

Master's degree programme

Sustainable Chemistry and Technologies for Circular Economy

***Presentation of the Master's degree programme:
motivation, the international context, main characteristics and
enrollment procedures***

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Padova, 31 May 2021

- Motivation for the introduction of a new Master's degree programme
- Structure and main characteristics
- Admission requirements
- Employment opportunities
- Enrollment procedures and deadlines
- Website and contacts

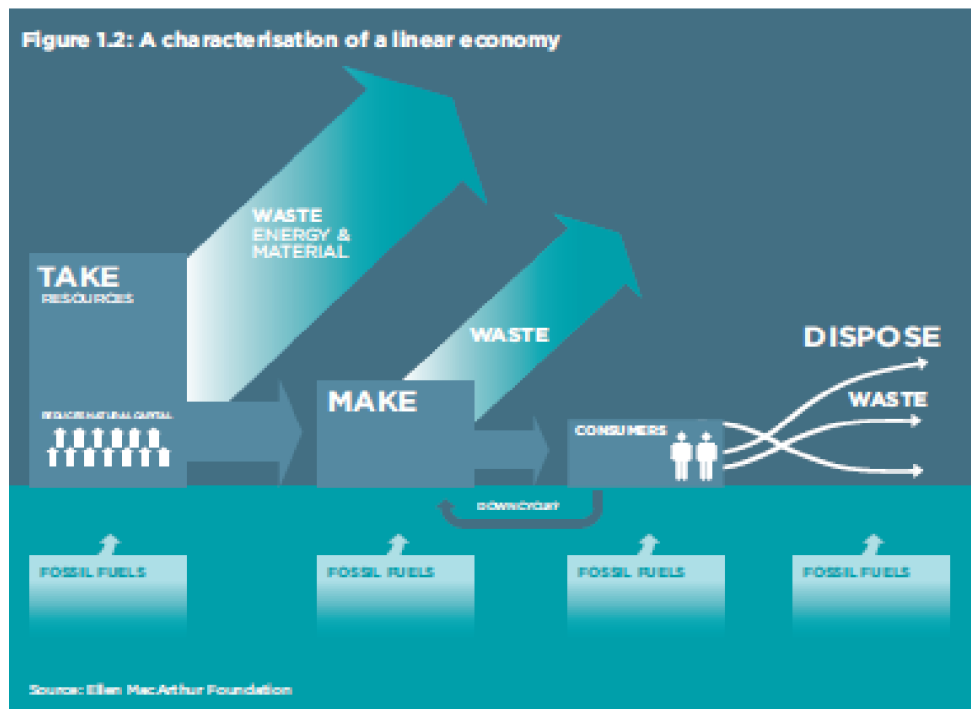
The linear economy model (Take-Make-Dispose)

- Extraction of raw materials
- Production of goods and services for consumption
- Disposal of waste and products



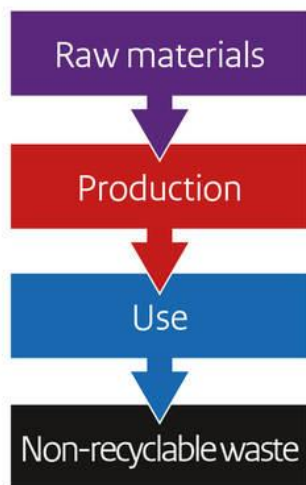
- Environmental issues (deforestation, desertification, pollution, greenhouse effect, waste accumulation)
- Non-rational and unplanned exploitation of resources
- Critical issues in the supply of energy and raw materials

→ **the linear economy is not sustainable**

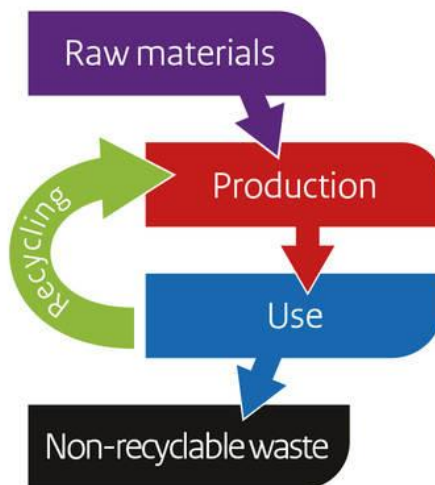


From a linear to a circular economy

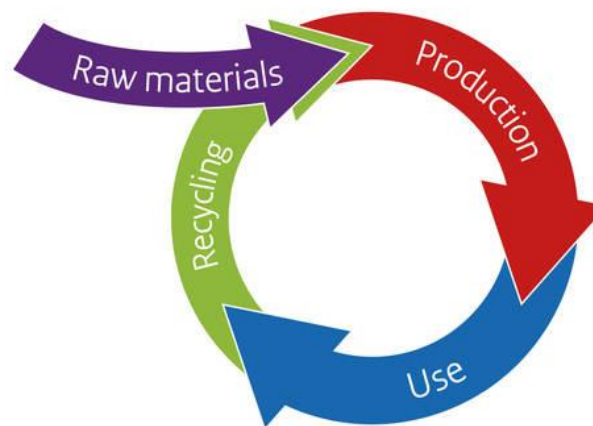
Linear economy



Reuse economy



Circular economy



Source: <https://www.government.nl/topics/circular-economy/from-a-linear-to-a-circular-economy>

Circular economy: what is it?



The circular economy model

«an industrial economy that is restorative or regenerative by intention and design.

In the circular economy there are two types of material flows: **biological**, designed to re-enter the biosphere; and **technical**, which are designed to circulate at high quality without entering the biosphere»

REQUIRED TECHNICAL SKILLS

Ellen MacArthur Foundation, 2007

- **Regenerative industrial economy** (conceptual view)
- **Efficient flows of materials, energy, work and information**



The Circular Economy Package – European Commission 4 March 2019
Circular Economy Action Plan – European Commission 20 March 2020

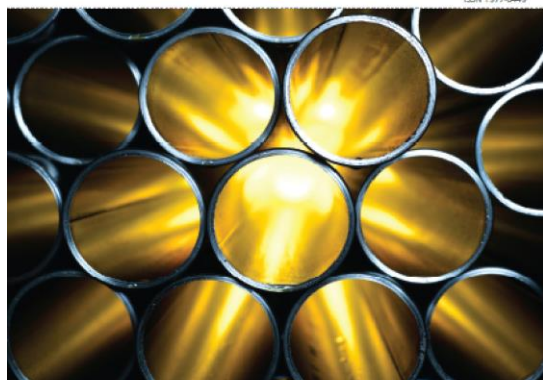
<https://ec.europa.eu/environment/circular-economy/>

EEA Report | No 2/2016

Circular economy in Europe

Developing the knowledge base

ISSN 1977-8449



European Environment Agency 



Impacts of circular economy policies on the labour market

Final report and Annexes

Between now and 2030, circular economy policies will help **increase EU GDP by 0.3-0.5% and the number of jobs by 700 thousand (before the pandemic from COVID-19)**

→ the circular economy model not only determines **positive effects** for the **environment**, but also constitutes an added value in **economic** and **employment** terms

«there are no real-skills related policies specifically designed to foster the transition to a more circular economy»

[Impacts of circular economy policies on the labour market, European Commission, 2018]



Need to develop new skills and abilities to support the transition from a linear to a circular economic model



Need for dedicated training and educational initiatives, intersectoral and interdisciplinary training

DG Environment, European Commission (2018)
Impacts of circular economy policies on the labour market

Four categories of circular skills can be identified:

- **Engineering and technical skills:** used in design, construction and assessment of technology. This type of knowledge is important for **ecobuilding, renewable energy design and energy-saving R&D projects**.
- **Science skills:** stemming from bodies of knowledge such as physics and biology. A study by Cedefop (2009) shows that there is a high demand for this type of skills at **early stages of the value chains** and in the utility sector.
- **Operation management skills:** related to change in organizational structure required to support **green activities through life-cycle management, lean production** and cooperation with external actors, including regulators and customers (UNEP 2012).
- **Monitoring skills:** concerning the compliance with technical criteria and legal regulatory requirements. **Compliance with environmental laws and standards** is especially important for firms operating in polluting sectors.

DG Environment, European Commission (2018)

Impacts of circular economy policies on the labour market

Circular economy: the new Master degree programme

Aim: the introduction of a new Master degree programme about circular economy starting in the Academic Year 2021-2022

➤ *Sustainable Chemistry and Technologies for Circular Economy (120 ECTS)*

Main characteristics:

- **International:** in English, with international students and lecturers
- **Interdepartmental:** teaching and expertise from **12** departments
- **Interdisciplinary:** chemistry, engineering, biotechnology, agricultural and forestry sciences, geology, economics, industrial logistics, environmental and community law
- **Intersectoral: important involvement of national and international companies and EU institutions (for teaching purposes, consultation, internships)**
- **Strong professional character: internship / thesis in / with companies or research thesis in department (15 ECTS): intended to train an expert, not an academic**
- Dominant **technical** and **scientific** connotation
- With basic knowledge of economics, EU law, industrial logistics, corporate responsibility
- **First initiative of this kind at national level, one of the few at EU level**

12 Departments involved in the new Master degree

More than 4 courses

Department of Chemical Sciences – **DiSC** (reference department)

Department of Industrial Engineering – **DII**

2-3 courses

Department of Management and Engineering – **DTG**

Department of Biology – **DiBio**

Department of Land, Environment, Agriculture and Forestry – **TESAF**

Department of Economics and Management – **DSEA**

Department of Civil, Environmental and Architectural Engineering – **ICEA**

Department of Geosciences

1 course

Department of Agronomy, Food, Natural Resources, Animals and Environment – **DAFNAE**

Department of Developmental Psychology and Socialisation - **DPSS**

Department of Statistical Sciences – **DSS**

Department of Public, International and European Union Law - **DiPIC**

Italian title of the Master's degree programme	Chimica e tecnologie sostenibili per l'economia circolare			
Title of the Master's degree programme	Sustainable Chemistry and Technologies for Circular Economy			
Class (Ministerial field of study code)	LM-71 Industrial Chemistry (Classe delle lauree magistrali in SCIENZE E TECNOLOGIE DELLA CHIMICA INDUSTRIALE)			
Experimental course with professional orientation	no	<input type="checkbox"/>	yes	<input type="checkbox"/>
Reference department	Department of Chemical Sciences			
Language	English			
Location and offices	Department of Chemical Sciences			
Admission type	Open access with admission requirements			

Structure of the new Master degree

- Common 1st year (60 ECTS, 1 ECTS = 1 European credit)
- 2nd year: two curricula (45 + 15 ECTS):
 - ✓ **Resources and product design and recycling**
 - ✓ **Energy conversion and storage**
- 8 optional courses (6 ECTS per course) common to the two curricula
- 3 ECTS for experimental, practical and computational activities
- Internship in companies, research bodies, agencies (15 CFU)
- Tutoring activities (1st year, 50 hr) in *i*) chemistry, *ii*) engineering, *iii*) biology
- Optional activities: 2 summer schools (36 hr) with 4 courses on soft skills (9 hr, funded by companies)
- Optional activities : interactive seminars with industrial experts

1st year (60 ECTS): common to the two curricula

Course title	ECTS	Semester
Green Chemistry and innovative chemical process	9	1
Thermodynamics and catalysis for circular economy (C.I.)	12	1 & 2
Mod. A - Thermodynamics of processes and materials	6	
Mod. B - Catalysis for circular economy	6	
Operations & Supply Chain Management	6	2
Renewable energy technologies	6	1
European Union Environmental and Energy Law	6	2
Water resources management in the circular economy	6	1
Economics for the Circular Economy	6	2
Circular and sustainable waste management	9	1

1° Curriculum “Resources and product design and recycling”

Course title	ECTS	Semester
Materials design & selection for circular economy	9	1
Sustainable materials and recycling for circular economy (C.I.)	18	1 & 2
Mod. A - Sustainable mineral (geo)-resources and critical raw materials (CRM)	6	
Mod. B - Recycling and transformation of inorganic materials	6	
Mod. C - New plastics economy: polymers, biopolymers and their recycling	6	
Circularity in biomass productions	6	2
Optional course 1: Advanced methods for sustainable processes and products	6	1
Optional course 2: Synthetic biotechnology	6	2
Optional course 3: Environment and Health in Circular Economy	6	2
Optional course 4: Innovative hybrid energy and energy storage solutions for the sustainable development	6	2
Optional course 5: Life Cycle Assessment	6	1
Optional course 6: Psychology, policy making, and education to a circular economy	6	2
Optional course 7: Understanding statistics of circular economy	6	1
Optional course 8: Crystal chemistry of materials for the sustainable built environment	6	2
Internship within a company or, alternatively, experimental thesis at a Department with a project in cooperation with a company	15	2

2° Curriculum “Energy conversion and storage”

Course title	ECTS	Semester
Biorefineries and sustainable energy production and storage	15	1
Sustainability strategies and energy economics (C.I.)	12	1
Mod. A - Sustainability strategies and Innovation management for Circular economy	6	
Mod. B - Energy Economics	6	
Life Cycle Assessment	6	1
Optional course 1: Advanced methods for sustainable processes and products	6	1
Optional course 2: Synthetic biotechnology	6	2
Optional course 3: Environment and Health in Circular Economy	6	2
Optional course 4: Innovative hybrid energy and energy storage solutions for the sustainable development	6	2
Optional course 5: Circularity in biomass productions	6	2
Optional course 6: Psychology, policy making, and education to a circular economy	6	2
Optional course 7: Understanding statistics of circular economy	6	1
Optional course 8: Crystal chemistry of materials for the sustainable built environment	6	2
Internship within a company or, alternatively, experimental thesis at a Department with a project in cooperation with a company	15	2

Students who wish to enroll in the Master's degree programme in *Sustainable Chemistry and Technologies for Circular Economy* must hold a degree or university diploma of three years' duration or foreign equivalent deemed suitable for admission purposes as per existing regulation.

1. Curricular requirements:

Students who wish to enroll must possess specific curricular requirements and the following knowledge, competencies and skills: basic knowledge of organic and inorganic chemistry; knowledge of synthetic processes and chemical and physical analytical techniques of the components of the different states of matter; competencies in mathematics, and in particular algebra and geometry; competencies in classical physics and physics of electromagnetic fields; basic knowledge of thermodynamics of fluids and transport phenomena; basic knowledge of morphological, chemical and structural properties of minerals; basic knowledge of chemistry of biological processes.

2. Minimum graduation grade:

Bachelor degree ex DM 270/2004 or DM 509/1999

Final mark: $\geq 85/110$ (or equivalent)

3. Language skills:

have a B2 (or higher) English level (reading and comprehension and listening)

4. Previous training programme (students holding an Italian degree):

a) hold a degree in one of the following degree classes: **L-27 Chemical Sciences and Technologies** ex DM 270/04 or **L-21 Chemical Sciences and Technologies** ex DM 509/99

OR

b) hold an Italian degree and have acquired at least 40 ECTS in the following Scientific Disciplinary Sector (SDS):

- 12 ECTS in: CHIM/01, CHIM/02, CHIM/03, CHIM/04, CHIM/05, CHIM/06, CHIM/07, GEO/06

- 28 ECTS in: MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09 FIS/01, FIS/02, 03; BIO/01, BIO/10, GEO/04, GEO/07, GEO/09, CHIM/11, CHIM/12 ING-IND/35

4. Previous training programme:

For all the candidates the assessment of curricular requirements and of the knowledge, competencies and skills listed above will be performed by the Admission Committee, according to criteria and procedures that are detailed in the Didactic Regulations of the Master's Degree Programme.

For highly-qualified graduates with proven knowledge and competencies (as per curriculum) resulting from previous training programmes that are not completely coherent with admission requirements, a different entry route and/or specific admission tests could apply.

For non-EU candidates who reside abroad and hold a foreign qualification, a ranking in the so-called merit order will be established based on the candidate's assessment of knowledge. This does not apply within the framework of international agreements that establish different entry routes.

The first cycle degree courses, at the University of Padua, that satisfy the achievement of 40 ECTS in the SDSs listed above are:

- ✓ **Chemistry**
- ✓ **Industrial Chemistry**
- ✓ **Materials Science**
- ✓ **Biotechnology**
- ✓ **Environmental Sciences and Technology**
- ✓ **Natural Science**
- ✓ **Geological Science**
- ✓ **Biology**
- ✓ **Molecular Biology**
- ✓ **Chemical and Materials Engineering**
- ✓ **Environmental and Land Planning Engineering**
- ✓ **Forestry and Environmental Technology**
- ✓ **Agricultural Science and Technology**
- ✓ **Food Science and Technology**

Private companies / private sector

- Research and Development (R&D) manager, responsible for the research, design and development of products
- Responsible for raw materials supply and logistics
- Managers for sustainability and corporate social responsibility (CSR)
- Manager in companies that have implemented/intend to implement a circular production model
- Circular Economy manager: responsible for communication between all business divisions and the integrated management of the different components of the value chain (e.g., design, production, logistics and recycle)
- Environmental corporate communication manager
- EU project manager (including conceiving, writing, and leading European or scientific projects on circular economy)
- Consultant for the implementation of circular models in small- and medium-sized companies

Public administration / public organization

- Expert in drafting circular economy policies and the Green Public Procurement (GPP) within the public administration
- Direction of the division/office «Environment», «Industry», «Research» at public institutions (UE, Regions, Government etc.)
- Planning of sustainability policies and programs
- EU project manager (including conceiving, writing, and leading European or scientific projects on circular economy)
- Training, educational and outreach activities related to circular economy

PRE-ENROLLMENT AND ENROLLMENT PROCEDURES

International and EU candidates - <https://apply.unipd.it/>



Discover the University of Padua

DEADLINE DATES
Deadline for applications are:
- **2nd June** for non-European candidates residing outside Italy
- **2nd September** for European candidates or non-European candidates residing in Italy.

Sustainable Chemistry and Technologies for Circular Economy

University of Padua
Italy, Padua
Department of Chemical Sciences Italy, Via Marzolo, 1 - 35131 Padua

Italy, Padua

Master's degree, full-time

2 years (120 ECTS)

English

(Master's degree in Sustainable Science and Technology for Circular Economy)

Apply now!
Academic year 2021/22

Application deadline
2 Sep 2021 23:59:59
Europe/Rome time
ONLY for EU applicants or EU-equated, i.e. applicants from Iceland, Liechtenstein, Norway, Switzerland or non-EU applicants residing in Italy

Studies commence
Oct 1, 2021

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PRE-ENROLLMENT AND ENROLLMENT PROCEDURES

Italian students -

https://www.scienze.unipd.it/index.php?id=lauree_magistrali_2021-2022

1. PRE-IMMATRICOLAZIONE ONLINE

(una sola domanda di preimmatricolazione per ogni Corso di studio prescelto), comprensiva della richiesta di valutazione preventiva del curriculum, **dal 19 luglio al 30 settembre**, ore 12.00, 2021 su www.uniweb.unipd.it.

2. VALUTAZIONE DEI REQUISITI CURRICULARI MINIMI

La procedura è disponibile online (solo dopo aver completato la preimmatricolazione) **dal 19 luglio al 18 ottobre**, ore 12:00, 2021.

La richiesta va presentata alla pagina www.uniweb.unipd.it/valutazionetitoli, accedendo con le credenziali Uniweb; le istruzioni dettagliate per presentare la domanda sono disponibili all'interno della procedura.

3. IMMATRICOLAZIONE

I laureati in possesso dei requisiti curriculari richiesti, una volta ottenuto il **titolo accademico e risultati idonei** nella loro area riservata in www.uniweb.unipd.it, potranno perfezionare la domanda di immatricolazione **dal 19 luglio 2021 al 25 ottobre**, ore 12:00, 2021.

Thank you for the attention

Websites:

<https://www.chimica.unipd.it/en/circulareconomy>

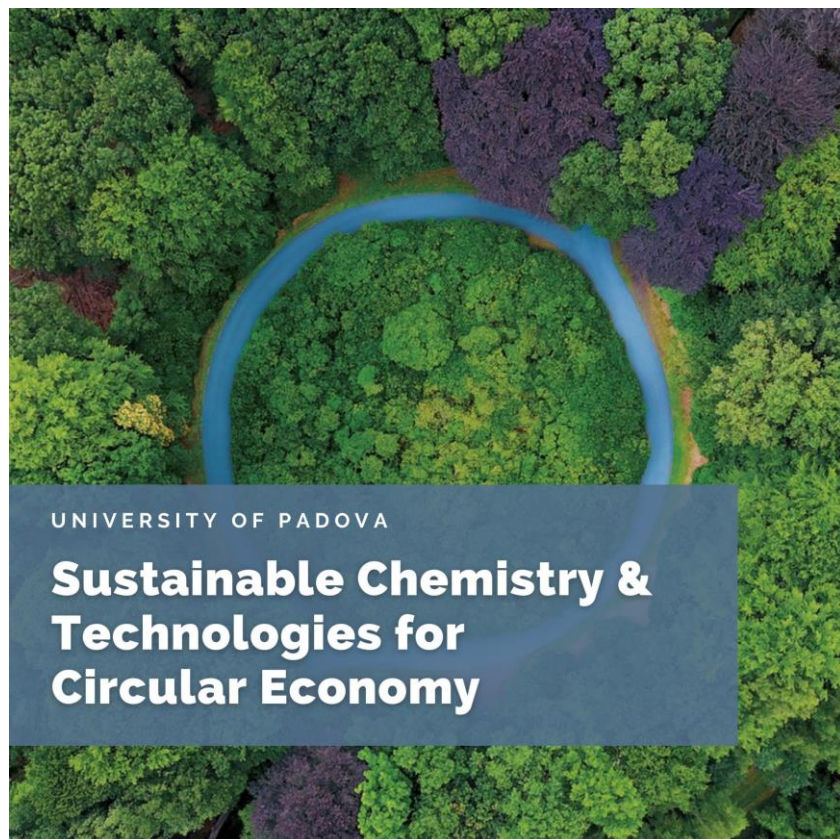
<https://www.chimica.unipd.it/circulareconomy>

Twitter: @CircularUnipd

Instagram: circular_unipd

Promotional video:

<https://youtu.be/nkj1pBvKesI>



E-mail contact: circular.economy@unipd.it