

RESOURCE EFFICIENCY AND CIRCULAR ECONOMY - 10 ECTS

The course in Resource Efficiency and Circular Economy is the result of the Crea-RE and Crea-RE-RU projects, a joint collaboration of Lahti University of Applied Sciences (FI), University of Gävle (SE), University of Latvia (LV) and Itmo University (RU). The projects were addressing the need to develop the current education in resource efficiency in Central Baltic (CB) countries by developing higher vocational education training (VET) together to better match the needs of companies.

The Crea-RE and Crea-RE-RU projects lead to the aligned “resource efficiency and circular economy” curricula content and learning package. The content is implemented in four higher VET institutions in CB region and includes an E-learning web portal to share the aligned curricula content and 16 practical case studies for companies developed by international student groups.

Course content

The course in resource efficiency and circular economy focuses on the understanding of the effects of social and economic behaviours on the environment while offering an overview on the currently available technical solutions, obstacles and possibilities to develop into a more circular economy and resource efficient society.

Applying multiple disciplines, including engineering, management and sustainability sciences, this course is illustrating in theoretical and practical ways how processes are being implemented to switch from linear approaches to closed loop and ‘beyond the zero waste’ solutions with residual wastes from a process are further transformed into new useful end products.

The course will help the students gain knowledge of notions and theories as well as of real-world ideas and tools to support the development and assessment of resource-efficient and circular measures.

The course provides examples of both theoretical and applied circular methods and tools from product design to waste management, water treatment, energy production, raw material, textiles, electronics and industrial manufacture production engineering, industrial symbiosis, business models, service suppliers, system analysis, supply chain, management and policy solutions.

In doing so, the course also offers real examples of how the need for circularity is tackled in the three Central Baltic countries and also gives and insight on how geopolitics can influence the development of circular economy in different industrial sectors.

Course structure

The course is organized in

Theoretical lectures, both physical and on line	Presentations of 16 practical case studies
Individual assignments	Group projects

The course is structured in about 7 weeks (280 working hours):

40 hours lectures	80 hours individual study
10 hours exercises	16 hours of field experience (visits to businesses)
80 hours of group assignment	24 hours individual assignments
30 hours report revision / final presentation / exam	

Thematic plan of the study course

Section 1. [Introduction](#) (1 ECTS)

In this section concepts like demographic issues and environmental issues related to production and consumption will be illustrated and discussed together with possible solutions and examples of sustainable industrial models and consumer behavior improvement via digitalization.

Topics: Demographic issues / Environmental issues / Megatrends / Industry 4.0 / Digitalization

Outcomes

1. describe basic concepts in demographic and environmental issues
2. describe the advantages of different industrial models and digitalization
3. logically use basic terms and concepts related to the circular economy
4. explain how models for circular economics can be adapted to prevailing conditions

Section 2. [Technological Circles](#) (2 ECTS)

This section discusses the obtaining, use and dispose of natural resources in production of goods and energy. Theoretical and technical approaches to circularity in several fields will be described and discussed.

Topics: Materials: textiles, plastics, metals / Energy, renewable / Industrial processes, side- and waste streams, industrial symbiosis / Waste management / Hazardous waste / Water: tap, waste

Outcomes

1. describe basic terms and concepts of the technological circles
2. logically use basic terms and concepts related to technological circles
3. illustrate and analyze circular economy and resource efficiency solutions adopted for materials, energy, industrial processes, waste and water management
4. critically discuss the implications of increased resource-efficiency and circularity in technological areas

Section 3. [Biological Circles](#) (2 ECTS)

This section focuses on the obstacles and possible solutions to meet the needs for the increasing demand in natural resources, such as mineral fertilizers.

Topics: Forest industry / Agricultural industry / Food industry

Outcomes

1. describe basic terms and concepts of the biological circles
2. logically use basic terms and concepts related to biological circles
3. illustrate and analyze circular economy and resource efficiency solutions adopted in forest, agricultural and food industries
4. critically discuss the implications of increased resource-efficiency and circularity in biological areas

Section 4. [Circular Economy Businesses](#) (2 ECTS)

This section will allow an insightful understanding of circular economy priorities and opportunities in the innovation activity of the enterprises, the necessity of radical improvements in resource efficiency and highlight the main types of business models that facilitate the transition towards a circular economy.

Particular attention will be given to sharing and sharing economy, possible benefits and drawbacks of its development and realize various forms of sharing economy.

Topics: Business models / Ecolabels, eco standards / Eco design

Outcomes

1. describe basic terms and concepts in circular economy businesses
2. logically use basic terms and concepts related to circular economy businesses
3. illustrate and analyze circular solutions adopted to improve businesses and service businesses
4. critically discuss the implications of increased resource-efficiency and circularity for economy businesses
5. use different tools to work with circular design and circular business models

Section 5. Effectiveness and Evaluation (1 ECTS)

In this section concepts as resilience and participatory design are described and examples of sustainable cities are illustrated. Also, the advantages to evaluate the impact of a particular plan by performing environmental assessment will be discussed. Similarly, focusing on products or product systems, it will be addressed the topic of calculating the environmental impact of various parts of a product/service life cycle, comparing and choosing between different product/service, material and process alternatives via Life-Cycle Assessment (LCA)

Topics: Sustainable society / Social innovations / System analysis: LCA

Outcomes

1. describe basic terms and concepts in effectiveness and evaluation
2. logically use basic terms and concepts related to effectiveness and evaluation
3. illustrate and analyze circular economy and resource efficiency solutions adopted in planning and development of urban and industrial areas
4. critically discuss the advantages of increased resource-efficiency and circularity in planning
5. explain how the effectiveness of circular economy and resource efficiency can be evaluated
6. highlight, map and analyze by-product exchanges and infrastructure collaborations between different companies in an industrial area.
7. apply learned techniques and skills individually and as part of a group

Case Studies (2 ECTS)

1. Latvia , Riga	2. Sweden , Gävle
1.1. Plastic management - Eco Baltia	2.1. Tap water - Uppsala vatten
1.2. Energy sector - Fortum	2.2. Wastewater - Uppsala vatten
1.3. Waste management - Zaa0	2.3. Waste incineration - Vattenfall
1.4. Food waste - Brewery Valmiermuiža	2.4. Biogas production - Ekogas
3. Finland , Lahti	4. Russia , St. Petersburg
3.1. Construction waste - Purkupiha	4.1. Electronics manufacture - TPV
3.2. Consumer textiles - LSJH Oy	4.2. Coffee waste - Bushe
3.3. Environmental observation - EnvirateApp	4.3. Energy saving - Brewery Baltika
3.4. Industrial symbiosis - Päijät-Hämeen Oy	4.4. Wastewater treatment - Unilever

Outcomes

1. describe the bottlenecks to circularity identified in the different case studies
2. describe the consequences of such bottlenecks
3. illustrate and analyze circular economy and resource efficiency solutions adopted
4. Identify and illustrate new possible circular economy and resource efficiency solutions
5. explain how the solutions can be adapted to existing conditions
6. critically discuss the implications of increased resource-efficiency and circularity for sustainable development of the companies analyzed
7. apply learned techniques and skills individually and as part of a group

Examination

The final course examination will consist in one or more of the following activities:

- individual written exam
- group project with report and interview
- fulfilment of individual tasks

General course outcomes

After completing the course, the student should be able to:

1. describe basic terms and concepts in resource efficiency and circular economy
2. describe the consequences of linear economics
3. logically use basic terms and concepts related to the circular economy
4. illustrate and analyze circular economy and resource efficiency solutions adopted in different economic areas
5. critically discuss the implications of increased resource-efficiency and circularity for sustainable development
6. explain how models for circular economics can be adapted to prevailing conditions
7. highlight, map and analyze by-product exchanges and infrastructure collaborations between different companies in an industrial area
8. apply learned techniques and skills individually and as part of a group
9. use different tools to work with circular design and circular business models

Literature

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