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TrainERGY project

IO Number: 2

Energy Efficient Operations Curriculum Development

Energy efficient operations curriculum development framework

Table of Contents

1   Introduction

This document provides an overview on the development of the Energy Efficient Operations Curriculum. This framework provides requirements for:

- The courses development,
- Course materials preparation,
- ECTS guidelines,
- Framework for ECTS accreditation.

2   Overview

The skill matrix analysis served as a basis for selecting the skills worst addressed in the analysed countries, both in terms of CI (Covering Index[1]) and PI (Skill presence Index[2]). Therefore the project consortium decided that the courses developed within the curriculum focus on the skills, that are the least covered by the actual offer of EEO programs in EU and not possessed/used by the companies.

Those skills are as followed:

Country	Skills needing the strongest improvement actions (on the basis of PrI - Priority Index)
United Kingdom	B8 Green purchasing A4 Technologies for reducing waste B9 Green marketing A6 Database management systems C11 Green external operations management
Italy	B8 Green purchasing D15 Reporting activities E18 Interventions identification A6 Database management systems E16 Definition of Environmental objectives and Environmental Performance Indicators (EPIs)
Greece	B9 Green marketing D15 Reporting activities A2 Technologies for reducing pollution A3 Technologies for reducing consumption raw materials B8 Green purchasing
Poland	B9 Green marketing

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[1] a **Covering Index (CI),** measuring the covering degree of the skills by the actual offer of EEO programs in EU
[2] a **Skill Presence Index (PI)**, measuring the diffusion and possession degree of the skills in SMEs

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	D14 Auditing activities E18 Interventions identification B8 Green purchasing C11 Green external operations management

The skills requiring the strongest improvement actions and covered by the competences of the partners (as explained in the skill matrix development methodology) are addressed by the designed curriculum and piloted in every country. According to the project application requirements the framework for curriculum development focus on the following milestones:

- The curriculum includes 3 master level courses (one per every teaching and learning activity to be tested).
- The curriculum should be ready for ECTS accreditation, therefore the materials is prepared in line with ECTS requirements
- The EEO Curriculum is available online (being part of VLE) and is accessible at any point by anybody.

Due to the design of teaching and learning actions [as per description of Teaching & Learning Scheme (IO Number: 4, Deliverable number: 4.1; Open innovation & co-creation framework for EEO curriculum development methodology (QUADRUPLE HELIX CO-CREATION)], pilots for every country focuses on the top 3 skills needing the strongest improvement actions. Those skills were developed into thematic modules (topics) within the curriculum and further expanded into teaching material used during the pilot and in VLE. The thematic modules (topics) with reference to the priority index for every country, where the curriculum was piloted, are listed below.

UK - 1st short term joint staff training		IT - 2nd short term joint staff training		GR - 3rd short term joint staff training	
Topic	Owner	Topic	Owner	Topic	Owner
B8 Green purchasing	UoL	D15 Reporting activities	UoL	A3 Technologies for reducing consumption raw materials	SEERC
A4 Technologies for reducing waste	TUOS	A6 Database management systems	SEERC	B9 Green Marketing	UoL
C11 Green external operations management	UNINA	E16 Definition of Environmental objectives and Environmental Performance Indicators (EPIs)	UNINA	E18 Interventions identification	UNINA

PL skills are not listed above as there is no curriculum pilot in Poland. However, as the themes overlap to some extent, the skills listed as top priority for Poland were addressed directly and indirectly in the curriculum, as well as VLE and additional materials gathered there. The skills "Green marketing", "Interventions identification ", "Green purchasing" were be addressed directly, whereas the skills "Auditing activities" were be addressed indirectly by materials prepared for the skill "Reporting activities" and "Green external operations management" were be addressed indirectly by materials prepared for the skills "Technologies for reducing waste" and "Technologies for reducing consumption of raw materials".

3   Structure of the courses

The numbers of ECTS and hours are based on ECTS calculator used at the Faculty of Management, University of Lodz and are in line with general ECTS rules. Nevertheless the number of ECTS and number of hours were fine-tuned by every academic partner within their requirements for ECTS accreditation process.

3.1   Link between full course curriculum and piloted

According to the project application requirements for the curriculum development framework focus on the following milestones: The curriculum includes 3 master level courses.

However, as a result of the conducted survey and willingness to cover as much of the evaluated skills in the pilots / curriculum as possible the following scheme was implemented:

1.   The pilots focused on different topics, and were further developed into full course curriculums.
2.   In order to optimise the teaching process as well as the content of the curriculums the parts of the curriculum may be piloted during different teaching and learning activity (not only one curriculum per every teaching and learning activity).

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The full course curriculum includes the following topics, selected according to aforementioned PrI - Priority Index.

1. Curriculum 1 - Selected aspects of energy efficient management:
    a. Green purchasing
    b. Green marketing
    c. Green external operations management
2. Curriculum 2 - Improving processes and supply chains towards energy efficiency
    a. Technologies for reducing waste
    b. Technologies for reducing consumption of raw materials
    c. Interventions identification
3. Curriculum 3 - Internal and external sources of information on energy efficiency
    a. Reporting activities
    b. Definition of Environmental objectives and Environmental Performance Indicators (EPIs)
    c. Database management systems

3.2 Learning outcomes

Curriculum 1 - Selected aspects of energy efficient management	
Aim	The aim of the course is to build competences in selected aspects of energy efficient management, including: green purchasing, green marketing, green external operations management
Knowledge	Knows the definition of green purchasing and related aspects Knows the definition of green marketing and related aspects Knows the definition of green external operations management and related aspects Knows tools and methodologies used for implementation of green purchasing practices Knows tools and methodologies used for implementation of green marketing practices Knows tools and methodologies used for implementation of green external operations management practices
Skills	Analyses the current actions of enterprises and assesses them towards compliance with green purchasing practices Analyses the current actions of enterprises and assesses them towards compliance with green marketing practices Analyses the current actions of enterprises and assesses them towards compliance with green external operations management practices

	Understands and explains the influence of green purchasing on the functioning of supply chain / process Understands and explains the influence of green marketing on the functioning of supply chain / process Understands and explains the influence of green external operations management on the functioning of supply chain / process Analyses and discusses case studies and good practices oriented on implementing green purchasing practices Analyses and discusses case studies and good practices oriented on implementing green marketing practices Analyses and discusses case studies and good practices oriented on implementing green external operations management practices
Attitudes	Links the issues of green purchasing with general management aspects Links the issues of green marketing with general management aspects Links the issues of green external operations management with general management aspects

Curriculum 2 - Improving processes and supply chains towards energy efficiency	
Aim	The aim of the course is to build competences in Improving processes and supply chains towards energy efficiency, including: technologies for reducing waste, technologies for reducing consumption of raw materials, interventions identification
Knowledge	Knows the definition of technologies used for reducing waste and related aspects Knows the definition of technologies used for reducing consumption raw materials and related aspects Knows the definition of interventions identification and related aspects Knows tools and methodologies used for implementation of technologies for reducing waste Knows tools and methodologies used for implementation of technologies for reducing consumption of raw materials Knows tools and methodologies used for implementation of interventions identification practices
Skills	Analyses the current actions of enterprises and assesses them towards compliance with the implementation of technologies for reducing waste Analyses the current actions of enterprises and assesses them towards compliance with implementation of technologies for reducing consumption of raw materials Analyses the current actions of enterprises and assesses them towards compliance with interventions identification practices

	Understands and explains the influence of technologies for reducing waste on the functioning of supply chain / process
	Understands and explains the influence of technologies for reducing consumption of raw materials on the functioning of supply chain / process
	Understands and explains the influence of interventions identification on the functioning of supply chain / process
	Analyses and discusses case studies and good practices oriented on implementing technologies for reducing waste
	Analyses and discusses case studies and good practices oriented on implementing technologies for reducing consumption of raw materials
	Analyses and discusses case studies and good practices oriented on implementing interventions identification practices
Social competence	Links the issues of technologies for reducing waste with general management aspects
	Links the issues of technologies for reducing consumption of raw materials with general management aspects
	Links the issues of interventions identification with general management aspects

Curriculum 3 - Internal and external sources of information on energy efficiency	
Aim	The aim of the course is to build competences in Internal and external sources of information on energy efficiency, including: reporting activities, definition of environmental objectives and environmental performance indicators (EPIs), database management systems
Knowledge	Knows the definition of reporting activities and related aspects Knows the definition of environmental objectives and environmental performance indicators (EPIs) and related aspects Knows the definition of database management systems and related aspects Knows tools and methodologies used for implementation of reporting activities practices Knows tools and methodologies used for implementation of environmental objectives and environmental performance indicators (EPIs) Knows tools and methodologies used for implementation of database management systems
Skills	Analyses the current actions of enterprises and assesses them towards compliance with reporting activities practices Analyses the current actions of enterprises and assesses them towards compliance with environmental objectives and environmental performance indicators (EPIs) implementation practices Analyses the current actions of enterprises and assesses them towards compliance with database management systems Understands and explains the influence of reporting activities on the functioning of supply chain / process Understands and explains the influence of environmental objectives and environmental performance indicators (EPIs) on the functioning of supply chain / process Understands and explains the influence of database management systems on the functioning of supply chain / process Analyses and discusses case studies and good practices oriented on implementing reporting activities practices Analyses and discusses case studies and good practices oriented on implementing environmental objectives and environmental performance indicators (EPIs) Analyses and discusses case studies and good practices oriented on implementing database management systems
Social competence	Links the issues of reporting activities with general management aspects Links the issues of environmental objectives and environmental performance indicators (EPIs) with general management aspects

	Links the issues of database management systems with general management aspects

The learning outcomes can be further detailed in order to implement the learning content into a separate course or use its modules in other courses.

3.3 General structure of the pilot courses

The structure of the piloted courses corresponds to the Teaching & Learning Scheme (IO Number: 4, Deliverable number: 4.1; Open innovation & co-creation framework for EEO curriculum development methodology (QUADRUPLE HELIX CO-CREATION)

ECTS credits	n/a
Type of classes in a course	Workshop
Assessment form	Project (final presentation)
Total contact* (in-class) hours	20
*1 contact hour is 45 minutes	Contact (in-class) hours details: • Introduction: 2h • VLE crash course: 2h • Workshop (Teaching EEO Curriculum) o 6h for the whole content of the curriculum to be piloted during the teaching and learning activity (2h for every topic) • Mentoring sessions: 6h • Final Presentations: 4h
Student's own work hours (corresponding to the contact hours)	22
	Student's own work hours details: • Group work (Case study analysis and modelling): 8h • Group work (Development of good practices): 6h • Group work (Development of recommendations and final presentation): 4h • Literature / case studies reading: 4h (not included in the schedule of the training)

The learning materials for the pilots were prepared before the teaching and learning activity and tested during the 5-day training.

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The piloted learning materials were used to prepare the learning materials for the full course (using the feedback gathered during the pilots), after the pilot.

3.4 General structure of the full courses – PL

The piloted courses test the content and activities which were developed into full courses. The curriculum, being the result of the project, provided content and learning materials for the full courses.

ECTS credits	3
Type of classes in a course	Workshop
Assessment form	Project (final presentation)
Total contact* (in-class) hours *1 contact hour is 45 minutes	15

	Contact (in-class) hours details:
	• Workshop (Teaching EEO Curriculum): 12h
	   o 3 x 2 h for lectures (3 topics within one course)
	   o 3 x 2 h for exercises (1 set of exercises/case studies/etc. per every topic)
	• Final Presentations: 3h

Student's own work hours 1 (corresponding to the contact hours)	45

	Student's own work details:
	• Group work (SCEnAT*i* Case study analysis and modelling): 10h
	   o Based on case study template and SCEnAT*i* manual)
	• Group work (Development of good practices): 10h
	   o Based on good practice template
	• VLE Individual Practice: 10h
	• Self-study (literature / case studies reading prepared by the lecturer): 15h

Student's own work hours 2 (corresponding to preparation for assessment – final presentation)	15
	Student's own work details: • Group work (Development of recommendations and final presentation): 10h • Self-study (literature / case studies reading self chosen by students): 5h

3.5 General structure of the full courses – UK

UK Higher Education - ECTS credits	15
Type of classes in a course	Lecture
Assessment form	Project (Report (70%) + Final presentation (30%))
Total contact* (in-class) hours *1 contact hour is 50 minutes	33

	Contact (in-class) hours details:
	• Lectures (Teaching EEO Curriculum): 30h
	  ○ 10 x 2 h for lectures (3 topics within one course)
	  ○ 10 x 1 h for exercises (1 set of exercises/case studies/etc. with multiple sub-points per every topic)
	• Final Presentations: 3h

Student's own work hours 1 (corresponding to the contact hours)	30

	Student's own work details:
	• Group work (SCEnAT*i* Case study analysis and modelling): 5h
	  ○ Based on case study template and SCEnAT*i* manual)
	• Group work (Development of good practices): 5h
	  ○ Based on good practice template
	• VLE Individual Practice: 10h
	• Self-study (literature / case studies reading prepared by the lecturer): 10h

Student's own work hours 2 (corresponding to preparation for assessment – final presentation)	15
	Student's own work details: • Group work (Development of recommendations and final presentation): 10h • Self-study (literature / case studies reading self chosen by students): 5h

3.6 General structure of the full courses – IT

ECTS credits	3
Type of classes in a course	Lecture
Assessment form	Project (final presentation)
Total contact* (in-class) hours *1 contact hour is 45 minutes	27
	Contact (in-class) hours details: • Workshop (Teaching EEO Curriculum): 24h

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	9 x 2 h for lectures (3 topics within one course) 3 x 2 h for exercises (1 set of exercises/case studies/etc. per every topic) • Final Presentations: 3h
Student's own work hours 1 (corresponding to the contact hours)	32
	Student's own work details: - Group work (SCEnAT*i* Case study analysis and modelling): 8h - Based on case study template and SCEnAT*i* manual) - Group work (Development of good practices): 8h - Based on good practice template - VLE Individual Practice: 8h - Self-study (literature / case studies reading prepared by the lecturer): 8h
Student's own work hours 2 (corresponding to preparation for assessment – final presentation)	16
	Student's own work details: - Group work (Development of recommendations and final presentation): 10h - Self-study (literature / case studies reading self chosen by students): 6h

3.7 General structure of the full courses - GR

UK Higher Education - ECTS credits which are followed in Greece also.	15
Type of classes in a course	Lecture
Assessment form	Project (Report (70%) + Final presentation (30%))
Total contact* (in-class) hours *1 contact hour is 50 minutes	33
	Contact (in-class) hours details: - Lectures (Teaching EEO Curriculum): 30h 10 x 2 h for lectures (3 topics within one course) 10 x 1 h for exercises (1 set of exercises/case studies/etc. with multiple sub-points per every topic) - Final Presentations: 3h
Student's own work hours 1 (corresponding to the contact hours)	30
	Student's own work details:

	• Group work (SCEnAT*i* Case study analysis and modelling): 5h 　○ Based on case study template and SCEnAT*i* manual) • Group work (Development of good practices): 5h 　○ Based on good practice template • VLE Individual Practice: 10h • Self-study (literature / case studies reading prepared by the lecturer): 10h
Student's own work hours 2 (corresponding to preparation for assessment – final presentation)	15
	Student's own work details: • Group work (Development of recommendations and final presentation): 10h • Self-study (literature / case studies reading self chosen by students): 5h

Should the materials be implemented in a different country or credit system, then the proposed values for contact (in-class) hours and own work hours should be adapted according to these new regulations.

4 Requirements for course materials

Every course (presentation) consist of the following parts:
- Theoretical background (mainly for students and less advanced industry stakeholders)
- Practical implementation (mainly for industry stakeholders and also students)
- Additionally in the full course a follow-up learning material to be included (case studies, best practices, etc.)

4.1 Materials for contact (in-class) hours for lecture

The basis of learning materials used for pilot / full course is a presentation (e.g. MS Power Point format).

Regarding the lecture - 1 contact hour is an equivalent of approx. 15 – 20 slides of normalised text (prepared on a TrainERGY presentation template).

4.2 Materials for contact (in-class) hours for exercises

Equivalent of 2 contact hours (2x45 minutes)
For the full course, additional materials (above those required for the pilot course) were developed. The additional materials may include at least:
- Case studies
- Group exercises
- Discussion questions

The additional materials are described in an additional presentation (e.g. MS Power Point format; prepared in a TrainERGY presentation template).

The required in-class workload is 2x45 minutes, however the proposed tasks may cover more time. Tutors can choose the tasks and modify the duration time.

4.3 Materials for self-study

Equivalent of 15 hours (15x45 minutes)
The learning material should indicate external sources of knowledge supporting the presented topic for own study. Those sources may include:
- Webpages, case studies, reports, etc.
- Book / paper references (preferably open source)
- Any other valuable materials indications

Specifically the external materials can include:
- Documents (pdf format)
- Presentations (ppt format)
- Photographs and infographics (jpeg format)
- Videos (uploaded in YouTube, etc.)
- Links to websites

The reading / studying of materials indicated within the "own work" part should be an equivalent of
- 4 hours for the pilot
- 20 hours for the full course

The further reading materials are described in an additional presentation (e.g. MS Power Point format; prepared in a TrainERGY presentation template).

4.4 Work group / own study activities

The work group during the pilot / full course focus on three main elements presented in the table below.

Work group / own study activity	Description	Requirements

Case study analysis and modelling (using SCEnAT)	• A basis for the case study is SCEnATi
	• The participants develop case studies analysing the CO_2 hotspots for particular companies
	• The participants formulate recommendation for reducing the CO_2 emissions for the companies (e.g. recommendations can be based on specific actions connected with the skills covered during every pilot/course)
	• The case study should be prepared in the case study template
		• Introduction to SCEnATi and its methodology during every teaching and learning activity
		• Access (logins and passwords) to:
		  o SCEnAT*i*
		  o Ecoinvent
		  o Other databases / tools
		• The participants should have their own computers or have access to computers / access to internet
		• The data for the case studies should be prepared beforehand for the participants / gathered by the participants as a part of the final project

Development of good practices	• The participants identify best practices for the topics learned during the pilot/course • The basis of the best practices are external /secondary sources of knowledge supporting the presented topic (webpages, external case studies, reports, book / paper references) • The good practice descriptions should be prepared in the good practice template	• The participants should have their own computers or have access to computers / access to internet in order to use VLE

Development of recommendations and final presentation	• The participants (trainees / students) present the outcomes of their work (case study + best practice) during a final presentation, which is a basis for completion (evaluation) of the pilot/course • The final presentation should be prepared in the final presentation template	

4.5   Assessment test

In case of full course the assessment test can be done in any suitable / required form. In case of e-learning it can be done in form of self-assessment quiz.

Requirements for assessment test:
- A set of 10 multiple choice questions per topic.
- Each question should have 3 possible answers to choose from (a – b – c).
- Indicate the right answer. For each question provide feedback (1-2 sentences explaining the wrong / correct answer).

4.6   Additional requirements content development

4.6.1   External sources

Distinguish between original material that has been developed for the project and available material compiled from other sources. References for external material needs to be provided at any point. Terms of use for the external material used for the course needs to be checked. If the use of any material is restricted in any way, a permission form the author needs to be obtained.