



Desk Research Collection of Innovative Learning Offers on ESD/CCE & Biochar



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Table of Contents

1.	INTRODUCTION: FROM ESD TO BIOCHAR IN VOCATIONAL EDUCATION	3
1.1.	BACKGROUND AND INTENTION OF THE B4C DESK RESEARCH	3
1.2.	ESD IN THE EUROPEAN VET SECTOR	3
1.3.	CIRCULAR CARBON ECONOMY IN THE VET SECTOR	4
1.4.	BIOCHAR IN THE VET SECTOR	5
2.	COLLECTION OF RELEVANT ESD, CCE & BIOCHAR REFERENCES AND MATERIALS FOR VET	6
2.1.	PROJECTS	6
2.1.1.	ESD IN VET	6
2.1.2.	CCE IN VET	9
2.1.3.	BIOCHAR IN VET	11
2.2.	LEARNING FORMATS	12
2.2.1.	ESD	12
2.2.2.	CCE	14
2.2.3.	BIOCHAR	15
2.3.	MATERIALS (OERS) & TOOLS	16
2.3.1.	ESD	16
2.3.2.	CCE	18
2.3.3.	BIOCHAR	19

1. Introduction: From ESD to Biochar in Vocational Education

1.1. Background and intention of the B4C Desk Research

The B4C project aims to introduce biochar in European Vocational Education and Training as a part of Education for Sustainable Development and the Introduction of Circular (Carbon) Economy in VET programmes.

The project has started with an extensive research phase based on a mixed method approach consisting of quantitative and qualitative analyses based on a through desk research.

The desk research on hand relates to the collection of innovative learning offers and formats related to the Circular Carbon Economy and connected sustainable development projects which may include biomass to biochar chains, researching existing:

- Approaches,
- Instruments (platforms, apps),
- Materials and
- Pilot projects

It hence aims at collecting available approaches related to VET in which Circular Carbon Economy and Biomass to Biochar (BC) value chains could be implemented, e.g. to substantiate Sustainability education, following a holistic, competence-oriented approach.

The desk research starts with an introduction on ESD in VET on the example of Germany and Sweden, describes the state of involving circular carbon economy aspects before moving to the state of biochar implementation in VET offers. This introduction is backed up by example projects that deal with the respective thematical areas (ESD – CCE – BC) and identifies available VET learning offers along the same clustering (ESD – CCE – BC).

1.2. ESD in the European VET sector

The integration of Education for Sustainable Development (ESD) in Europe's Vocational Education and Training (VET) sector plays an important role in preparing a skilled workforce equipped to meet modern environmental, economic, and social sustainability challenges. By embedding ESD principles, Europe aims to create a foundation for lifelong learning, fostering competencies that enable individuals to make informed decisions and contribute to sustainable work environments. This approach aligns with Germany's commitment to the UN's 2030 Agenda for Sustainable Development, which emphasizes the importance of inclusive and quality education (UNESCO, 2019).

One significant German initiative is the "National Action Plan on ESD," which promotes ESD as a core component in VET programs to ensure that graduates are prepared for sustainable practices across diverse sectors (German Federal Ministry of Education and Research, 2017). In addition, the German Sustainability Strategy has influenced VET curricula by embedding green skills and circular economy principles, which are vital for sectors such as agriculture, manufacturing, and construction (BMZ, 2021).

A further example is the GOVET (German Office for International Cooperation in Vocational Education and Training) project, which advocates ESD in international partnerships, sharing Germany's dual VET model as a framework for sustainable skills development (GOVET, 2022). Furthermore, resources from the BIBB (Federal Institute for Vocational Education and Training) highlight the integration of ESD competencies, such as resource management and ethical decision-making, into industry-specific VET modules (BIBB, 2021).

This strong focus on ESD within VET fosters sustainable decision-making, resource efficiency, and ethical responsibility, positioning Germany's workforce to address global and local sustainability challenges effectively.

In Sweden the Circular Economy is a central element of Sweden's environmental and educational policy frameworks, and vocational education and training institutions play a critical role in advancing this agenda. Sweden's vocational schools have been proactive in incorporating CE projects that emphasize sustainability, waste reduction, and resource efficiency, thus preparing students for a greener labor market. [Sweden's National Circular Economy Strategy](#), launched in 2020, aims to accelerate the transition to a resource-efficient and sustainable economy. This strategy focuses on promoting circular business models, sustainable production, and fostering innovation in waste management and resource use. Education and skills development are essential components, with a clear mandate to integrate CE principles into the VET system to meet future labor market needs. The strategy encourages training programs in VET that focus on minimizing waste and promoting recycling in industries such as construction, agriculture, and manufacturing and recognizes the need for a workforce equipped with skills in sustainability and circular practices, thus placing a strong emphasis on VET to foster CE-aligned professions.

A hallmark of CE projects in Swedish VET schools is the strong collaboration with local industries and municipalities. These partnerships ensure that CE projects are grounded in real-world applications. For instance, companies provide waste materials for student projects, offer internships, and guide project-based learning to align with industry needs. This symbiotic relationship benefits both students and industries, as vocational students are introduced to the sustainability challenges faced by businesses, while industries gain fresh perspectives on solving those challenges through circular strategies. For example, The Swedish School of Textiles, part of the University of Borås, has joined the [Nordic Circular Hotspot Partnership](#). This initiative focuses on sustainability and circularity within the textile industry, emphasizing research in fibers, recycling, and textile management. The school aims to foster partnerships with businesses and academia to enhance students' practical experience before graduation. The "Circular Economy in Practice" initiative at VET schools in Malmö involves students working on projects that address sustainability challenges faced by local industries, such as reducing resource consumption and enhancing recycling processes.

1.3. Circular Carbon Economy in the VET sector

The Circular Carbon Economy (CCE) is increasingly relevant in Germany's Vocational Education and Training (VET) sector, aiming to equip future professionals with the skills to manage carbon resources sustainably and mitigate climate impacts. Integrating CCE into VET aligns with Germany's climate goals, emphasizing carbon reduction, recycling, reuse, and removal within industries like agriculture, manufacturing, and energy (BMU, 2021).

VET programs are incorporating CCE principles to foster resource efficiency and carbon management. Initiatives by the German Federal Institute for Vocational Education and Training (BIBB) aim to equip trainees with essential "green skills," such as waste reduction and sustainable production, which are integral to CCE (BIBB, 2020). Similarly, the German Sustainability Strategy advocates for the circular economy by promoting sustainable resource cycles, a core aspect of CCE (BMZ, 2021). The role of CCE in VET is also underscored by the interviews and discussions led during the Bio360 international fair, bringing together the leading CO₂ removal and CO₂ certification agencies, through which collaboration with educational institutions to develop industry-specific skills in circular carbon management (CCN, 2022) is still mainly related to Higher Education Institutions.

Furthermore, projects like Carbon2Chem, which explores converting carbon emissions from steel production into usable materials, are used as case studies within VET curricula to demonstrate practical CCE applications in real-world scenarios (Fraunhofer Society, 2022).

[The Swedish government's Circular Economy Action Plan](#) outlines the integration of circular economy concepts into vocational training, aiming to ensure that future professionals are equipped with the knowledge to support sustainability in their industries. Vocational schools are encouraged to incorporate sustainability and circularity in their curricula, focusing on practical applications of CE principles across various sectors. Swedish vocational schools have increasingly recognized the importance of embedding CE into the curriculum as a cross-sectional topic that cuts across various disciplines and trades. Rather than treating sustainability as a standalone subject, CE principles are integrated into traditional VET courses such as construction, agriculture, manufacturing, and waste management. This thematic approach ensures that students across different sectors are exposed to sustainability practices that are both relevant to their chosen fields and contribute to Sweden's national and global environmental goals. [The Swedish National Agency for Education has updated curriculum frameworks to include CE-related competencies, ensuring that vocational students are equipped with the knowledge and skills to engage in sustainable practices.](#) For instance, in construction programs, students learn about eco-friendly building materials, energy efficiency, and waste reduction in construction projects. In agriculture, students are introduced to regenerative farming techniques, composting, and biochar production, linking directly to the carbon sequestration and resource management efforts prominent in CE.

1.4. Biochar in the VET sector

When it comes to the application of biochar in education, there is hardly any course, module or material available, and if there is any, it relates to HE (BSc) programs.

Biochar in Agriculture: Institutions like the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) conduct extensive research on biochar's agricultural applications. This includes exploring its benefits for soil health, carbon sequestration, and sustainable crop production, which may provide a foundation for VET modules or supplementary courses on biochar within sustainable agriculture programs.

Sustainable Agriculture Programs with Biochar Components: Universities of applied sciences, such as Hochschule Rhein-Waal, integrate sustainable agricultural practices, including biochar applications, in their Bachelor's programs. These programs focus on eco-friendly production methods and are designed to support professionals entering fields related to soil science and agroecology. Although these are higher education programs, they complement VET curricula by offering advanced insights into biochar's role in sustainable agriculture.

In Sweden's climate policies Biochar has gained importance due to its potential for carbon sequestration and agricultural enhancement. The Swedish government has supported biochar research and development through various initiatives, and this focus is being integrated into vocational education, particularly in sectors like agriculture and forestry. According to [Swedish Climate Policy Framework](#), Sweden's goal to become carbon neutral by 2045 includes the use of biochar as a climate solution. This involves educating future professionals through VET on biochar's applications in soil restoration, carbon capture, and renewable energy production.

Hence, if we consider biochar having a pivotal role for carbon sequestration, we need to introduce it into the Vocational Education in Europe, be it in iVET or cVET offers.

2. Collection of relevant ESD, CCE & Biochar references and materials for VET

2.1. Projects

2.1.1. ESD in VET

UNESCO-UNEVOC

<https://unevoc.unesco.org/home/>

UNESCO-UNEVOC International Center in Bonn, which opened in 2002, supports the development of vocational education and training systems worldwide and promotes regional and international cooperation in this field. One focus of its work is the coordination and strengthening of the global UNEVOC network, which consists of more than 280 UNEVOC centers in over 160 industrialized and developing countries. Members of the network include national ministries, research and training institutions.

CATALYST (EU)

<https://projectcatalyst.eu/>

The CATALYST (European VET Excellence Centre for Leading Sustainable Systems and Business Transformation) project will strengthen the sustainable competitiveness of skilled workers, students and small and medium-sized enterprises (SMEs). Upskilling and reskilling are crucial for long-term and sustainable growth, productivity and innovation and therefore a key factor for the competitiveness of companies of all sizes, especially SMEs. The aim of the project is to provide citizens participating in various vocational training programs with the right skills to work more effectively and use new technologies. By activating and inspiring, the project aims to have a positive impact and break down identified barriers.

Sustainable at work - future-oriented training (DE)

<https://www.bibb.de/de/161509.php>

The program "Sustainable at work" promotes the implementation, dissemination and anchoring of vocational training for sustainable development. It supports the application of the standard vocational training position "environmental protection and sustainability" in company, inter-company and external training practice, so that the skilled workers of tomorrow learn to act in an ecologically, socially and economically responsible manner today. Skilled workers become pioneers, trainers become multipliers and companies become places of sustainable change.

Handwerk^N (DE)

<https://zwh.de/projekt/nachhaltigkeit-in-handwerksbetrieben-staerken/>

The "HANDWERK^N" project was launched to establish the many facets and possibilities of sustainability in social, ecological and economic terms in the skilled trades sector. From 2018 to 2022, various sustainability offerings were created for the skilled trades sector. At the heart of the project is a free digital management tool, the Sustainability Navigator for the Craft Sector.

Sustainability Navigator

<https://navigator.nachhaltiges-handwerk.de/>

The "Sustainability Navigator for the Craft Sector" from the project "HANDWERK^N - Strengthening Sustainability in Companies!" offers a free desktop and browser application for managing directors and managers from the craft sector, providing a simple and well-founded introduction to sustainable management and sustainability reporting. With information, practical tips and examples, the navigator

makes it possible to highlight and utilize the strengths and development potential of sustainable business management.

Excellence Network Vocational Education for Sustainable Development (DE)

<https://ex-n-bbne.com/>

In the BBNE Network of Excellence, teachers from universities, colleges, vocational schools, general education schools, district adult education centers, vocational training centers, continuing education centers and other relevant education and vocational training partners, including from the areas of non-formal and informal education, share and pool their knowledge in order to enable high-quality (excellent) education and vocational training globally in line with SDG 4.

KORN-SCOUT (DE)

<https://elearning.izt.de/course/view.php?id=120>

The Technical University of Berlin, the Wuppertal Institute, the Institute for Futures Studies and Technology Assessment and the Education and Information Center Berlin (EPIZ) e.V. have developed teaching/learning formats to promote skills for sustainable action in the context of grain processing. The focus was on the "grain-handling" professions of miller, baker, confectioner, brewer, maltster and related professions.

NachLeben (DE)

<https://nachleben.net/>

The aim of Otto von Guericke University Magdeburg in cooperation with Magdeburg-Stendal University of Applied Sciences and Agrarmarketinggesellschaft Sachsen-Anhalt mbH was to develop and test didactic teaching/learning arrangements for vocational training for sustainable development for the following vocational training occupations: confectionery technologist, food technology specialist, distiller, distiller and wine technologist.

NIB-SCOUT (DE)

<https://nib-scout.de/>

The Akademie Deutsches Bäckerhandwerk Nord gGmbH, the University of Potsdam, Iconate Gesellschaft für Kommunikation und Medien mbH and k.o.s. GmbH have developed a competence model as well as a teaching-learning concept and a digital learning tool for vocational training for sustainable development in the bakery trade.

B.A.U.M e.V. (DE)

<https://www.baumev.de/News/10475/SDGScouts%E2%80%93SchulungvonAuszubildendenundNachwuchskrftenfrNachhaltigkeit.html>

B.A.U.M. is a network for sustainable business. The coaching program "SDG Scouts - trainees and junior staff in companies" supports young people in identifying and promoting innovation potential in relation to sustainability in their training companies. In each case, the focus is on a practical sustainability project that trainees and junior employees develop, implement and present together with company mentors. The aim of the program is to approach the SDGs and their future implementation within companies in order to drive forward the transformation of the economy.

INNEB (DE)

<https://inebb.org/>

The INEBB pilot project aimed to strengthen training with sustainability-oriented skills. Competencies. The project therefore developed an IHK-certified further training course for training specialists in commercial professions.

NaMiTec (DE)

<https://www.lufa-nord-west.de/index.cfm/nav/11/article/2080.html>

Under the auspices of the Dairy Education Center of the Lower Saxony Chamber of Agriculture, teaching and learning arrangements for the implementation of sustainability skills in the dual training of dairy technologists were developed together with Fraunhofer UMSICHT and the University of Osnabrück.

TRANS-SUSTAIN (DE)

<https://www.transustain.de/>

Together with the University of Erfurt, the Berlin University of Applied Sciences has developed a transversal competence framework and tools for promoting sustainability in small and medium-sized butchery businesses.

Eco-Ecole (FR)

<https://www.eco-ecole.org/>

Sustainable Development Education programme for schools, focusing on raising awareness of eco-responsible practices (energy management, biodiversity, sustainable food, etc.).

Les Agendas 21 scolaires (FR)

<http://www.agenda21france.org/agenda-21-scolaires/>

Varies from region to region, but is often available on the rectorat or school website. Several schools in France are developing an Agenda 21, a structured programme to train students in sustainable and responsible practices.

ESD skills framework (FR)

<https://eduscol.education.fr/3921/l-education-au-developpement-durable-dans-le-cadre-des-enseignements>

<https://www.pedagogie.ac-nantes.fr/education-au-developpement-durable/referentiel-de-competences-edd-reperes-de-progression-et-attendus-de-fin-de-cycle-4-1544056.kjsp?RH=PEDA>

<https://www.education.gouv.fr/l-education-au-developpement-durable-7136>

On Tuesday 3 October 2023, the French Ministry of Education and Youth published a reference framework, progression benchmarks and end-of-cycle expectations for developing pupils' skills in education for sustainable development and the ecological transition.

Aires éducatives (FR)

<https://eduscol.education.fr/3851/les-aires-educatives>

This scheme enables pupils to manage a small natural area (marine, terrestrial or river) in a participatory way, and to make decisions about its protection.

Pupils are directly involved in managing the educational area alongside local stakeholders, giving them a practical experience of environmental citizenship.

Cube.S (FR)

<https://www.cube-s.org/>

An energy-saving competition between schools. It raises awareness among pupils of the need to reduce energy consumption through concrete actions in their schools.

2.1.2. CCE in VET

Skilling Eco-VET

Skilling Eco-VET is a 3-years project funded by the European Executive Agency for Education and Culture, whose activities are carried out by four European partners and five partners from the African continent. It is based on the dual objective of simultaneously improving the education system and making the transition to a greener economy. An interdisciplinary VET course introduces circular principles within environmental studies and practical sustainability skills.

<https://mundusgroup.com/portfolio/skilling-eco-vet/>

Green Growth Project in Construction

A roadmap for circular economy training in the construction industry that includes practical approaches for implementing sustainable building practices in VET centers

<https://greengrowthproject.eu/en/home/>

Circvet Project (Circular Economy for Plastics)

Offering resources and courses tailored for the plastics sector, Circvet promotes circular economy practices specifically for plastic processing, providing hands-on materials and e-learning options for VET learners

<https://circvet.eu>

CircleVET

A project developing and sharing teaching methods on Circular Economy skills, targeting VET educators with practical tools and methods across sectors including fashion, coworking, and recycling.

<https://circular.berlin/portfolio-item/teaching-methods-for-circular-economy-skills/>

Fit for Circular Economy

German program focusing on embedding circular practices within schools, helping students learn zero-waste strategies and sustainable practices

<https://circular.berlin/portfolio-item/fit-fur-circular-economy-integrating-circular-economy-education-into-vocational-schools-curricula/>

EDUCEN - European Disasters in Urban Centres

Provides VET educators with resources to introduce circular economy concepts in green sector training, enhancing skills in sustainability and recycling

<https://systemssolutions.org/projects-and-activities/educen/>

CIRCLE

Project CIRCLE is a Erasmus supported project, part of the KA2 Strategic Partnerships Programme. The CIRCular economy though integrated LEarning in VET, has been developed to support trainers in vocational training, introduce the concepts of the circular economy to students in the tourism, transport and agricultural sectors.

<https://circlelearning.eu/project/>

Education for Zero Waste and Circular Economy (EduZWaCE)

Education for Zero Waste and Circular Economy (EduZWaCE) is an Erasmus+ project aimed at addressing a gap in vocational education and training by creating new training courses focused on waste and circular economy, as well as developing interdisciplinary skills required for new jobs in the region. The

international consortium consists of organizations from nine European countries. As part of the project, four substantive outputs have been developed: an interactive platform that includes a Knowledge Hub, an online course, and a diagnostic tool.

<https://lms.eduzwace.eu/>

Circular Economy in Metal Industries (CEMIVET)

This program supports metalworking SMEs and VET centers by integrating circular economy concepts into metal manufacturing, with resources such as courses and Living Labs for practical learning on sustainable practices in metal industries

<https://ibbf.berlin/assets/images/Dokumente/One%20Pager%20CEMIVET.pdf>

Training for Resource Efficiency and Circular Economy (TREE)

This course on EPAL offers VET-focused modules on circular economy topics for various sectors, providing resources for trainers and students in waste management and resource efficiency

<https://treeproject.eu>

BuildSkills Academy

The BuildSkills Academy project was designed to help VET centers all across Europe to adapt their offerings more quickly to labour market needs, to prepare the workforce for the digital and green transition in occupations of high demand. In other words, the project will provide VET centres with modern and digitalized training provisions that are internationally recognized and certified.

<https://buildskillsacademy.com/about/>

Tiche Academy

The project aims at establishing an European VET Academy on Circular Economy, based on a transnational cooperation of a very experienced and complementary partnership,, joining Research centres, Vet centres, Universities, SMEs, clusters, Umbrella organizations and international networks, public administrations, that will work together as an ecosystem to increase capacity building and responsiveness of the VET systems, according to an “European Education Area”.

<https://tiche-academy.eu/>

Circular Skills Project

<https://circularskills.eu/>

The Circular Skills Project also offers workshops designed for vocational education trainers to help embed circular economy skills into their teaching. The workshops are available across several countries, including Sweden, and focus on sustainable business models and practices.

ADEME Platform on the Circular Economy (FR)

<https://formations.ademe.fr/recherche-de-formation.html>

Offers modules, case studies and teaching aids for training in circular economy practices, with a particular focus on carbon management and reduction.

AFFPA, National Agency for Adult Vocational Training: (FR)

<https://www.afpa.fr/>

The AFFPA offers training courses that include modules on sustainability and the circular economy, with a focus on resource management and reducing the carbon footprint in several industrial sectors.

Coop Carbone (FR)

<https://coopcarbone.coop/economie-circulaire-rappels-et-mise-en-pratique-les-initiatives-de-la-coop-carbone/>

For more than 10 years, Coop Carbone has been deploying a multitude of projects aimed at reducing greenhouse gas emissions, thereby actively responding to the climate emergency. Introducing the principle of the circular economy means integrating a new economic paradigm that promises to have a major impact on reducing greenhouse gas emissions.

Circular innovation Hub Wiltz (LU)

<https://economie-circulaire.public.lu/en/inpractice/projects/circular-innovation-hub-wiltz.html>

This project, resulting from a collaboration between the Municipality of Wiltz and the Housing Fund, aims to offer the public a national platform in order to facilitate and promote the exchange of knowledge and experiences around the theme of the circular economy. At the same time, the HUB will enable better communication and information on the projects that are being developed and implemented in the territory of the municipality of Wiltz. Firstly, the HUB will focus on offering various training courses and information sessions on the subject of the circular economy. Indeed, the two project leaders play an important role in this context: Wiltz as a "National Hotspot for the Circular Economy" with around twenty projects currently being implemented and the Fund as the promoter of the new urban space "Wunne mat der Wooltz". The Circular Innovation HUB offers a program adapted to different audiences:

- [Professionnel](#) (communes, administrations, private companies, design offices, etc.)
- [Scolaire](#) (from an early age)
- [Grand public](#)

2.1.3. Biochar in VET**BodenBerufsBildung ("soil vocational education") (DE)**

<https://www.geo.fu-berlin.de/v/ag-geoökologie/bodenberufsbildung/projekt/index.html>

The project BodenBerufsBildung ("SoilVocationalEducation") has created model projects that have dealt on the one hand with the integration of the topic of regional material cycles and biochar and the associated positive environmental aspects into vocational training and further education and on the other hand with the production and sale of biochar substrate. The production of biochar substrate was scientifically monitored and the market potential for biochar substrate in the Berlin/Brandenburg region was raised.

The European Biochar Certificate (EBC) (FR)

<https://www.european-biochar.org/en>

A European network that includes France and aims to promote biochar in agriculture. This project offers practical learning tools for agricultural vocational training courses.

Projet Biochar 2021 (FR)

<https://www.unilasalle.fr/actualites/projet-biochar-2021-la-recherche-au-service-de-la-fertilite-des-sols>

This scientific project aims to assess the effect of weathering on the biological stability and fertility of biochar-compost formulas. The use of biochar, which is a solid residue from the pyrolysis of biomass, is also being suggested for use in agriculture.

2.2. Learning Formats

2.2.1. ESD

Apprenticeship: Environmental technologist for circular economy and waste management (DE)

<https://web.arbeitsagentur.de/berufenet/beruf/14757>

In Germany, there is a three-year apprenticeship to become an environmental technologist for recycling and waste management, which provides extensive knowledge in the field of circular economy. From August 2024, a new apprenticeship regulation will apply, which has been modernized due to new technical developments as well as social and legal requirements for sustainable recycling.

Advanced training courses

Example of good practice: Advanced training Circular Economy - Micro Certificate

<https://www.ibb.com/weiterbildung/circular-economy-mikro-zertifikat>

The Institute for Vocational Training, one of the largest private training providers in Germany, offers the acquisition of a Circular Economy certificate. Course provides an in-depth understanding of the fundamentals and principles of the circular economy. It teaches students to understand the circular economy as a sustainable response to resource scarcity and to apply the process of circular transformation in companies. By learning about the circular economy, participants will be able to develop products and business models that are ecologically sound and at the same time strengthen a company's profitability.

Similar programs are also offered by public institutions such as the cologne chamber of industry and commerce:

<https://www.ihk.de/koeln/hauptnavigation/weiterbildung/zertifikatslehrgaenge/zertifikatslehrgang-circular-economy-5901538>

Example 1: Greening apprenticeships (Yrkeshögskolan) (SE)

This program offers various courses related to sustainability and circular economy. While not classified as traditional apprenticeships, these programs include significant work placements, allowing students to gain practical experience in relevant fields. Many programs focus on areas such as waste management and resource efficiency, which are critical components of the circular economy.

<https://www.cedefop.europa.eu/en/news/greening-apprenticeships-sweden>

Example 2: Circular Economy Manager

This online certification program by the Circular Economy Alliance allows participants to gain advanced knowledge of circular economy principles, covering topics like strategic design, value cycles, and the role of ecosystems in the transition to a circular economy. (Duration: Approximately 30 hours, fully online and self-paced; Outcome: Participants earn a verifiable blockchain-secured certificate upon completion)

<https://circulareconomyalliance.com/circular-economy-manager-advanced/>

Example 3: Certificate in 'Circular Economy: transform your organisation using innovative approaches and tools' (FR)

<https://executive-education.minesparis.psl.eu/formations/certificat-executive-economie-circulaire-transformer-votre-organisation-par-des-approches-et-outils-innovants/>

The 'Circular Economy' certificate aims to develop an understanding of the fundamentals of the circular economy and the obstacles and levers inherent in its implementation, and to provide participants with the tools, methods and practical approaches needed to embark on this transformative process.

Career orientation camps

Example of good practice: "Six Days for Future"

<https://6days4future.de/project/bildungsmaterialien/>

As part of the VETSD project "Generation Future - the Professionals of Tomorrow", educational modules were developed that combine sustainable development with aspects of career guidance. The modules deal with different professional sectors and were trialled in free theme camps and workshops lasting several days for young people aged 14 and over.

Higher education programs

Example of good practice: Master en Développement Durable – Filière Energie et Environnement (LU)

<https://www.uni.lu/fstm-en/study-programs/master-en-developpement-durable-energie-et-environnement/>

The Master en Développement Durable – Filière Energie et Environnement (MDD) developed by the University of Luxembourg and the University of Liège trains students in environmental approaches to energy issues and buildings.

Virtual learning environments

Example of good practice: Cross-trade qualification for energy-efficient building refurbishment

https://bbne-mutzenbecher.blogs.uni-hamburg.de/?page_id=1763

In a virtual 360-degree tour, the GESA project has created learning modules on the renovation of the Villa Mutzenbecher (1889/1890) in Hamburg. These modules focus on the fundamental content of heritage conservation, BBNE and interdisciplinary work. The starting point is concrete renovation work in the villa.

Game-based learning

Example of good practice: Dilemma

Dilemma is a board game for teaching sustainable development

<https://www.jonerikdahlin.com/dilemma/>

Example of good practice: Bamboleo

The game Bamboleo is primarily a skill game in which the systemic boundaries of our planet and the effects of our actions become experientially apparent in a playful manner. In a subsequent lecture (by the teacher), the concept of planetary boundaries will be addressed, and the connection to biochar will be established.

Whole School Approach

Example 1: Green Schools Initiative

Many Swedish schools participate in the Eco-School program, which promotes sustainability through a WSA. This initiative encourages schools to embed sustainability principles across all aspects of school life, including curriculum, teaching methods, school operations, and community engagement. Schools are recognized for their efforts in integrating environmental education into their daily activities, fostering a culture of sustainability among students.

A study examining two green schools in Sweden highlighted their commitment to ESD through a WSA. These schools incorporate sustainability topics into various subjects, engage in extracurricular activities focused on environmental issues, and collaborate with local communities to address real-world problems. This approach not only enhances students' understanding of CE but also empowers them to take action within their communities

<https://eera-ecer.de/ecer-programmes/conference/28/contribution/54611>

Example 2: Skrivares Skola

Another example of CE integration into the curriculum is Peder Skrivares Skola, which has been a pioneer in incorporating CE into its educational framework since 2016. It has developed a comprehensive approach to teaching sustainability through practical applications. CE principles are embedded in various subjects, particularly in young entrepreneurship programs. Students utilize a "circular canvas" to design sustainable business models, moving away from traditional linear approaches focused solely on profit.

EduSTA (FR)

<https://projects.tuni.fi/edusta/>

Focus on sustainability competences of teachers. Strengthen the European dimension of teacher education via Digital Open Badges as means of performing, acknowledging, documenting and transferring the competencies as microcredentials.

ESD Board games:

<https://www.reseau-canope.fr/actualites/actualite/transition-ecologique-des-ressources-pedagogiques-et-des-formations-pour-une-education-au-developp.html>

In the classroom, board games are at the heart of learning sessions: they motivate and capture pupils' attention to help them acquire knowledge. Réseau Canopé is convinced of the value of games in education for sustainable development and is currently offering a webinar training course for primary schools.

2.2.2. CCE

Advanced training courses

Example of good practice: Low Carbon Construction Training Courses by IFSB (LU)

<https://www.ifsb.lu/spip.php?page=recherche&recherche=d%C3%A9veloppement+durable>

IFSB already offers a wide range of training courses related to Sustainable Development and/or Circular Economy. Here are some examples:

- Eco Construction and Low Carbon Construction - The Essentials
- Low-Carbon and circular design
- Low Carbon Concrete
- Circular and Low Carbon Economy Advisor
- Integrating the Circular Economy in the Design of Construction Operations

Online Training Courses

Example of good practice: EduZWaCE Online Training Course for Zero Waste and Circular Economy

The EduZWaCE online adult education course is designed for two target groups: EduZWaCE managers (vocational education teachers and professionals from companies) and EduZWaCE specialists (vocational education teachers, technicians, and staff from reuse/repair centers). The two courses are available in 10 languages, and each of the 5 learning units consists of an introductory video, accompanying training materials, audiovisual materials, and a final assessment procedure.

Project Workshops

Example of good practice: CE@KTH

CE@KTH organizes workshops for companies, researchers, and students that focus on Circular Manufacturing Systems (CMS) and Circular Economy practices. These workshops often involve real-life problem-solving with industry partners and aim to develop innovative circular solutions.

<https://www.kth.se/>

Problem-based learning

Example of good practice: Circular Sweden

<https://www.circularsweden.se/>

The Circular Sweden platform offers strategy workshops and roundtable discussions that utilize PBL methodologies. These sessions engage participants in problem-solving tasks focused on creating circular material flows and fostering innovation in the Swedish industrial sector.

Apps

Example of good practice: Green Growth project App

The *aim* of this App is to make the circular economy visible in building renovation works. In this App shows 10 products and materials commonly used in the construction sector in Europe, indicating the different aspects considered as priorities, related to energy efficiency and circular economy, among others.

2.2.3. Biochar

Online Training Courses

Example of good practice: Biochar Training for Environmental Sustainability and Economic Development by the International Biochar Initiative

The course is an intensive, 19-module training series that provides an in-depth, scientific overview of the biochar industry. Course content focuses on biochar production technologies; physicochemical properties; standards, classification, and certification; biochar effects when used as a soil amendment; biochar carbon persistence in soils, carbon accounting, and climate change; and commercialization of the biochar industry.

Project-based learning

Example of good practice: Producing and testing biochar yourself

The trainees conduct experiments to produce biochar. In doing so, they vary the pyrolysis temperature and time or the feedstock. To achieve this, they build a simple pyrolysis oven from conventional cans in groups of 3-4 people. They produce biochar themselves from residual materials such as wood chips, nut shells, and similar materials. The trainees examine the quality of the produced biochar using simple tests. The instructor explains the criteria for awarding the European Biochar Certificate (EBC).

https://www.geo.fu-berlin.de/v/ag-geoökologie/bodenberufsbildung/Medien/pflanzenkohle_module_FU.pdf

Excursions

Excursions to pyrolysis plants provide trainees with valuable hands-on experience and insights into the biochar production process. During these visits, participants have the opportunity to observe the operational aspects of pyrolysis technology, including the equipment used, the feedstock preparation, and the various stages of the pyrolysis process. Trainees can interact with industry professionals, who share their expertise and discuss the challenges and benefits associated with biochar production. This interaction allows trainees to ask questions and gain a deeper understanding of the practical applications of biochar in agriculture, waste management, and environmental sustainability.

Additionally, the excursions often include guided tours of the facilities, where trainees can see the end products and learn about quality control measures. They may also explore case studies of successful biochar applications in different sectors, enhancing their knowledge of how biochar can contribute to soil health, carbon sequestration, and resource recovery. After the visit, trainees are encouraged to reflect on their experiences, document their observations, and discuss how the insights gained can be applied in their own projects or future careers. This experiential learning approach not only reinforces

theoretical knowledge but also fosters critical thinking and problem-solving skills related to biochar and its applications.

Storytelling

Example of good practice: International Biochar Initiative (IBI)

The International Biochar Initiative (IBI) is launching a narrative campaign featuring stories from participants of the Biochar Academy. This initiative aims to showcase the experiences and impacts of alumni who are implementing biochar solutions in their communities. By sharing personal stories, the campaign seeks to build awareness and inspire others about the potential of biochar in addressing climate change and promoting sustainable practices

<https://biochar-international.org/news/biochar-education-as-a-catalyst/>

<https://biochar-international.org/news/this-is-biochar-harnessing-biomass-to-power-a-circular-economy/>

Simulations

Example of good practice: Lindeborgs Biochar Simulation Model

This project developed a simulation model to estimate the biochar production potential and environmental performance of small-scale pyrolysis systems on Swedish farms.

<https://biochar.systems/case-studies/2-lindeborgs/>

2.3. Materials (OERs) & Tools

2.3.1. ESD

Collection of Materials of the of the German national ESD portal (DE)

https://www.bne-portal.de/SiteGlobals/Forms/bne/lernmaterialien/suche_formular.html?cl2Categories_Bildungsbereich=berufliche-bildung#searchFacets

The National Platform Education for Sustainable Development provides selected teaching and learning materials on education for sustainable development in vocational education and training.

ESD Sachsen (DE)

<http://www.bne-sachsen.de/>

The portal, which is managed by civil society and funded by the state and federal government, offers thematically appropriate educational offers and teaching materials for each of the 17 global Sustainable Development Goals (SDGs). In addition to current information on ESD in Saxony, over 130 associations and organizations present themselves and their bookable offers and projects. This allows the learning content of the school to be linked with extracurricular learning opportunities, learning locations and partners. The events and further education calendar lists the events currently on offer.

KATE SDG toolbox (DE)

<https://www.kate-stuttgart.org/sdg-toolbox>

The website gives multipliers from small and medium-sized enterprises and vocational training institutions access to all the educational materials in the SDG toolbox so that they can implement low-threshold and attractive sustainability education for employees and junior staff in their own organization. The SDG toolbox consists of five components: visual awareness-raising, auditory awareness-raising, sustainability rally, SDG videos and interactive e-learning.

Practical guide: Designing learning processes in vocational training with a focus on sustainability (DE)

<https://www.bibb.de/dienst/publikationen/de/18631>

This guide from the German Federal Institute for Vocational Education and Training shows company trainers and teachers at vocational schools how to enable young people to think and act in an ecologically, socially and economically responsible way. Using the example of professions in the food trade and food industry, practical tips and scientifically based impulses for designing sustainability-oriented learning tasks and processes are provided. With the help of numerous explanations and tasks, tips and checklists, the guide thus supports vocational training personnel in concretizing the standard vocational training position "Environmental protection and sustainability" and implementing it in the company. With these tools, sustainability-oriented didactic vocational training work in companies and schools can be tackled immediately and very concretely.

KATCH-E

<https://www.katche.eu/knowledge-platform/>

This EU project has developed tools and training materials for enabling the circular economy with a focus on the construction and furniture sectors, although any industry can make use of the tools.

Zero Waste Hierarchy

<https://zerowasteurope.eu/2019/05/a-zero-waste-hierarchy-for-europe/>

One of the fundamental ideas underlying the circular economy concept is the Zero Waste Hierarchy pyramid. This tool from Zero Waste Europe explains their 7-tier approach to the pyramid.

„Sustainable at work“ Collection of Materials (DE)

<https://www.bibb.de/de/85132.php>

The German project "Sustainable at work" (see above) offers a rich collection of materials for the implementation of sustainability in vocational education and training in various sectors.

Kickstarter's Environmental Resource Guide

<https://www.kickstarter.com/environment>

The crowdsourcing platform partnered with the Environmental Defense Fund to create this guide to more sustainable product design and manufacturing, including many circularity considerations.

SDG Action Manager

<https://unglobalcompact.org/take-action/sdg-action-manager>

The United Nations Global Compact offers this tool to help measure and manage a company's social and environmental impact, benchmark against industry peers and set goals to continually improve impact.

Idemat

<https://idematapp.com/>

This sustainable material selection tool makes it easy to compare carbon footprints and eco-costs to enable more sustainable product design.

CTI Tool – Circularity Transitions Indicators Tool

<https://ctitool.com/>

This online tool helps companies accelerate their circularity journey by supporting and guiding them through the WBCSD's Circular Transition Indicators process. The tool structures data and calculates results to help companies take concrete action towards their circularity goals.

Circulator's Circular Business Model Mixer

<https://www.circulator.eu/>

This tool allows users to explore common circular business models, navigate potential circular strategies and learn from inspiring cases.

NiB-Scout App

<https://nib-scout.de/>

SUSTAINICUM COLLECTION, BOKU Vienna

<https://sustainicum.at/resources/methods>

2.3.2. CCE

Circular Design Guide

<https://www.circulardesignguide.com/methods>

The Circular Design Guide is a collaboration between the Ellen MacArthur Foundation and IDEO. It offers a number of activities to inspire circular design ideas and prototypes.

Education for sustainable development and ecological transition (FR)

https://eduscol.education.fr/sti/ressources_pedagogiques/education-au-developpement-durable-et-la-transition-ecologique#description

The French Ministry of Education and Youth has published a set of benchmarks for progress and end-of-cycle expectations for education in sustainable development and ecological transition in the nursery to secondary school curriculum. Teachers will be able to find acquisition objectives at the end of each cycle, linked to subject content and associated with examples of pedagogical activities and teaching situations.

Ecological transition: educational resources and training for education in sustainable development (FR)

<https://www.reseau-canope.fr/actualites/actualite/transition-ecologique-des-ressources-pedagogiques-et-des-formations-pour-une-education-au-developp.html>

Réseau Canopé offers resources to help you implement education for sustainable development in the classroom.

Cirkulär Ekonomi Hub (SE)

A platform that offers resources and educational materials focused on circular economy practices across various sectors in Sweden. It serves as a comprehensive guide for educators and practitioners.

<https://circularhub.se/om-circular-hub/>

Guide to teach circular skills in VET Education

The Guide to teach circular skills in VET education contains information about the circular economy situation in Europe, the specific needs in education, and presents some examples of circular economy business around Europe.

<https://circularskills.eu/>

Getting to know the Circular Economy teaching kit (FR)

<https://emploi.graine-occitanie.org/formation/prise-en-main-du-kit-pedagogique-economie-circulaire>

https://www.grainepaca.org/wp-content/uploads/2021/01/economie_circulaire_2020-2.pdf

Once they have returned to their organisation, the trainees will be able to run awareness-raising events on the circular economy using the tools produced by GRAINE.

2.3.3. Biochar

BodenBerufsBildung - Collection of Materials

<https://www.geo.fu-berlin.de/v/ag-geoökologie/bodenberufsbildung/bildungsmaterialien/index.html>

The project BodenBerufsBildung (“SoilVocationalEductaion”, see below) project provides material for vocational training on the subject of biochar and its use in horticulture and agriculture. The didactic material focuses on the history and rediscovery of terra preta in the course of archaeological and anthropological research as well as the current production of biochar and substrates similar to terra preta through composting and the use of the substrates. In addition, the contribution of Terra Preta technology to climate and soil protection and sustainable resource utilisation is conveyed. The aim of these modules is to make VETSD concrete, visible and tangible and to link sustainability-orientated skills to specific professional fields of action and activity. The aim is both an in-depth cognitive examination of the topic of biochar and the acquisition of practical skills in pyrolysis and composting, as well as the transfer of what has been learnt into their own composting concepts or planting trials. The trainees should also critically discuss and evaluate biochar in the context of sustainable development.

Biokolguiden (Biochar Guide by Uppsala University)

<https://biokol.org/>

This guide, while more of an educational platform than an app, offers open resources on biochar. It includes information on production, usage, and the environmental benefits of biochar, specifically focused on Swedish applications.

US Biochar Initiative – Learning Database

<https://biochar-us.org/index.php/learning>

The US Biochar Initiative is a not-for-profit organization promoting the sustainable production and use of biochar through research, policy, technology and implementation. It offers comprehensive specialist information on biochar.

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