AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Life Cycle Assessment

Academic year: 2015/2016 Code: DIS-2-333-IK-s ECTS credits: 3

Faculty of: Mining Surveying and Environmental Engineering

Field of study: Environmental Engineering Specialty: Municipal Engineering

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 3

Course homepage: http://home.agh.edu.pl/~grzesikk/LCA.html

Responsible teacher: dr inż. Grzesik Katarzyna (grzesikk@agh.edu.pl)

Academic teachers: dr inż. Grzesik Katarzyna (grzesikk@agh.edu.pl)

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	is aware of his/her current knowledge, understands the necessity of studying through the whole life	IS2A_K01	Activity during classes, Execution of a project, Participation in a discussion
Skills			
M_U001	carry out a complete LCA of a product including: 1) identify and delimit the system, 2) identify and use relevant data from LCA databases, 3) collect and use data from other sources, 4) implement and use a computer model of the system in the LCA software SimaPro, 5) analyse, explain, and interpret results	IS2A_U01, IS2A_U05, IS2A_U11	Execution of a project
M_U002	write a report of the performed LCA	IS2A_U03	Project
M_U003	make a presentation of the performed LCA	IS2A_U04, IS2A_U05	Presentation
Knowledge			
M_W001	explain the overall purpose and principles of life cycle assessment (LCA), describe the content and explain the purpose of the analytical steps of LCA	IS2A_W05, IS2A_W10, IS2A_W11	Execution of a project, Activity during classes

M_W002	discuss possible applications and limitiations of LCA	IS2A_W11	Execution of a project, Activity during classes, Test, Oral answer

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Others	E-learning
Social competence												
M_K001	is aware of his/her current knowledge, understands the necessity of studying through the whole life	-	-	-	+	-	-	-	-	-	-	-
Skills												
M_U001	carry out a complete LCA of a product including: 1) identify and delimit the system, 2) identify and use relevant data from LCA databases, 3) collect and use data from other sources, 4) implement and use a computer model of the system in the LCA software SimaPro, 5) analyse, explain, and interpret results	-	-	-	+	-	-	-	-	-	-	-
M_U002	write a report of the performed LCA	-	-	-	+	-	-	-	-	-	-	-
M_U003	make a presentation of the performed LCA	-	-	-	+	-	-	-	-	-	-	-
Knowledge												
M_W001	explain the overall purpose and principles of life cycle assessment (LCA), describe the content and explain the purpose of the analytical steps of LCA	+	-	-	-	-	-	-	-	-	-	-
M_W002	discuss possible applications and limitiations of LCA	+	-	-	-	-	-	-	-	-	-	-

Module content

Lectures

Introduction to Life Cycle Assessment

History, definition, standards, structure of LCA.

Goal and scope
System of a product, system boundary, unit process, functional unit.

Life Cycle Inventory
Data collection, databases, allocation, validation.

Life Cycle Impact Assessment
Impact categories, classification, normalization, weighting.

Life Cycle Impact Assessment Methodologies
Overview of methodologies, Eco-indicator99 methodology, ReCiPe methodology.

Life cycle interpretation, limitation of LCA
Identification of significant issues, evaluation, reporting, critical review.

LCA in practice
LCA and life cycle management, life cycle thinking, sustainability.

Project classes

Overview of LCA software, Introduction to SimaPro
Overview of LCA software, Introduction to SimaPro.

Defining the topic of the project
Defining the product, indentifying the system, system boundaries, functional unit.

Data collection
Data collection on product, processes components and materials.

Life cycle impact assessment
Performing Life cycle impact assessment with SimaPro software.

Interpretation, limitation
Interpreting the result of LCA, explaining limitations.

Report
Writing a report of the performed LCA.

Presentation
Presentation of LCA study.

Method of calculating the final grade

The final grade FG is calculating according to the following formula:
FG = PG
where:
PG – project grade
PG is calculating according to the following formula:
PG= 0,7• R + 0,3• Pres
where:
R – report grade
Pres – presentation grade

Prerequisites and additional requirements

Knowledge of physics, chemistry, biology, ecology, ecotoxicology, materials science, environmental management, environmental impact assessment.

Recommended literature and teaching resources

1. Guinée, et al. (2002), Handbook on life cycle assessment. Operational guide to the ISO standards. I: LCA in perspective. IIa: Guide. IIb: Operational annex. III: Scientific background. Kluwer Academic Publishers, ISBN 1-4020-0228-9, Dordrecht, 2002, 692 pp http://cml.leiden.edu/research/industrialecology/researchprojects/finished/new-dutch-lca-guide.html.
2. Life cycle assessment: Principles and practice. EPA600/r-06/060 May 2006 http://www.epa.gov/NRMRL/lcaccess/pdfs/600r06060.pdf.
3. Rebitzer et al. (2004) Life cycle assessment. Part 1: Framework, goal and scope definition, inventory analysis, and applications. Environment International 30 (2004) 701 – 720. AGH library electronic scientic journals.
4. Pennington et al. (2004) Life cycle assessment Part 2: Current impact assessment practice, section 7. Environment International 30 (2004) 721– 739 AGH library electronic scientificc journals.
5. PRé Consultants (2006) SimaPro 7 Introduction to LCA www.pre.nl.
6. PRé Consultants (2006) SimaPro 7 Tutorial www.pre.nl.
7. PRé Consultants (2001) The Eco- indicator 99. A damage oriented method for Life Cycle Impact Assessment. Methodology report.. www.pre.nl.
8. EN-ISO 14040-06. 2006. Environmental Management – Life Cycle Assessment – Principles and Framework.
9. EN-ISO 14044-06. 2006. Environmental Management – Life Cycle Assessment – Requirements and Guidelines.

Scientific publications of module course instructors related to the topic of the module

1. Grzesik K.: Wprowadzenie do oceny cyklu życia (LCA) – nowej techniki w ochronie środowiska. Inżynieria Środowiska, 2006, t. 11, z. 1, 111-113.
2. Grzesik K., Guca K.: Screening study of Life Cycle Assessment (LCA) of the electric kettle with SimaPro
software — Wstepna analiza cyklu zycia czajnika elektrycznego z wykorzystaniem programu SimaPro. Geomatics and Environmental Engineering,, 2011, vol. 5, no. 3, pp. 57-68.
3. Grzesik K., Terefeńko T.: Life Cycle Assessment of an Inkjet Printer. Polish Journal of Environmental Studies. Hard Olsztyn Vol. 21, 2012, No. 5A, pp 95-1052.
4. Grzesik-Wojtysiak K., Kukliński G.: Screening life cycle assessment of a laptop used in Poland. Environment Protection Engineering, Vol. 39, 2013, No. 3, pp. 43-55.
5. Grzesik K. Application of IWM-PL model for Life Cycle Assessment (LCA) of municipal waste management in Kraków. Part 2. Geomatics and Environmental Engineering, Vol. 7, 2013, No. 4, pp. 43-58.
6. Grzesik K.: Application of IWM-PL model for Life Cycle Assessment (LCA) of municipal waste management in Kraków. Part 1. Geomatics and Environmental Engineering, Vol. 7, 2013, No. 3 , pp. 35-55.
7. Bieda B., Sala D., Grzesik-Wojtysiak K.: Stochastic approach for Life Cycle Inventory (LCI) modeling used to energy production by integrated steel plant in Poland – power plant energy production: a case study. HKICEAS ; EECS : Hong Kong International Conference on Engineering and Applied Science; International Conference on Electrical Engineering and Computer Science: Hong Kong, December 2013: conference proceedings.
8. Grzesik-Wojtysiak K.: Ocena modelu IWM-PL – polskiej aplikacji do przeprowadzania LCA (analizy cyklu życia) systemów gospodarki odpadami. Czasopismo Inżynierii Lądowej, Środowiska i Architektury; 2013 t. 30 z. 60 nr 3, 101-115.
9. Grzesik K., Kozakiewicz R., Bieda B., Life cycle assessment for landfilling, incineration and mechanical-biological treatment of residual waste for Krakow city (Poland), SGEM2014 : GeoConference on Energy and clean technologies : International multidisciplinary scientific geoconference: 17–26, June, 2014, Albena, Bulgaria: conference proceedings. Vol. 2, Nuclear technologies, recycling, air pollution and
climate change, pp. 143-150.
10. Grzesik K., Jakubiak M., Choosing the municipal waste management scenario with the Life Cycle Assessment (LCA) methodology — Wybór scenariusza gospodarki odpadami komunalnymi z zastosowaniem metodyki analizy cyklu życia (LCA), Logistyka ; ISSN 1231-5478, 2014 No 4, pp. 4303-4309.
11. Bieda B., Grzesik K., Sala D., Gaweł B., Life cycle inventory processes of the integrated steel plant (ISP) in Krakow, Poland – coke production, a case study, International Journal of Life Cycle Assessment; 2015, vol. 20, iss. 8, 1089-1101. http://link.springer.com/content/pdf/10.1007%2Fs11367-015-0904-9.pdf.

Additional information

A student can choose either the module Life Cycle Assessment in English OR the module Analiza Cyklu Życia (LCA) in Polish. It s not possible to choose these two modules by a student.

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	14 h
Participation in project classes	28 h
Realization of independently performed tasks	6 h
Completion of a project	26 h
Preparation of a report, presentation, written work, etc.	4 h
Contact hours	1 h
Summary student workload	79 h
Module ECTS credits	3 ECTS