is the priority task for the next period

18

### **Creation of Centers on Environmental Studies at US-MEF, UT-MEF and SM-MEF**

- To facilitate environmental education and to develop the Master program in Industrial Ecology in BH, the Centers on Environmental Studies will be created at partner universities
- The creation of computer classes is in progress at US-MEF, UT-MEF and SM-MEF
- In order to develop the environmental laboratory and library, equipment proposal and corresponding software must be obtained which is currently in the progress at US-MEF
- The establishment of staff regulations has been completed
- A new way of payments from Tempus office has made this process go slowly

19

### **Creation of Environmental Library**

- During the previous period, we looked for relevant books, periodicals and electronic materials, which will serve a vital support for the Master Program and we purchased some of them
- Based on the experience from KTH we carried out some activities, which provided a base for creating an electronic library of teaching materials: collection of books, presentations etc. in contact with responsible teachers, preparation of the material to publish on the web site.

20

## **Design and maintenance of the Centers' websites**

- To promote and market the Centers (as a place for training, research and development) as well as the Master program and training courses, we started with activities on constructing the website. We analyzed necessary data for the website.
- In addition, we investigated which design will offer the best presentation of our education program while waiting for the workshop outcome realization
- The experiences of KTH and UPC will be welcomed

21

## **Training of students and retraining teachers**

### **English course for teachers and students**

- To improve the English language skills, we organized English courses for teachers
- Eleven teachers have attended to business English course

### **Retraining the involved teachers**

- In order to use a modern teaching methodology such as introducing problem-oriented, project-based courses and so on, several teachers responsible for new courses will need to be retrained for some period at KTH
- For now, only one of them, Dr. Ibrahim Busuladžić stayed at KTH for five weeks.
- During this period, Dr. Busuladžić prepared teaching materials and gained experience in conducting the same course from teachers at KTH

22

## Students Mobility

- According to the Project, three graduates from US-MEF, UT-MEF and SM-MEF have possibilities to be selected for participation in the KTH International MSc program in Sustainable Technology, which is the closest to the one developed during the Project.
- Students will take courses at KTH for 9 months and they will write thesis at their home universities
- Only one student from the Faculty of Electrical Engineering of University of Sarajevo applied for the study at KHT
- This particular student is excellent and quite ambitious - he sent his application for the program as early as April of 2007!

23

## DISSEMINATION

### Design and maintenance of the project website

- The website is under construction
- Some information about developed courses is prepared and it is ready to be published on the website, which will be launched in the following phase
- The leaflets about the development of the Master programmed in Industrial Ecology have been published in order to attract local and international partners

24

## SUSTAINABILITY

- To assure the sustainability of the project outcomes, several activities were executed
- The project Reference Team, consisting of representatives of university administration, representatives of an industry and the Chamber of Economy , analyzed and recognized the actual environmental problems in Bosnia and Herzegovina. This will ensure that the new Master program is relevant to the labor market

25

## MANAGEMENT OF THE PROJECT

### Coordination meetings

- To ensure the common understanding of the project goals, outcomes and activities as well as roles of each partner, the first kick-off meeting was organized in Neum on October 3, 2006
- The participants were representatives of US-MEF, UT-MEF and SM-MEF and the Chamber of Economy of the Federation of BH. They discussed the project management and communication procedures
- The Coordination meeting has been arranged at KTH on December 2006, where the project work plan has been revised and the detailed project work plan for the first year has been harmonized
- The members of the Project Team responsible for each project activity have been appointed
- The criteria for selection of teachers and students to participate in the mobility have been discussed and settled.

26