Course guide
320006 - TAS - Environmental Technologies and Sustainability

Last modified: 16/07/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
702 - CEM - Department of Materials Science and Engineering.
709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: ESCALAS CAÑELLAS, ANTONI
BUSCIO OLIVERA, VALENTINA

Others: María Guadalupe Barajas López, Antoni Escalas Cañellas, Gemma Molins Duran, Gabriela Mijas, Helena Oliver Ortega, Valentina Buscio Olivera

*** Attention: This course has groups taught in Catalan and groups taught in Spanish. For details, look under "Metodologies docents"/"Metodologías docentes"/"Teaching Methodology."

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)

Generical:
CG03-INDUS. Knowledge in basic and technological subjects that enable them to learn new methods and theories and provide them with versatility to adapt to new situations.
CG04-INDUS. Ability to solve problems with initiative, decision-making, creativity, critical reasoning, and to communicate and transmit knowledge, skills, and abilities in the field of Industrial Engineering.
CG05-INDUS. Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans, and other similar tasks.
CG07-INDUS. Ability to analyze and evaluate the social and environmental impact of technical solutions.

Transversal:
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

Basic:
CB3. That students have the ability to gather and interpret relevant data (typically within their field of study) to make judgments that include reflection on socially, scientifically, or ethically relevant issues.

TEACHING METHODOLOGY

Languages in which class groups are taught:
--Autumn semester--
Group 1 - Catalan
Group 2 - Spanish
Group 3 - Spanish
Group 4 - Spanish
Group 5 - Catalan (B1) /Spanish (B2)
Group 6 - Catalan/Spanish
This subject has some groups in Catalan, in Spanish and groups in Catalan and Spanish. Check the schedule to verify the language for each group of theory and problems.

--Spring Semester--
Group 1 Catalan / Spanish

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

---METHODOLOGY---
In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.
There will be three types of practical work sessions:
a) Sessions in which the lecturer provides students with guidelines for analysing data and solving problems using techniques, concepts and theoretical results.
b) Sessions in which students present group work.
c) Examination sessions
Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set, whether manually or with the help of a computer.

LEARNING OBJECTIVES OF THE SUBJECT

The course is structured in two parts: Sustainability (at a conceptual level) and Environmental Technologies. In the first part the aim is to introduce the student to the knowledge of the principles and foundations of sustainable development, the causes that have led to the unsustainability of today's society, the current state of the world, development models and policies, including the United Nations Sustainable Development Goals, all from a systemic perspective and the logic of complexity. The students have to acquire the ability to understand the mechanisms driving the different economic models and the implications and influence they have on the administration of a company, especially in industry, and in the engineering profession.
In the second part, the main objective focuses on the knowledge of the main environmental technologies (water management, energy, waste, air pollution) and the tools of environmental assessment and management that can contribute to a sustainable society. , as well as the most appropriate environmental technology for each reality.
The course assesses levels 1 and 2 of the generic competence Sustainability and Social Commitment.

STUDY LOAD

Type	Hours	Percentage
Self study	105,0	70.00
Hours medium group	30,0	20.00
Hours large group	15,0	10.00

Total learning time: 150 h

CONTENTS

TOPIC 1: STATE OF THE WORLD

Description:
1.1. Carrying capacity.
1.2. Population.
1.3. Economy, inequalities and social impacts.
1.4. Impacts of human activity. Ecological footprint

Specific objectives:
For students to:
- Understand the concept of carrying capacity and its influencing factors, as applied to humankind.
- Understand the evolution of the world's population in terms of volume, and also disaggregated into regions or rural and urban areas. Understand how the demographic transition model enables the data to be interpreted.
- Understand the bases of the economic model of growth and its quantitative evolution. Understand economic and social imbalances on a worldwide scale and analyse their main consequences and causes.
- Understand the basic resources used and the main forms of waste generated by human activity, as well as the resulting environmental impacts. Analyse the relationship between these impacts and the development model. Become familiar with indicators of these impacts, such as the ecological footprint.

Related activities:
Presentation of the activities
Practice: CIRCULAR ECONOMY
Practice: ECOLOGICAL FOOTPRINT

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

TOPIC 2: CAUSES OF UNSUSTAINABILITY

Description:
2.1. A problematic model.
2.2. The Copernican revolution and mechanism.
2.3. Utilitarianism, anthropocentrism and technocracy.
2.4. The sacrifice of equity.
2.5. The prisoner's dilemma.
2.6. The example of Easter Island.

Specific objectives:
- Understand that "reality" is a relative concept that is interpreted and constructed differently in each cultural context.
- Understand the foundations of our worldview, especially the elements that underlie the current unsustainability.

Related activities:
Practical activity: ECOLOGICAL FOOTPRINT

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

TOPIC 3: THE SUSTAINABILITY PARADIGM

Description:
3.1. Historical background.
3.2. Introduction to the concept of sustainable development. Discussion.
3.3. World summits and institutional initiatives.
3.4. The equation I = P*C*T.
3.5. The capital-based approach. Strong and weak sustainability.
3.6. The principles of sustainability.

Specific objectives:
For students to:
- Understand the historical background to the concept of sustainable development.
- Become familiar with different perspectives on the concept of sustainable development.

Related activities:
Practical activity: DIVERSE SOCIETIES

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

TOPIC 4: DEVELOPMENT MODELS

Description:
4.1. The various aspects of development:
4.1.1. The origin of the concept of development.
4.1.2. The various aspects of development.
4.1.3. Development as a complex dynamic phenomenon.
4.2. Human development and well-being:
4.2.1. Oikonomia and chrematistics: the emergence of the modern free-market model.
4.2.2. Fake goods: the crises of modern sustainability.
4.2.3. Needs and development.
4.2.4. Criticism of political ecology: the welcoming society and post-industrial utopias.
4.2.5. Human-scale development.
4.2.6. The capability approach and the UNDP's human development proposal.
4.2.7. Alternative models of human development.

Specific objectives:
For students to:
- Understand development as a multifaceted phenomenon comprising social, cultural, political, economic, institutional, technological, environmental and ecological aspects.
- Understand the interdependence between these dimensions and their conditioning factors.
- Understand the role of technology, engineering and cooperation in global change.
- Understand the concept of human development and well-being.
- Understand the main proposals of human development models: political ecology proposals, the model of human-scale development, and the human development of the UNDP.

Related activities:
Practical activity: MATRIX OF NEEDS / SUSTAINABLE DEVELOPMENT GOALS

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

SUBJECT 5: UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Description:
5.1. UN Agenda 2030
5.2. Origin of the UN SDGs
5.3. How and who agreed to the UN SDGs
5.4. What are the SDGs and what do they entail
5.5. How to implement the ODS in our reality
5.6. Commitments in SDGs in Europe, Spain and Catalonia

Specific objectives:
- Know the spheres and the different objectives
- Know basic questions about each objective: current situation, basic goals, some examples
- How they relate to our social / economic / industrial reality
- Understand historical globalism theory and some of the new global governance proposals that have arisen in this context.

Related activities:
Practical activity: THE ECONOMY OF THE COMMON GOOD

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

TOPIC 6. CLIMATE CHANGE

Description:
6.1. Introduction. Climate change science.
6.2. Physical effects of climate change
6.3. Social impacts of climate change: relationship of impacts with poverty, refugees, gender
6.4. Climate change mitigation. UNFCCC, Kyoto, Paris. Energy transition. Future scenarios.
6.5. Adaptation to climate change

Specific objectives:
- Understand basically the climate of the Earth and the causes and measure of anthropogenic climate change
- Know the physical changes caused by climate change (warming, extreme weather, melting ice, sea level rise)
- Understand the social impacts, especially in what the unequal impacts in different social centers
- Understand the magnitude of mitigation needs, ongoing international efforts and their strengths and weaknesses

Related activities:
Practical activity: CLIMATE CHANGE

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

TOPIC 7: ENERGY

Description:
7.1. Introduction and basic concepts, primary and final energies, current energy sources
7.2. Fossil fuels: types, characteristics, problems
7.3. Nuclear energy
7.4. Renewable energies
7.6. Energy efficiency
7.7. Energy future; conventional projections
7.8. Energy future: energy transition, scenarios compatible with the Paris Agreement
7.9. Conclusions

Specific objectives:
- Ability to identify the problems associated with the current energy model, in relation to emissions, and to the future depletion of fossil reserves.
- Ability to understand the relationship between the current energy model and the environmental problems it generates.
- Understand how climate change mitigation requires an effective energy transition to renewable sources and obstacles
- Know the main obstacles to the energy transition

Related activities:
Practical activity on ENERGY

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 9h
Theory classes: 1h
Practical classes: 2h
Self study : 6h

TOPIC 8: WATER MANAGEMENT

Description:
8.1. Water resources.
8.2. Uses of water. Sources of pollution.
8.3. Sustainability indicators: environmental and socioeconomic.
8.4. Overview of the main water-treatment technologies. Water treatment. Water softening. Water purification.
8.5. Demand management.

Specific objectives:
For students to:
- Identify and understand the environmental significance of the main indicators of water quality.
- Identify the main treatments applied in order to soften and purify water and make it potable.

Related activities:
Practical activity: WATER MANAGEMENT

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 14h
Theory classes: 2h
Practical classes: 2h
Self study : 10h

TOPIC 9: AIR POLLUTION

Description:
9.1. Atmosphere.
9.2. Main air pollutants and emission sources.
9.3. The effects of pollution.
9.4. Air-quality indicators (ICQA).
9.5. Description of the main elimination-treatment technologies and gaseous pollutants.

Specific objectives:
For students to:
- Identify the main air pollutants and emission sources.
- Determine air-quality indices.
- Describe the main treatment technologies for eliminating particles and gaseous pollutants.

Related activities:
Practical activity: POLLUTANT SOURCES AND EMISSIONS
Practical activity: POLLUTANT DISPERSION MODEL

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 34h
Theory classes: 2h
Practical classes: 8h
Self study : 24h

TOPIC 10: WASTE MANAGEMENT

Description:
9.1. Generation of waste (municipal, industrial).
9.2. Management and technology for assessing/processing municipal waste.
9.3. Management and technology for assessing/processing industrial waste.

Specific objectives:
For students to:
Identify the main management models and technologies for assessing/treating municipal and industrial waste.

Related activities:
Practical activity: WASTE MANAGEMENT

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 15h
Theory classes: 2h
Practical classes: 2h
Self study : 11h

TOPIC 11: ENVIRONMENTAL MANAGEMENT TOOLS

Description:
11.1. Environmental impacts of technology, industry, services and infrastructure.
11.2. Environmental management:
11.2.1. Environmental audits.
11.2.2. Environmental impact assessments.
11.2.3. Environmental management systems.
11.2.4. Lifecycle analysis.
11.2.5. Eco-design.
11.2.6. Eco-labelling.
11.2.7. Industrial ecology, clean technologies and best available technologies.

Specific objectives:
For students to:
- Identify and understand the environmental impacts of any sort of activity.
- Determine and understand where the various environmental management tools should be applied in order to reduce the impacts of an activity. Understand the advantages of making environmental management an integral part of an activity.
- Understand, identify and assess the application of clean technologies and best available technologies in an activity.

Related activities:
Practical activity: ECODESIGN PROJECT

Related competencies :
CE16-INDUS. Basic knowledge and application of environmental technologies and sustainability. (Common module in the industrial branch)
CED65-DIDP. Basic knowledge and applications of environmental technologies and sustainability. (Common module in the industrial branch)
CT02 N2. Sustainability and social commitment - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
CT02 N1. Sustainability and social commitment - Level 1. Analysing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 23h
Theory classes: 2h
Practical classes: 3h
Self study : 18h

GRADING SYSTEM

Oral or written tests: 60%
- 1st bimester, weight: 30%
- 2nd bimester, weight: 30%
Practical work: 40%

In accordance with section 3.1.3 of the General Academic Regulations, in this subject it was established that it is a necessary condition to pass the subject to have completed the practices and presented the corresponding reports. This condition will apply to students who, without justification at the discretion of the teaching staff, have not completed at least 75% of the practices, including the delivery of reports. In this case, the final grade of the subject that will be applied will be "Not Presented".

Reconduction of unsatisfactory results:
- In application of the ESEIAAT regulations for unsatisfactory results, there will be a recovery of the 1st exam, consisting of an exam with the same format and content base as the 1st exam.
- This reconduction exam will be carried out in the space, day and hours assigned for the final exam.
- Students with a grade of less than 5 in the first exam will have the right to the re-conduction exam as long as they request it through the methods and time established by the teacher.
- The grade for the reconduction exam will have a maximum score of 5 and will replace the grade obtained in the first exam as long as the grade for the reconduction exam is higher than that the previous one.

BIBLIOGRAPHY

Basic:
- Aguado Alonso, J. Los residuos peligrosos: caracterización, tratamiento y gestión. Madrid: Síntesis, 1999. ISBN 8477387036.
- García Rodríguez, A. La contaminación acústica: fuentes, evaluación, efectos y control. Madrid: Sociedad Española de Acústica, 2006. ISBN 8487985106.
- Masters, Gilbert M. Introducción a la ingeniería medioambiental [on line]. 3ª ed. Madrid: Prentice-Hall, 2008 [Consultation: 09/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3884. ISBN 9788483224441.
- Wark, Kenneth. Contaminación del aire: origen y control. México: Limusa, 1990. ISBN 9681819543.
- Masoliver, Dolors. Guía práctica para la implantación de un sistema de gestión ambiental. Barcelona: Departament de Medi Ambient, 2000. ISBN 8439353057.
- Max-Neef, Manfred A. Desarrollo a escala humana: conceptos, aplicaciones y algunas reflexiones. Montevideo: Nordan Comunidad, 1993. ISBN 9974420059.
- Morin, Edgar. "Complejidad restringida, complejidad general". Sostenible? [on line]. Núm. 9 (2007), p. 23-49 [Consultation: 10/07/2017]. Available on: http://hdl.handle.net/2099/3883.- Novo, María. El desarrollo sostenible: su dimensión ambiental y educativa. Madrid: Pearson Educación, 2006. ISBN 9788483223550.
- Orozco, Carmen. Contaminación ambiental: una visión desde la química. Madrid: International Thomson, 2003. ISBN 8497321782.
- Sawyer, Clair N. Química para ingeniería ambiental. 4a ed. Bogotá: McGraw-Hill, 2001. ISBN 9584101641.
- Tchobanoglous, George. Gestión integral de residuos sólidos. Madrid: McGraw-Hill, 1994. ISBN 8448118308.
- Xercavins, J. [et al.]. Desarrollo sostenible [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 06/05/2020]. Available on: http://hdl.handle.net/2099.3/36752. ISBN 8483018055.

Complementary:
- Campos electromagnéticos, salud pública y laboral: ponencias y materiales de las Jornadas sobre Contaminación Electromagnética y Salud Pública celebradas los 10 y 11 de diciembre de 2002 en Madrid. Madrid: Unión Sindical de Madrid Región, 2003. ISBN 8497210786.
- Fullana i Palmer, P. Análisis del ciclo de vida. Barcelona: Rubes, 1997. ISBN 8449700701.
- Rieradevall, Joan. Ecodisseny i ecoproductes. Barcelona: Departament de Medi Ambient, 1999. ISBN 8439349920.
- Stahel, Andri. "Las necesidades humanas y la (re)producción de la pobreza por el desarrollo económico moderno". Ecología política: cuadernos de debate internacional. Núm. 23, p. 141-151.
- Stahel, A.; Cano, M.; Cendra, J. "Oikonomía vs. crematística: base de las contradicciones del desarrollo moderno". Sostenible? [on line]. Núm. 7 (2005), p. 47-71 [Consultation: 06/05/2020]. Available on: http://hdl.handle.net/2099/1805.- Stahel, A.; Cano, M.; Cendra, J. "Desarrollos sostenibles". Sostenible? [on line]. Núm. 7 (2005), p. 73-91 [Consultation: 06/05/2020]. Available on: http://hdl.handle.net/2099/1806.- Fullana i Palmer, P. Análisis del ciclo de vida. Barcelona: Rubes, 1997. ISBN 8449700701.
- Programa de las Naciones Unidas para el Desarrollo. Informe sobre desarrollo humano 2006: más allá de la escasez: poder, pobreza y la crisis mundial del agua [on line]. Madrid: CIDEAL, 2006 [Consultation: 23/07/2024]. Available on: https://www.undp.org/sites/g/files/zskgke326/files/migration/sv/Informe-Mundial-sobre-Desarrollo-Humano-2006.pdf.
- Water in a changing world. Paris: UNESCO, 2009. ISBN 9789231040955.

RESOURCES

Other resources:
Tecnologia i Sostenibilitat. http://tecnologiaisostenibilitat.cus.upc.edu