Supported by:

Federal Ministry
for Economic Affairs
and Climate Action

European
Climate Initiative
EUKI

on the basis of a decision
by the German Bundestag

CURE+

CENTRES FOR URBAN RESOURCES, REUSE AND REMANUFACTURE

Roadmap for policy Recommendations

Deliverable 1: Set of Criteria

Describe the main gaps in the policies across countries and cities, describe the current situation and identify the gaps and challenges that will provide the necessary knowledge for implementing the ELECTRE II method and designing the policy recommendations

Amsterdam University of Applied Sciences

TORTU

Contents

List of Figures

List of Tables

1 Introduction

1.1 The CURE+ project

Across the EU, the management of Construction and Demolition Waste (CDW) poses a significant environmental challenge and an opportunity for progress towards sustainability goals. CDW accounts for a considerable portion of total waste generated, amounting up to the 40% of the total waste in the EU and is pivotal in the union's efforts to transition to a circular economy (García et al., 2024) . This transition aims to minimise waste and maximise the reuse and recycling of resources, which is vital for reducing landfill use and conserving natural resources and energy, aligning with the EU's broader environmental and climate objectives.

Total global GHG emissions are projected to reach 75 Gt CO_2 eq by 2060 of which materials management would constitute approximately 50 Gt CO_2 eq (OECD, 2019). So far, policy efforts are required from each country to reach the goals set on reducing GHG emissions and increasing circularity and environmental sustainability. All waste generation has social, economic and environmental impacts and a loss of valuable materials and resources for the economy. Expanding the construction sector leads to a corresponding increase in construction materials use. In addition, the construction sector is mainly driven by investment needs (OECD, 2019). Construction and Demolition Waste (CDW) is the EU's most significant waste stream, accounting for almost 40% of all waste generated in EU (Padilla et al., 2018; Garcia et al., 2024).

EU policies on waste management, specifically the Waste Framework Directive (European Comission, 2018), have been instrumental in setting the regulatory groundwork for enhancing the processing of CDW. These policies mandate the preparation of waste materials for reuse, recycling, and other recovery operations. Furthermore, the ambitious targets set by the EU's Circular Economy Action Plan emphasise the necessity of increasing the recycling rate of construction and demolition materials and decreasing landfilling, thereby fostering a more sustainable construction sector.

Despite these comprehensive frameworks, implementation varies significantly across member states due to differing national capacities, economic conditions, and technical expertise. This variability presents challenges and opportunities for localized adaptation and innovation in CDW management. The need for tailored solutions that reflect local conditions is critical, as is the engagement of a broad spectrum of stakeholders, including governments, industries, and communities, to enable effective policy execution.

The CURE+ project is situated within this context, seeking to address these disparities by enhancing the capacity of municipalities in the Baltic and Southern Europe to align with and excel in implementing EU CDW management standards. By focusing on capacity building and the development of innovative, locally adapted CE strategies, CURE+ aims to propel these municipalities towards becoming leaders in sustainable CDW management, thereby contributing to the EU's goals of reducing material consumption, lowering emissions, and fostering economic growth through new green technologies and jobs. This strategic approach underlines the project's commitment to achieving a resilient and sustainable built environment across Europe.

The CURE+ project represents a significant initiative to transition municipal operations towards a more sustainable, circular economy (CE) model, specifically focusing on managing Construction and Demolition Waste (CDW). By targeting four specific municipalities in the Baltic and Southern

European regions, the project seeks to catalyse changes that reduce the reliance on virgin materials through enhanced waste prevention and recycling practices. This shift is essential for decreasing urban development's environmental footprint and supporting municipal capabilities in sustainable waste management. The initiative's core objective is to ensure that these municipalities become exemplars of CE, leveraging local capabilities and resources to foster environmental resilience and sustainability.

1.2 Objectives

This deliverable aims to identify the gaps based on the regulations currently used in the pilot countries (Estonia, Latvia, Greece and Spain) and respective municipalities (Tartu, Barcelona, Riga and Kavala). The main objective will be to describe each country's situation and developments concerning the EU "fit for 55% package", prioritising the importance of CE measures to achieve climate goals. In this particular report, we aim to:

- map the maps, mismatches, or challenges all pilot countries may face.
- describe the current situation in each country
- describe the information and set the first step to build up the criteria based on which they will evaluate and formulate the policy recommendations.

To succeed in this, this deliverable is built as follows: in Chapter 2, we briefly describe the methodology, the method and the data used to identify the gaps. In Chapter 3, we present the current situation in each country and, where possible, in each municipality. At the same time, we specialise the enabling factors and the barriers to moving to a circular economy in each country. Furthermore, we describe the EU policy on CDW management, and we provide country/municipality-specific descriptions. In Chapter 4, we provide the national CDW management and policy status, while in Chapter 5, we identify gaps and challenges. The report concludes with Chapter 6.

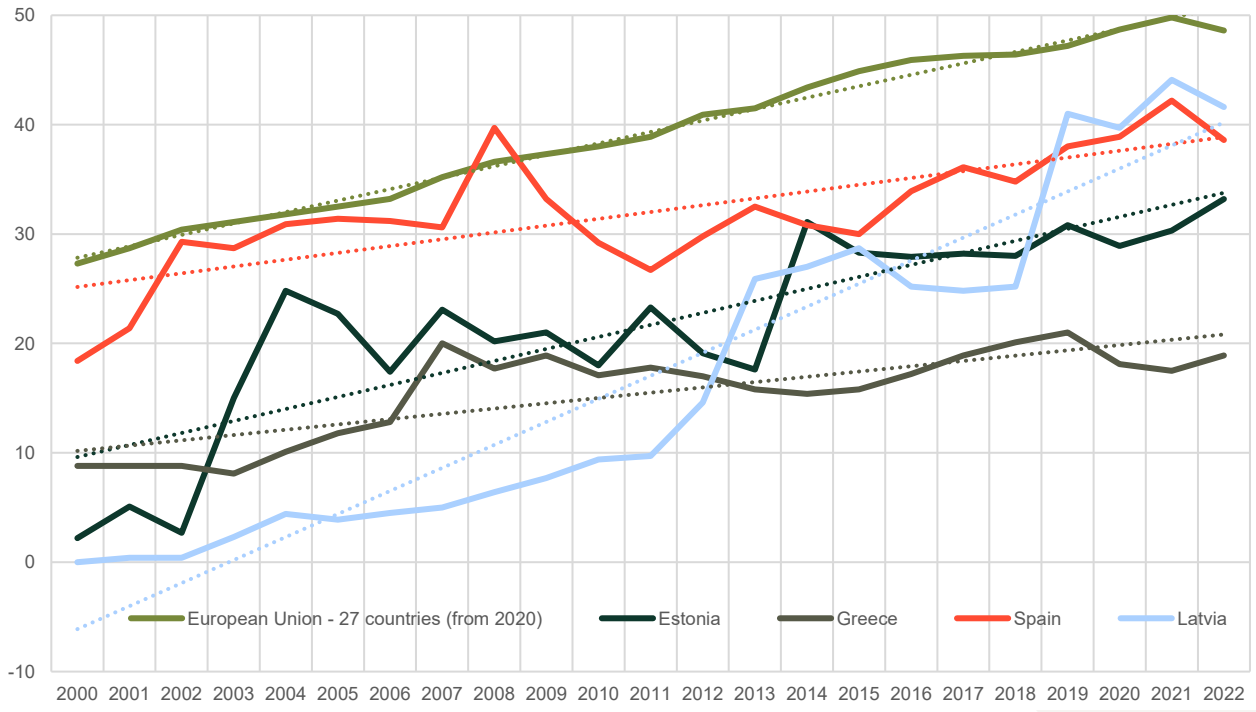
2 Current Policy and Regulation Analysis

2.1 Current Situation

This chapter provides an in-depth analysis of the evolution of key socioeconomic indicators across the European Union and selected member states over recent decades. By examining trends from 2000 to 2022, the chapter aims to highlight growth patterns, disparities, and convergence among countries within the EU framework. Focusing on specific examples such as Estonia, Greece, Spain, and Latvia offers insights into how these nations have responded to economic, social, and policy-driven challenges and opportunities. The analysis contextualises these trends within broader EU objectives, such as fostering cohesion, reducing inequalities, and promoting sustainable development. By comparing individual country trajectories with the EU average, the chapter sheds light on the complex interplay of national policies, regional dynamics, and external influences shaping these outcomes.

Figure 1 depicts the recycling rates for the European Union (27 countries as of 2020) alongside Estonia, Greece, Spain, and Latvia from 2000 to 2022. The European Union average shows a steady and consistent increase throughout the period, reflecting gradual improvements. Estonia exhibits significant growth, especially between 2002 and 2007, before stabilising. Latvia shows sharp increases from 2011 onward, indicating rapid advancement compared to earlier years. Greece's performance remains relatively stable, with modest growth and some fluctuations. Spain mirrors the EU's growth pattern but has notable peaks and troughs, particularly between 2008 and 2014. These trends suggest varying rates of development and recovery among these countries, likely influenced by economic, policy, or structural factors.

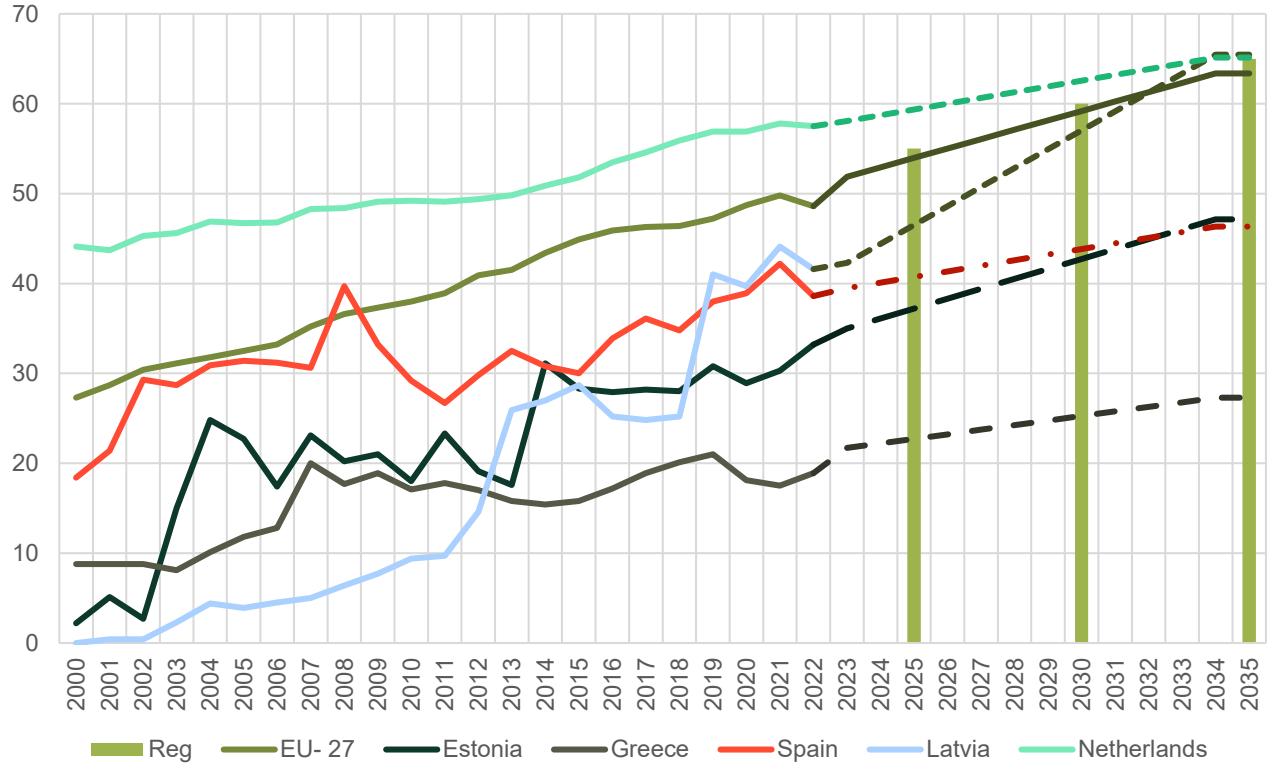
Figure 1. Recycling rate of municipal waste



Source Recycling rate of municipal waste [cei_wm011], Eurostat (2024) authors' work

In **Figure 2** are displayed the projections (dotted line) for the recycling rate of municipal waste. The projections are based on a simple linear regression model with a trend, and the usual limitations are applied. The only independent variable is the time, and by that, a lot of things may change in those numbers due to policy regulations at the EU and national levels. Also, in the same figure are the limits for the years 2025, 2030, and 2035. In more detail the EU regulations dictate that by 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55 % by weight; by 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60 % by weight; and by 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65 % by weight. It seems that the only countries that will succeed in meeting the targets by 2035 are Latvia, the Netherlands and the EU-27 in total. However, Greece, Spain and Esthonia will lag behind by at least 15 units.

Figure 2 Projections of recycling rate of municipal waste (2000-2035)



Source Recycling rate of municipal waste [cei_wm011], Eurostat (2024) authors'estimations

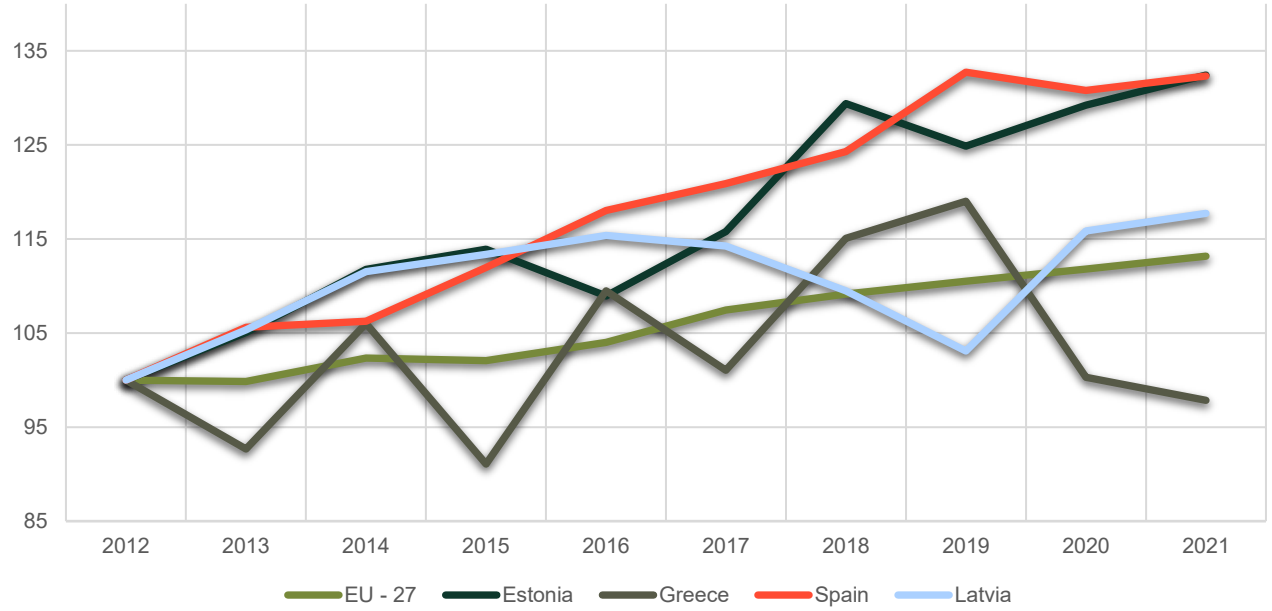
The next indicators is about the persons employed in the recycling sector, repair and reuse sector and rental and leasing sector. Jobs are expressed in number of persons employed. In oerde to have a better undestanding of we expressed the numbers iun constat prices of 2012.

The EU-27 shows a steady increase in employment in circular economy sectors over the years, with a significant uptick starting around 2017, reaching its peak in 2021. Spain and Esthonia have a stable increasing tredn in the employment in those sectors, with the increase from 2012 to 2022 to increase by around 32% for both countries. Spain starts above the 2012 index level, dips below it around 2014, and then shows strong growth from 2016 onwards, reaching the highest point among the plotted entities by 2021. Estonia experiences some fluctuation but generally follows an upward trend similar to the EU-27, although with more variability year-on-year.

Latvia has the most variability, with sharp increases and decreases, but ends slightly below its starting point by 2021. Latvia, display a 17,7% increase in the employment in circular economy sectors. The Netherlands shows an initial increase, a plateau phase, and then a decline after 2018, finishing below the 2012 index level. The Netherlands has the slightest increase in employment by 5.3%. However, it remains stable over the years. Greece showed a significant dip around 2015 before recovering and surpassing its initial 2012. Greece displays a decrease in employment by 2.2% in 2022 compared to 2012.

Figure 3 is very useful since the employment trends in this sector can be indicative of how well different countries are adapting to and investing in sustainable economic practices. Based on the graph alone, we can deduce which countries are experiencing growth in employment in circular economy sectors relative to their own starting points in 2012. However, we need to take into consideration more factors, such as the size of the workforce, the scale of the circular economy relative to the total economy, policy support, economic conditions, and sector-specific growth.

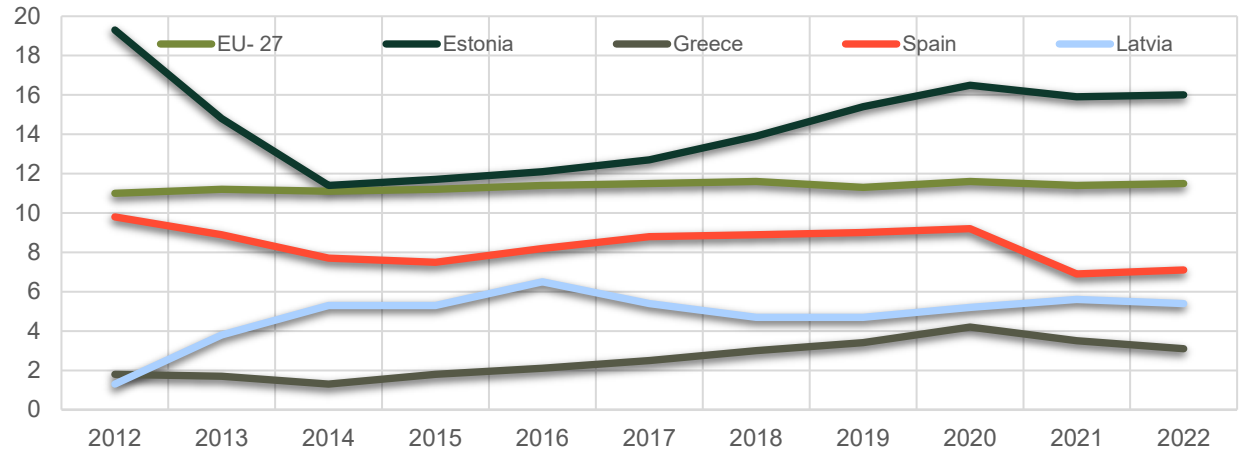
Figure 3 Persons employed in circular economy sectors (2012=100)



Source, Eurostat 2024, authors calculations

Figure 4 present the circular material use rate. The indicator measures the share of material recycled and fed back into the economy - thus saving extraction of primary raw materials - in overall material use. The circular material use, also known as circularity rate is defined as the ratio of the circular use of materials to the overall material use. The overall material use is measured by summing up the aggregate domestic material consumption (DMC) and the circular use of materials. DMC is defined in economy-wide material flow accounts. The circular use of materials is approximated by the amount of waste recycled in domestic recovery plants minus imported waste destined for recovery plus exported waste destined for recovery abroad. Waste recycled in domestic recovery plants comprises the recovery operations R2 to R11 - as defined in the Waste Framework Directive 75/442/EEC. The imports and exports of waste destined for recycling - i.e. the amount of imported and exported waste bound for recovery – are approximated from the European statistics on international trade in goods. A higher circularity rate value indicates means that more secondary materials substitute for primary raw materials thus reducing the environmental impacts of extracting primary material.

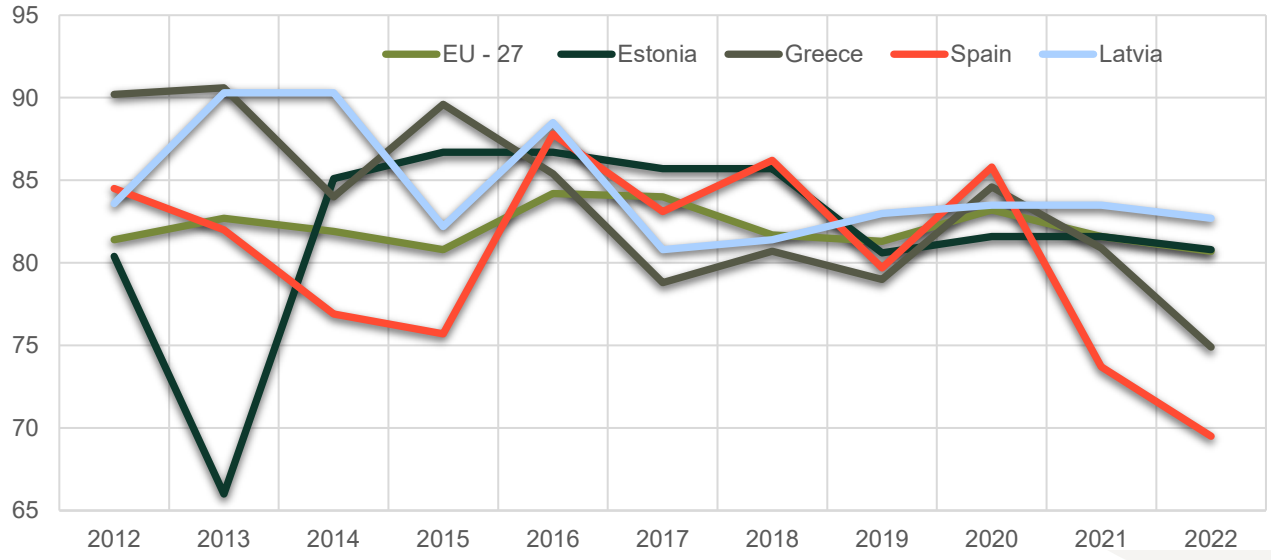
Figure 4 Circular material use rate (%)



Source Circular material use rate [cei_srm030], Eurostat 2024, authors calculations

Figure 5 presents the recycling rates of Waste Electrical and Electronic Equipment (WEEE) separately collected across the European Union (EU) and selected member states (Estonia, Greece, Spain, and Latvia) between 2012 and 2021. The indicator is calculated by dividing the weight of waste of electrical and electronic equipment (WEEE) that enters the recycling/preparing for re-use facility by the weight of all separately collected WEEE (both in mass unit).The EU average recycling rate fluctuated slightly over the period, starting at 81.4% in 2012 and ending at 80.7% in 2022. Estonia showed stable performance, consistently maintaining high recycling rates, with values ranging from 80.4% to 86.7% over the years. Greece, while initially leading with rates above 90%, experienced a notable decline by 2022, dropping to 74.9%. Spain showed a sharp decrease in recycling performance, with its rate falling from 84.5% in 2012 to 69.5% in 2022. Latvia exhibited stable performance overall, with recycling rates hovering around 83-90%, ending at 82.7% in 2022.

Figure 5 Recycling rate of waste of electrical and electronic equipment (WEEE) separately collected

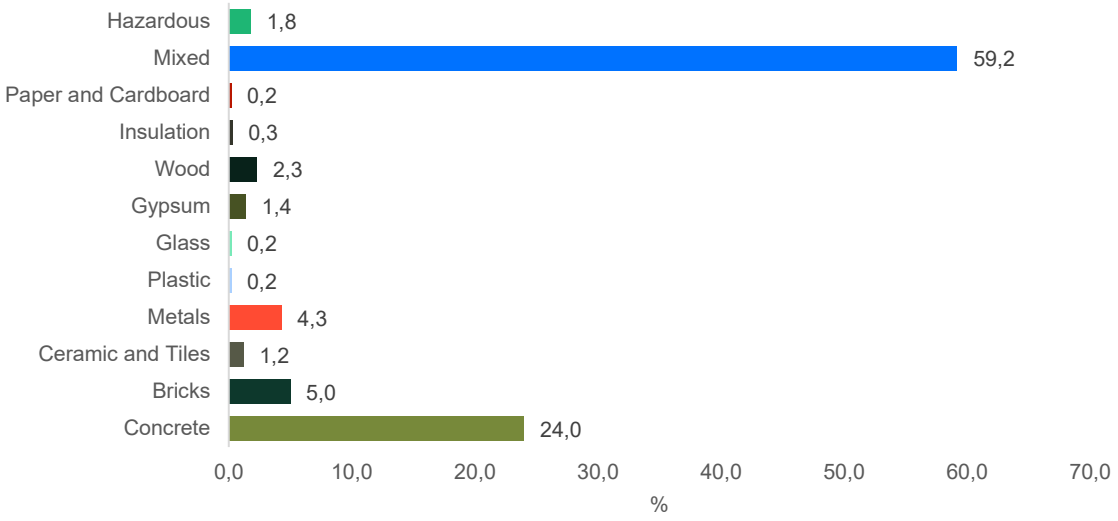


Source 1https://doi.org/10.2908/CEI_WM060, Eurostat (2024), authors work

2.2 EU Policy on CDW Management

Construction and Demolition Waste (CDW) is the largest waste stream in the EU, which accounts for almost 40% of all waste generated in EU (Padilla et al., 2018; Garcia et al., 2024). Expanding the construction sector leads to a corresponding increase in construction materials use. In addition, the construction sector is driven mainly by investment needs (OECD, 2019). In 2020, demolition and renovation were responsible for 83% and 17% of material flows respectively, whilst the corresponding percentages for 2050 are expected to be 87% and 13% (García et al., 2024). CDW is composed of different waste fractions and materials registered under specific codes according to two main coding systems applied within the EU: the List of Waste (LoW), which is administration-oriented, and the European Waste Code Statistics (EWC-Stat), which is substance-oriented. Waste types can be converted from one coding system to the other. The average composition of CDW is presented in the following figure (Damgaard and Lodato, 2022):

Figure 6 CDW composition in EU



Key legislation in CDW management is the Waste Framework Directive, which sets the basic concepts and definitions related to waste management and prescribes Member States to achieve the target of 70% of CDW being recovered by 2020 (Padilla et al., 2018). Also, the EU adopted the Circular Economy Action Plan (CEAP) in 2020, which is one of the main building blocks of the European Green Deal and aims to stimulate Europe's transition towards a circular economy. Meeting EU Waste Framework Directives (Directive 2008/98/EC), national policy regulations and accompanied guidance documents (EU Construction and Demolition Waste Management Protocol, Guidelines for audits before demolition of building, Circular Economy-Principles for building design) on CDW management and sustainable development (2020 Circular Economy Action Plan, EU Soil Strategy for 2030), contributes to the development of circular economies. The main objective of waste management policies is to limit climate change through a better exploitation of critical resources embedded into obsolete products. According to European Commision's ETC CM report 2024/01, GHG emissions from material extraction, manufacturing of construction products, and construction and renovation of buildings are estimated at 5-12% of total national GHG emissions, whilst a greater material efficiency could save 80% of those emissions. According to **Figure 6**, concrete is a dominant fraction of CDW. Cement is a building agent used for the production of concrete. The cement industry alone contributes to 7% of global CO_2 emissions due to the nature of the cement production process (Purchase et al.,

2021). The main changes introduced in the management/reporting of CDW by the amended WFD as of 2018 consist of:

1. A revised definition of backfilling, to further clarify the distinction between backfilling and other recovery operations, notably recycling
2. An increased frequency of reporting to the Commission via Eurostat (2 years instead of 3)

At the moment, police are more focused on supporting environmental protection and resource efficiency than considering the economic sustainability of actors involved in the CDW management sector. In addition, there is a lack of control measures to avoid the risk of increasing illegal waste, supply chain management is insufficient and poor practices are applied within source segregation and selective demolition. Moreover, in many countries the "mixed CDW" fraction is high. The CE of CDW is a 4R solution focusing on Reduce-Reuse-Recycle-Recover operations of raw materials and with greater application of reuse, recycle and recover operations, the procurement of raw materials becomes slow and/or stagnant, which not only brings economic benefits but also reduces the amount of GHG emissions resulting from procurement and supply chain activities (Purchase et al., 2021). In the following table, the contribution of the construction industry to environmental degradation is presented according to Karachaliou and Paralika (2019).

Table 1 Contribution of the construction industry to environmental degradation

Global Resources		**Global Pollution**	
Resource	**Building use** (%)	**Type of pollution**	**Building related** (%)
Energy	50	Air quality	24
Water	42	Global warming gases	50
Materials	50	Drinking water pollution	40
Agricultural land loss	48	Landfill	20

Due to the environmental burden of CDW, social factors associated with their effect on delaying the transition towards more sustainable cities and communities (SDG 11) constitute a primary area impacted (Papamichael et al., 2023). CDW can lead to safety hazards for workers and nearby communities, causing accidents or injuries while unsightly and unsanitary conditions, causing a decline in property values and negatively impacting tourism and local economies as well as the quality of life of close-by residents (Papamichael *et al.*, 2023). Table 2 depicts the barriers to the implementation of circularity in CDW management and Table 3 depicts the drivers for the implementation of circularity in CDW management (Gherman *et al.*, 2023):

Table 2 Barriers in implementation of circularity in CDW management

Category	**Barriers**
Environmental	Lack of storage species in reverse logistics, adaptive use and deconstruction site access limitations
	Health and safety risks from contaminated materials
	Emissions from transport and reconditioning for 3R and prefabrication
Economic	Undeveloped market for recycled materials
	High or equivalent cost of secondary material compared to primary materials
	High purchasing costs for circular materials
	Low cost of landfilling
	Costs of labor and time-intensive nature of deconstruction and reuse
	High upfront investment costs
	Limited funding for circular projects
	Profit-driven decision-making

Category	Barriers
Cultural	Lack of awareness and demand
	Cultural resistance of the stakeholders
	Lack of systematic vision regarding sustainable buildings, reverse logistics, DfD
	Uncertainty regarding quality of recycled materials
	Lack of awareness about the benefits
Organizational	Lack of information, experience and skills
	Lack of partnership networks between stakeholders
	Operating in a linear system
	Limited top management commitment and support for circularity
	Lack of time and human resources
	Poor partnership with the supply chain
Technical	High costs for new technology
	Lack of tools for material recovery
	Lack of circular design guidelines
	Lack of an information exchange system
Regulatory	Lack of standardization
	Lack of global consensus about CE
	Limited circular procurrment
	Uncertainty regarding future legislation

Table 3 Drivers for implementation of circularity in CDW management

Category	Drivers
Environmental	Scarcity of landfill sites
	Reduction in use of virgin material
	Energy and carbon footprint reduction
Economic	Funding for circular projects
	Circular business model
	Financial incentive to use circular or secondary materials
	Lower costs for recovery actions
	Development of secondary material market
	Increased landfilling costs
Cultural	Social awareness
	Education, training and workshops
	Awareness-raising event and projects
	Increased awareness of the benefits of the CE in CDW management
Organizational	Commitment and support from the management
	High priority on circularity within the organization
	Collaboration between stakeholders
	Promoting the green image of the companies
	Intergrating CE principles in the design phase
	Availability of storage space
Technical	Development of tools and guidelines (collection and separation)
	Development of enabling technologies
	Development of digital marketplace for secondary materials
	Development of circular procurement system
Regulatory	Global agreement on regualtions
	Waste management directives
	Policy support
	Circular economy legislation

According to Garcia et al. (2024), recycling and preparing for reuse are preferred over incineration and landfilling in EU countries for most of the individual material fractions of CDW because of the associated environmental benefits. The most widely currently applied recycling practice for CDW is crushing to secondary aggregates (Zhang *et al.*, 2020). Besides excavated soils and dredging spoils, 83% of CDW can be sent for reuse and recycling (Garcia et al., 2024). Thus, preparing for reuse should be promoted along with recycling to maximise potential environmental and economic benefits. The average recovery rate for CDW in the EU is currently 89%, higher than the 70% by-weight goal set for 2020 in EU countries (Garcia et al., 2024). According to CEAP (2020), the annual waste generation in the European Union is expected to increase by 70% by 2050. By 2020, the preparation for reuse, recycling and backfilling of non-hazardous construction and demolition waste in the list will be increased to a minimum of 70% by weight in all Member States. After its recovery, CDW is used as filler material in road construction or as backfilling material (downcycling). In 2018, 73 million tons of CDW remained to be recycled to reach the 70% recovery target at EU level (Padilla et al., 2018). Caro et al. (2024)reported that the recovery rate of CDW in Europe is at 89%, whilst huge variations can be observed among countries. Many of CDW individual fractions are not available for recycling because of poor demolition and collection practices or, if potentially available, may simply not be recycled in the local market due to economic constraints or market failures. Potential economic and non-economic barriers to recycling CDW in the EU include the following (Caro et al., 2024; García et al., 2024):

- Perceived high cost of recycling relative to other treatment options such as incineration and landfilling
- Lack of local buyers
- Regulatory impediments (chemical composition, safety requirements)
- Competition with low-cost products stemming from primary materials that not always internalize their externalities

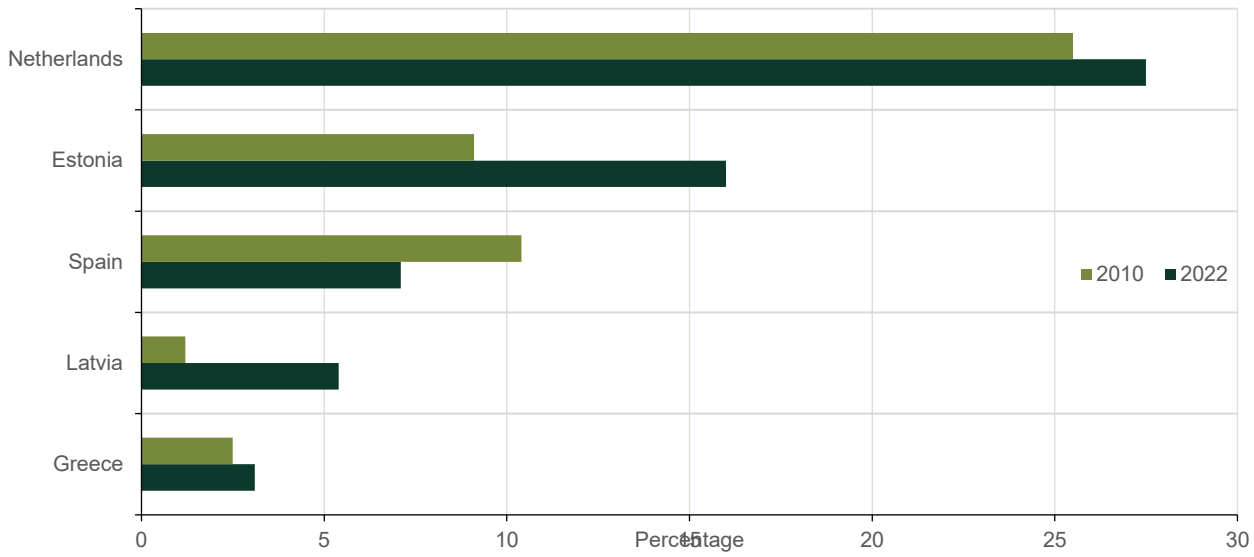
A major barrier towards recycling of CDW is the lack of confidence in the quality of recycled materials (European Commission, 2016). A circular model that enables materials to be recycled, reused or remanufactured, thereby extending their life cycle, is essential for achieving smooth transitions towards cicruclarity while accounting for environmental factors, such as waste generation, societal factors, such as job opportunities, and economic factors, such as revenue from circularity activities (Papamichael et al., 2023). According to Caro et al. (2024), recycling of CDW in EU with advanced technologies could save 264 kg CO_2 eq t^{-1} with a cost of 25 t^{-1}. According to the researchers, recycling performs better than landfilling and incineration for most CDW fractions, whilst the highest GHG savings are observed when metals are recycled. It is worth mentioning that for the majority of GDW material fractions, recycling technology exists today. However, in terms of cost, and in particular for advanced pathways, recycling is generally more expensive than landfilling and incineration. In order to achieve high CDW recycling in line with the CEAP, increased and improved CDW recycling infrastructure is needed. High quality recycling relies mainly on effective separate collection of waste. The European Commission has published the EU Construction and Demolition Waste Management Protocol to support EU members reach the targets of the Waste Framework Directive. The protocol suggests that local, regional and national governments should prepare Integrated Waste Management Strategies which will include the following (European Commission, 2016):

- Involve stakeholders from the local construction industry, main developers, associations, NGOs and relevant public administration departments, including regional organisations.
- Prioritize waste prevention through several mechanisms oriented at the construction industry.

- Establish minimum waste sorting and management requirements in construction sites of a certain size.
- Identify and quantifies future flows of wastes and establishes monitoring mechanisms.
- Calculate total costs and the impact of its implementation.
- Establish objectives for recycling in 2020 with appropriate monitoring mechanisms and, in some cases, enforcement mechanisms.
- Aim to provide clear guidance, especially for SME and very small producers.
- Identify and quantifies collection and treatment needs.
- Identify recycling opportunities and provides realistic frameworks for industry for its implementation.

All waste generation has social, economic and environmental impacts associated with it, as well as a loss of valuable materials and resources for the economy. Total global GHG emissions are projected to reach 75 Gt CO_2 eq by 2060 of which materials management would constitute approximately 50 Gt CO_2 eq (OECD, 2019). Environmental costs for recycling stem mainly from the recycling process itself, sorting and selective demolition when applicable (Caro et al., 2024). So far, policy efforts are required from each country to reach the goals set on reducing GHG emissions and increasing circularity and environmental sustainability.

Figure 7 Circular material use rate in Netherlands, Estonia, Spian, Latvia and Greece (2010 and 2022)



It is obvious that in most cases, except for Spain, the circular material use has increased in the upper coutries during 2010-2022.

3 National CDW management and policy status

3.1 Driving policy change

In 2019, OECD published a report which included policy guidance to increase CDW management efficiency (OECD, 2019). Countries need to apply mixes of policy instruments that ensure a coherent set of incentives for resource efficiency along the product value chain. In addition, implementing policies that promote resource efficiency across the lifecycle of products is necessary, combined with treating resource efficiency as an economic policy challenge and integrating it into cross-cutting and sectoral policies. Lastly, strengthening policy development and evaluation through better data analysis is also important. In this section the cases of Grece, Spain, Estonia and Latvia are presented as far as CDW management is concerned. Developing or promoting CDW management policies should undergo a three-step process, including assessment, prioritization and evaluation. The first step is assessing each country's national context to determine the current state of CDW management and identify the materials and systems with the greatest potential for reduction or diversion. The second step is about establishing goals and selecting a short list of strategies and policy measures that are most closely aligned with each country's priorities, needs and context. The final step is about evaluating the potential benefits and impacts of each policy and deciding on a path forward.

3.1.1 GREECE

In Greece, Law 4042 of 2012, is the legislative framework for waste management. In 2010, the government enforced the Joint Ministerial Decision 36259/1757/E103 to stipulate measures, conditions and programmes for the alternative management of excavation and CDW. Currently, the National Waste Management Plan is in a final draft version. However, administrative regions have adopted their own regional Waste Management Plans. In addition, a Waste Prevention Plan has been published since 31 December 2014. In the country, private land/allotments are used for the purpose of dumping CDW by their owner for a price and thus diverting CDW away from CDW management systems. In general, recovery/recycling costs for CDW are high and the same applies for the establishment of treatment facilities. Best practices on CDW management include: a) the Hellenic Recycling Agency monitoring the operation of existing CDW alternative management systems, b) the obligation of the officially licensed CDW management systems to report data regarding CDW management, c) inexistence of an effective policy for the use of recycled materials and d) no obligations for recycled materials or recycled content in construction materials. Key opportunities in the CDW management sector include: a) the fact that about 40% of the Greek population is not covered by any system of alternative CDW management, b) local community action, taking matters in its hands, c) recycling of CDW comprises thriving new business opportunities in small communities and d) rising conscience among the public about the need of sound environmental management and sustainability issues in general. Last but not least, in Greece the letter of guarantee is required by the building and urban planning authorities in order to make sure that the management of CDW will comply with existing legislation and it amounts to 0.2% of the total project budget for excavation and construction works and 0.5% of the total project budget for demolition.

At the moment recycling in Greece is highly uneconomical since the market price for recycled secondary mateirals in Greece has an upper limit of 4€/t. According to, the 2012 and 2015 national targets on CDW management were not achieved and it was reported that there is lack of reliable data on CDW generation and treatment and therefore it is difficult to monitor the performance of CDW management in Greece. Moschen-Schimek et al. (2023) reported that Greece achieved the targeted

recovery rate of CDW set by EU. The CDW recovery rate of Greece was 0, 0, 0, 88, 97 and 100% in 2010, 2012, 2014, 2016, 2018 and 2020 respectively (Cristobal Garcia et al., 2024). According to Figure 2, Greece has increased its circular material use rate by 24% from 2010 to 2022. Paralika and Karachaliou (2019) reported that there is a large network of licenced collectors-carriers of CDW, capable of meeting the country's needs, an absence of licenced landfills for the disposal of CDW treatment residues and no official listing of inactive/abandoned quarries that could be backfilled with CDW waste for restoration purposes. In the following table, certain obstacles in CDW management in Greece are present according to a report prepared by *The SwitchMed Initiative* for Greece:

Table 4 Barriers in CDW management in Greece

General economic context and investment climate	**Economic difficulties stemming from the debt crisis**
	Low level of private investment in green/circular businesses
	Tourism as the coruntry's main economic driver
General political context	Delays in implementation and failures in actual implementation of the EU legal framework on circular economy
	Existence of contradictory legislations and regulations
	Lack of law enforcement and absence of sufficient audit mechanisms
Policy and Regulatory	Lack of criteria for end-of-life waste and technical standards on secondary products and raw materials that produce waste
	Environmental policy still focuses on encouraging the use of renewable energy and adopting energy efficiency measures
Subsidies and fiscal benefits	Subsidies available are highly dependent on European structural funds
Knowledge and awareness about CE	Poor consumer awareness to circular and green products
	Lack of awareness around business opportunities associated with circular business models
Consumer demand	Purchasing power has been decreasing, and Greek consumers are extremely price-conscious
Public-private partnerships	Most of PPP projects in the country have been funded through the European Fund for Strategic Investments
Support programs or platforms for green and circular businesses	Most programmes rely mainly on European funding
Professional training and education on CE	Currently lack of knowledge and skills needed for the development of circular and sustainable bussinesses
	R&D still deply depends on European funds
Specific economic sectors	Major structural problems with waste management
Other socio-cultural factors	Major gender equality issues
Other commercial or legal challenges	Non transparent and deficient licencning regimes for circular economy activities
Available technologies and infrastructure	Great dependency on imported technology and know-how

Greece's waste management policies and broader environmental strategies highlight both progress and persistent challenges. While the country has implemented frameworks like Law 4042/2012 and the Joint Ministerial Decision 36259/1757/E103 for managing waste, including construction and demolition waste (CDW), significant gaps remain. These include a lack of reliable data, high recycling costs, and limited infrastructure, compounded by weak law enforcement and reliance on EU funding. The National Waste Management Plan, although in draft form, provides a foundation, while regional waste management plans and local initiatives attempt to fill policy voids. The Long-Term Strategy (LTS) complements these efforts by targeting climate neutrality by 2050 through ambitious greenhouse gas reduction and renewable energy goals. However, fragmented implementation, inadequate public consultation, and the absence of legally binding targets hinder progress. The recovery rates for CDW have improved, reaching 100% by 2020, but issues such as inadequate licenced landfills and lack of policies promoting recycled materials persist. Addressing these systemic barriers and integrating CDW management into broader circular economy objectives is essential for Greece to achieve its environmental and sustainability goals (Ricardo Energy & Environment, 2020a).

3.1.2 SPAIN

The Spanish government issued the 2007-2015 Integrated National Plan for Waste, the 2007-2015 National Plan on Construction and Demolition Waste (II PNRCD) and the 2015-2020 State Waste Framework Plan (PEMAR) with a specific section on CDW including qualitative and quantitative targets. One of the objectives in the PEMAR is to include environmental costs within the cost for natural aggregates in order to make recycled aggregates more competitively priced. Moreover, an Integrate Waste Plan for CDW was enforced in Madrid. Landfill tax and gate fee exist in the country, whilst the Baleares regional waste plan is also enforced. The National - Royal Decree 105/2008 is about obligation for the waste producer to include a document outlining how CDW will be managed throughout the project's duration. A mandatory deposit is required by law prior to demolishing buildings, which is reimbursed after proving lawful management of CDW. In addition, it outlines the separation fractions per waste flow and states that hazardous waste must be collected separately from nonhazardous waste. In the Aragon region the Decree 262/2006 is enforced regarding CDW management and recovery of debris not from construction and home repair. This outlines an obligation for selective demolition; however, Article 12 indicates this can be waived if the financial costs outweigh the environmental benefits.). Key best practices in Spain include: a) a best practice interactive portal aimed at SMEs, b) best practice documents illustrating best practices of C&D Building Waste management, c) a guide to Recycled aggregates originating from CDW, d) the fact that various working groups have been established to address the topic of recycled aggregates, e) research focusing on the development of new products (e.g. panels, wood-plastic composites) by using fibers from wood CDW and there are already products on the market. However, the recyclability of these products needs also to be assessed, especially if the wood fibers are mixed with other materials, and f) experimental analysis on identifying effective indicators to quantify total waste generation on construction site in each site and for different material categories. Key opportunities in the country include: a) important C&D waste actors which are involved in legislation process, b) the fact that the number of permanent treatment sites is higher than landfills or transition platforms that could potentially host a favorable climate for recycling, c) the fact that regions have the freedom to develop their own waste laws or plans; this facilitates better design and uptake, according to regional needs, d) potential opportunity for non-legislation initiatives after the economic crisis drastically lowered the amount of CDW generated, e) standards for recycled CDW under discussion at the Ministry level and f) the fact that Green Public Procurement it is a currently discussed topic on the

national scale. A positive driver towards promoting regulations consists of a mandatory financial deposit, required by law prior to demolishing buildings. Upon proving that the demolished building's CDW was lawfully managed, the deposit is reimbursed. While this system facilitates good management, as financial incentives are set in place, tighter monitoring needs to be set in motion in order to ensure that all actors are following through. At this stage, it is not clear whether this deposit scheme functions.

In Spain, the high volume of CDW generated is accompanied by a low recycling rate (Colmenero Fonseca *et al.*, 2023). In 2018, the total CDW which was recycled corresponded to 38.7%, being far away from the 70% goal set by EU until 2020. Moschen-Schimek et al. (2023) reported that Spain achieved the targeted recovery rate of CDW set by EU. The main issues emerge from the nonstrict rules and the lower prices for the raw materials used in construction-related activities. Spain set in force the Spanish Circular Economy Strategy in 2020, detecting the construction and demolition sector as one of the priority sectors for action. In addition, the country has set in force the State Framework Plan for Waste Management and Law 22/2011 on waste and contaminated soils. The main objectives of these policies are to regulate waste management, promote waste prevention activities and reduce negative impacts on human health and the environment. Many communities of Spain have also launched environmental plans and strategies promoting the circular economy. It is worth noting that 54% of Spain's waste (40% of which is CDW) is sent to landfills, a percentage significantly higher than the average EU value (Colmenero Fonseca et al., 2023). This fact indicates the sustainability gap between Spain and other EU countries. Financing in the CDW management sector is a significant issue due to the enormous costs of fixed waste management systems. Goverments can incentivize using recycled CDW at all levels. Research should focus on the life cycle of materials, not just the use of recycled materials but also on regulations and guidelines that promote the ability to design dismantled buildings so that they have a high rate of discarded reuse at the end of their useful life (Colmenero Fonseca et al., 2023). Measures to improve the value chain and sustainable waste management that consider the environmental impact (Colmenero Fonseca et al., 2023):

- ✓ Raw material extraction: Extracting materials from a local site is recommended to make this step more sustainable. Therefore, the environment is preserved.
- ✓ Manufacturing of different materials: This process plays a vital role. In this stage the materials can be chosen by their ecological impact on the environment, along with using recycled materials.
- ✓ Transportation: The impact of this activity can be mitigated by reducing the distance between different points, which also allows for the usage of local materials.
- ✓ Construction: This step is one of the most important, as it can significantly impact waste management. Once the waste is produced, it should be classified on-site and redirected to a proper waste recovery sector, depending on the category.
- ✓ Refurbishment: This stage occurs once the building has been constructed and requires repair of those materials. Many recycled materials can be inserted through this stage, improving the sustainable chain regarding C & D waste.

According to Figure 2, Spain has decreased its circular material use rate by 32% from 2010 to 2022. The CDW recovery rate of Spain was 65, 84, 70, 79, 75 and 73% in 2010, 2012, 2014, 2016, 2018 and 2020 respectively (García *et al.*, 2024). The main obstacles in CDW management in spain as described in SCP/RAC (2020) are the political instability along with the strong economic contractoion (2020-2021) estimated at 10,6%, the independence of the Autonomous Regions and the limited regulation to incentivize sustainable behaviours

Spain has implemented various policies and strategies to enhance waste management and promote sustainability, particularly focusing on construction and demolition waste (CDW). Key initiatives include the 2007–2015 Integrated National Plan for Waste, the II National Plan on Construction and Demolition Waste (II PNRCD), and the 2015–2020 State Waste Framework Plan (PEMAR), which aims to make recycled aggregates more competitive by internalizing environmental costs. Spain's approach also includes mandatory deposits for CDW management, regional waste management plans, and specific decrees such as Royal Decree 105/2008, which outlines requirements for CDW documentation and separation of hazardous waste. Despite these efforts, Spain faces challenges, including a high reliance on landfills, limited recycling rates (38.7% in 2018), and low enforcement of sustainable behaviours due to non-strict regulations.

The Spanish Circular Economy Strategy launched in 2020 prioritizes construction and demolition sectors as critical areas for improvement. Regional autonomy allows tailored waste management strategies, yet it also creates regulatory inconsistencies. While Spain achieved EU recovery rate targets, the overall circular material use rate declined by 32% between 2010 and 2022. Research and innovation in recycled materials, sustainable construction practices, and value chain optimization are promising areas for improvement. Addressing economic constraints, improving regulation, and fostering investment in sustainable infrastructure will be essential to bridging the gap between current practices and EU circular economy goals (Ricardo Energy & Environment, 2020b).

3.1.3 ESTONIA

The Estonian government launched the National Waste Management Plan for the period 2014-2020 and the recovery rate of CDW was 72% in 2011. Although Estonia adopted the Waste Act (RT I 2004, 9, 52) and its subsequent amendments (the most recent being the one in 2015), no specific rules for CDW were included. At the moment there are standards for recycle aggregates. The Environmental Charges Act (RT I 2005, 67, 512) describes the conditions under which the landfill operators should pay landfill tax to the State for receiving waste in landfills. The government applies waste management rules locally and has issued standards for recycled aggregates. The government issued also a pollution charge (landfill tax) applied to all waste being disposed in landfills and lower gate fees for separately collected CDW than for mixed CDW. The Estonian government also issued significantly lower charges for asbestos-containing waste in order to discourage illegal dumping of this waste. Best practices on CDW management include: a) Construction and demolition companies must submit CDW management plan to local authorities, b) Landfilling is an expensive option and as a result services providing recovery and recycling option are well developed, c) Mineral resource extraction tax, d) Local waste management rules in municipalities, e) well developed Waste Register database (JATS), f) The Estonian Waste Management Association has been granted financing through the Enterprise Estonia for development a project crushed concrete as constructions material (recycling of aggregates). Key opportunities in the CDW management sector include: a) financial support through for demolition projects of the obsolete Soviet era military, industrial and collective farms (agricultural) buildings if demonstrate separate collection in the demolition project and that CDW is handled according to the waste hierarchy, and b) CDW management has been increasingly elevating the steps of the waste hierarchy over the recent years and currently the recovery performance is high. As far as the Estonian recycling cluster is concerned, the Estonian Recycling Cluster and the Estonian Waste Recycling Competence Centre were developed by the Estonian Waste Management Association (EWMA) and has 40 members (private waste management companies). The cluster's

mission is to stand for the common interests of the members and to develop waste management by the general principles of sustainable development which are about to increasing the amounts of waste recycled, producing from waste, products compliant to quality standards and certified, increasing production capacity and volumes, joint marketing, sales of the products-services and export and international competitiveness.

Moschen-Schimek et al. (2023) reported that Estonia achieved the targeted recovery rate of CDW set by EU. The CDW recovery rate of Estonia was 96, 96, 98, 97, 95 and 93% in 2010, 2012, 2014, 2016, 2018 and 2020 respectively (Cristobal Garcia et al., 2024). According to Figure 2, Estonia has increased its circular material use rate by 76% from 2010 to 2022. According to European Commission's factsheet (2015) on Construction and Demolition Waste Management in Estonia, the main obstacles to sustainable CDW management and the barriers and obstacles to increasing CDW recycling in Estonia are presented in the following Table 5:

Table 5 Barriers and Drivers to increase CDW recycling in Estonia

Barriers
Rules on CDW management are not kept all the time
Underdeveloped on-site source separation
Illegal dumping
Limited recovery options for CDW
CDW treatment follows market dynamics and not waste hierarchy
Considering recycled CDW as lower quality material
Unreported amounts of CDW
Unspecified treatment method
Discrepancies in CDW backfilling data
No market for recycled CDW, except from metals
Low resource tax on natural materials
Most part of CDW is used for backfilling operations
Lack of GPP criteria for recycled material content in new construction projects
Ineffective source separation and sorting of CDW
Construction requirments have not been adopted to recyclable CDW
No EoW criteria for inert CDW
No treatment of gypsum based materials and sheet glass exist
Wood CDW is used exclusively for energy recovery
Drivers
Existance of comprehensive national legislation
Local government waste management rules include specific provisions for the management of CDW in practice
Source separation of CDW on-site
Target in the Waste Management Plan of Estonia is set at higher level than that defined in the WFD for recovery of CDW
Generally sufficient inspection procedures
Fines administered to CDW management rules violators
Sufficient network of treatment facilities
The Estonian Recycling Cluster supports waste companies in improving their techniques and producing higher quality recycled materials.
Commercial engagement of private waste management companies in the collection and treatment of CDW, in response to policy obligations
The Environmental Investment Centre is providing financial support to projects in relation to sound environmental management of CDW, following the waste hierarchy
Obligation of the legally permitted CDW management companies to report data regarding CDW management by waste code (according to the European List of Waste) for both the receiving quantities and the treated quantities, indicating the final destination of CDW, R-D codes.
Well-developed Waste Register database (JATS) including very detailed data on CDW generation, treatment, exports and imports by waste code

Eurostat guidelines on CDW data reporting
Pollution charge
Well developed recovery and recycling options
Lower charges for asbestos-containing waste
Lower gate fees for separately collected CDW than for mixed
Good market of CDW metals
Strong competition in the waste management sector which lowers the cost of CDW management
The Waste Recycling Cluster boosts the image of recycled aggregates
If the generation of CDW in a construction/ demolition project is more than 10m3 then the contractor is obliged to submit a plan for appropriate treatment options to the Local Authority Environment Department
Demolition works are usually done at a good technical level.
Research projects on the application and quality of recycled aggregates
The Estonian Recycling Cluster supports waste companies in improving their techniques and producing higher quality recycled materials

Estonia's approach to environmental sustainability and waste management is guided by its Long-Term Strategy (LTS), which aims to reduce greenhouse gas (GHG) emissions by about 80% compared to 1990 levels by 2050. The strategy covers all major sectors except LULUCF and international aviation and maritime emissions, with the remainder of emissions expected to be compensated through enhanced carbon sequestration. Key features include the promotion of renewable energy, with wind and biomass anticipated to contribute significantly to energy production, and efforts to improve energy efficiency through infrastructure renovation and building modernization.

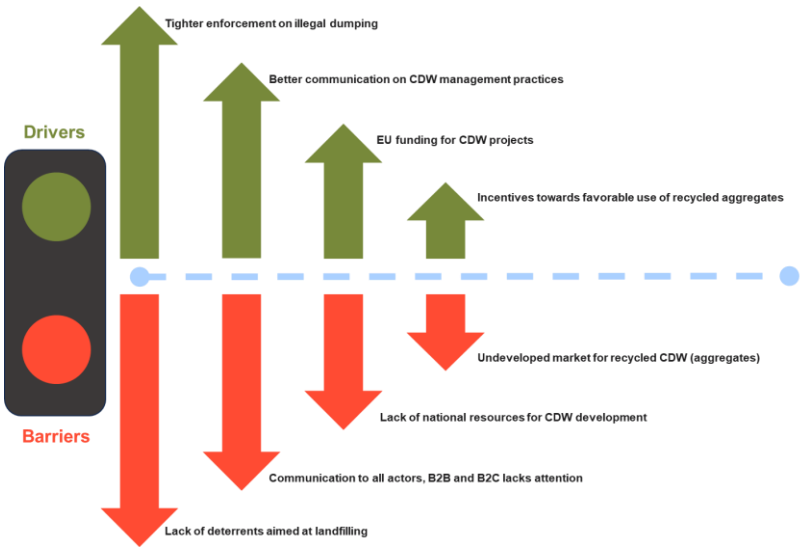
The LTS outlines several scenarios and roadmaps for different sectors, such as energy, agriculture, and waste, with GHG reduction targets set for 2040 and 2050. Adaptation policies are integrated through the “Climate Change Adaptation Development Plan until 2030.” Despite these efforts, challenges remain, such as limited public consultation, gaps in renewable energy projections, and insufficient data on emissions reductions for specific sectors. Investments in renewable energy and sustainable infrastructure are highlighted as essential steps to achieving these goals, though no comprehensive estimate of total investment needs is provided. Estonia's strategy underscores the importance of balancing economic development with climate neutrality while addressing structural challenges to transform its energy and waste management sectors effectively (Ricardo Energy & Environment, 2019).

3.1.4 LATVIA

In Latvia, waste management is implemented at the national, regional, and local levels. However, there are no legal acts or planning documents that specifically regulate CDW management. In 2006, the State Waste Management Plan was adopted in 2006, and was reviewed for 2013-2020, whilst in 2010 the Waste Management Act was announced. In addition, the Green Procurement Promotion Plan has been enforced along with tighter enforcement on illegal dumping and the introduction of stricter landfill costs. Best practices on CDW management include the guidelines on the promotion of environmentally friendly construction. Guidelines have also been published on the promotion of green procurement in state and municipal institutions, geared towards six groups of goods and services outside the scope of CDW, along with guidelines on the promotion of environmentally friendly construction including a) design, construction, operation of buildings and demolition phases and b) outline of possible environmental criteria relating to: energy consumption, renewable energy resources, construction and materials used in products, waste management and water management, environmental impact, architectural experience, and monitoring. Key opportunities in the country

include a) an organized hierarchy that could potentially facilitate waste management (i.e. MoE & regional authorities), b) EU funding for CDW projects and c) incentives towards favourable use of recycled aggregates.

Latvia has made some progress in decoupling economic growth and environmental pressures such as GHG emissions, and most air pollutants. Waste management is included in the Sustainable Development Strategy of Latvia to 2030 and the Latvian National Development Plan 2021-2027. According to the aforementioned documents and reports, Latvia aims to create a sustainable waste management system to increase recycling waste by more than 80% by 2030. Low-carbon, resource-efficient and climate-sustainable development enables Latvia to achieve national goals in climate change mitigation, energy, reduction of air and water pollution, and in waste management. In the Latvian National Development Plan 2021-2027, it is mentioned that action is needed to improve waste sorting and recycling. According to OECD's report on Latvia, low-value recovery remains for CDW whislt no sustainability criteria are in place beyond those required by the EU. Moschen-Schimek et al. (2023) reported that Latvia achieved the targeted recovery rate of CDW set by EU. The CDW recovery rate of Latvia was 92, 98, 97 and 99% in 2014, 2016, 2018 and 2020 respectively (Cristobal Garcia et al., 2024). According to Figure 2, Latvia has increased its circular material use rate by 350% from 2010 to 2022. According to European Commision's factsheet (2015) on Construction and Demolition Waste Management in Latvia, the main obstacles to sustainable CDW management and the barriers and obstacles to increase CDW recycling in Latvia.



The amount of generated CDW is routinely considered as an indicator for comparing waste management performance across different coutries and it is influenced by several factors such as gross domestic product (GDP), population and CDW-related regulatory measures (Osmani and Villoria-Sáez, 2019). The key performance indicators on CDW management are presented as far as Greece, Spain, Estonia and Latvia are concerned.

Table 6 Key performance indicators in Netherlands, Greece, Spain, Estonia and Latvia

Country	CDW						
	Total	Hazardous	Non-hazardous	backfilled	landfilled	Imported	exported
	tons/million turnover			(%)			
Greece	72.5	0.3	72.2	0	99.6	-	0.08
Spain	236	0.9	235.1	15.8	15.9	0.08	0.03
Estonia	127.9	1.8	126	21	3.6	-	0.42
Latvia	103	0.1	102.9	0	4.3	-	-

	Backfilling definition	EoW criteria	Green Public procurement	Pre-demolition audits	Landfill taxes
Greece	yes	no	no	no	yes
Spain	yes	no	no	yes	yes
Estonia	no	no	no	no	yes
Latvia	no	no	yes	no	yes

Source: European Commission, 2017

It seems that non-hazardous CDW are a dominant fraction in all five countries and landfill taxes have been enforced in all cases. However, CDW legislation promoting waste divertion, like EoW criteria, is yet to be enforced in almost all cases, except for The Netherlands. The CDW recovery rates of the countries also agree with the five countries' key performance indicators. The differences which can be observed between countries as far as CDW management is concerned are attributed to several reasons, including:

- ✓ Poor data sources and collection
- ✓ No existence of national regulations dealing specifically with CDW
- ✓ Low landfill taxes or bans
- ✓ Small number or inadequate distribution of recycling facilities
- ✓ The cost of primary raw materials
- ✓ The lack of confidence in recycled materials
- ✓ Avoiding the existence of a market for secondary materials

The European Environment Agency dictates that there is a price competition between the virgin materials and CDW. Stakeholders tend to favour cheaper and more credible solutions, and virgin materials are often cheaper than secondary materials due to the latter's processing cost. A competitive secondary materials market would create demand for both quantity and quality of waste material, thus directly increasing circularity. Furthermore, there is a lack of confidence in secondary materials' quality and structural properties. Stakeholders tend to choose virgin materials that are quality-assured by national, European, or international standards. Engaging in the development of standards for secondary raw materials would increase the trust in their properties and quality. Achieving "zero waste" in construction and demolition is difficult, but involving and committing all stakeholders to reduce waste at source and developing efficient waste management strategies by reusing and recycling materials and components could make the difference. Improving CDW management requires adopting a "cyclic" rather than "linear" approach to design and construction. This can be achieved by reengineering current practices to contribute to sustainable waste minimisation. However, for waste minimisation to be effective and self-sustaining, all stakeholders along the construction supply chain must embrace a more proactive approach to dealing with waste. Under this framework, promoting policy change could significantly improve CDW management in the five countries.

3.2 Assessment of these policies in the context of the EU "fit for 55% package".

The construction and demolition waste (CDW) management policies in Greece, Spain, Estonia, and Latvia show varying degrees of alignment with the EU's "Fit for 55%" package. Estonia, with a recovery rate consistently above 90% and a 76% increase in circular material use from 2010 to 2022, demonstrates substantial progress in GHG reduction and landfill diversion. Spain has prioritised CDW through its Circular Economy Strategy (2020) and regional waste management plans, but its low recycling rate (38.7% in 2018) and heavy reliance on landfilling highlight significant challenges. Greece has notably improved CDW recovery rates and increased circular material use by 24%. However, its reliance on private dumping and lack of enforced policies for recycled materials impede full alignment. Latvia, despite lacking specific CDW management regulations, boasts a 350% increase in circular material use and recovery rates exceeding 99%, reflecting effective waste hierarchy implementation.

Data transparency and enforcement remain significant gaps across all four countries. Greece struggles with reliable data collection on CDW generation and treatment, while Spain faces regulatory inconsistencies due to its decentralised system and insufficient market incentives for recycled materials. While performing well in recovery rates, Estonia and Latvia experience challenges in source separation and developing markets for secondary materials, particularly for non-metal CDW. Furthermore, all four countries face barriers in aligning construction and demolition practices with circular economy principles, such as adopting end-of-waste (EoW) criteria or ensuring widespread Green Public Procurement (GPP).

The "Fit for 55%" package offers opportunities to harmonise policies through increased EU funding, shared best practices, and stricter regulatory measures. For instance, developing a competitive market for secondary materials could incentivise recycling, reducing dependence on virgin materials. EU structural funds can provide financial support for building advanced CDW treatment facilities and fostering R&D in material recovery and reuse. Additionally, knowledge-sharing platforms, such as those developed by the Estonian Recycling Cluster, can promote best practices and collaboration between countries to strengthen circular economy efforts.

4 Identification of Gaps and Challenges

4.1 Analysis of potential gaps, mismatches, and challenges in current policies.

In this chapter, we present the gaps and challenges at the national and municipal levels. For the national level, we use the national long-term strategies submitted by Member States. The country tables have been prepared by a team led by the consultancy Ricardo as part of a contract to support DG CLIMA with the assessment of the Long-Term Strategies of EU Member States.[1] Table 8 describes the main gaps and opportunities for national-level strategies. This Table will be used later in the definition of the criteria and the ELECTRE valorisation of the possible policy scenarios at the national and city levels.

Table 7 In between counties gaps in policies

Country	Key Gaps	Opportunities
Greece	- Lack of DRS - Weak enforcement of recycling targets - Low landfill taxes - No PAYT or compost QMS - Low circular material use rate	- Introduce DRS and PAYT - Increase landfill/incineration taxes - Develop compost QMS - Strengthen CE measures
Spain	- Partial DRS implementation - PAYT only in select regions - Low awareness of recycling programs in some areas	- Expand DRS and PAYT nationwide - Strengthen public awareness campaigns
Estonia	- Needs improved selective demolition guidelines - Low quality of CDW recycling	- Improve CDW recycling quality and guidelines - Enhance QMS for recycled materials
Latvia	- No legal acts specifically regulating CDW - No compost QMS - Circular economy principles not fully integrated in construction sector	- Develop legal regulations for CDW - Improve CE integration in construction - Strengthen compost QMS

Based on the baseline studies, that were developed during the WP2, we identify the in-between cities, policies gaps

Table 8 Gaps in Circular Economy (CE) and CDW Management Between Cities

Criteria/Gap	Tartu	Riga	Kavala	Barcelona
DRS (Deposit Refund System)	Not implemented for construction waste; only basic for packaging.	Limited implementation for CDW.	No DRS for CDW.	DRS for some waste categories, but not fully implemented for
Landfill and Incineration Tax Levels	Limited and relatively low landfill taxes	Very low landfill tax; no incineration tax.	Landfill tax in place, but low.	Higher landfill fees, but varies between regions
EPR (Extended Producer Responsibility)	Not well developed for CDW.	EPR present but limited to certain sectors.	Weak EPR systems .	Well developed EPR, especially in packaging
Separate Collection Systems	Incomplete for bio-waste and hazardous CDW	Limited bio-waste collection.	Weak enforcement of separate collection.	Comprehensive system in place

[1] https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en

Criteria/Gap	Tartu	Riga	Kavala	Barcelona
Circular Material Use Rate	Low use of recycled materials	Very low circular material use .	Very low rate of material reuse.	Higher circular material use, but challenges remain
CDW Management Efficiency	Lack of data and infrastructure for CDW	Inconsistent tracking and low recycling .	Limited capacity to manage CDW	Better tracking and recycling infrastructure
Incentives and Economic Support	Limited government incentives	Minimal financial support for CE	Few financial incentives .	More subsidies and grants available for CE initiatives
Innovation and R&D in CDW	Limited innovation and R&D	Few innovative projects	Little innovation in CDW management	Many innovative practices and R&D centers
Barriers to Implementation	Lack of data and infrastructure	Financial and regulatory challenges .	Political and financial barriers	Strict regulations on recycled aggregates

4.2 Impact of these gaps on achieving climate goals and implementing CE measures.

Following the previous analysis and the identified gaps at both the national and municipal levels, we can assume that those gaps could significantly affect the ability of Member States and cities to meet EU climate goals and implement circular economy (CE) measures, especially CDW management.

For example, in Greece, these gaps might impact progress toward achieving the EU's "Fit for 55%" targets and broader sustainability objectives. In more detail, the lack of a Deposit Refund System (DRS) and weak enforcement of recycling targets undermine efforts to reduce waste generation and increase recycling rates. Also, the low landfill taxes fail to discourage landfilling, perpetuating reliance on unsustainable waste management practices. More to say the light or now application of key measures like Pay-As-You-Throw (PAYT) and quality management systems (QMS) for composting inhibits the transition to a circular economy.

In Spain, on the other hand, the partial implementation of DRS and inconsistent PAYT policies across regions result in fragmented efforts to address waste management. In Esthonia, the poor guidelines for selective demolition and low quality of CDW recycling hinder the efficient recovery and reuse of materials. Latvia's absence of legal acts specifically regulating CDW and limited integration of CE principles into the construction sector impede sustainable practices.

The impacts might be different at the city level. For example, in Tartu and Riga, the light landfill taxes and the lack of DRS for construction waste discourage waste diversion and recycling efforts, while the limited incentives for CE projects further constrain the development of sustainable practices.

In Kavala, the weak enforcement of separate collection systems and low circular material use rates restrict the adoption of circular economy practices, while the barriers further limit the implementation of effective CE measures. Despite a relatively higher circular material use rate and better infrastructure, in Barcelona the regional variability in landfill fees and strict regulations on recycled aggregates present challenges.

In total, we could identify some cross-cutting issues, such as limited data collection and monitoring, which undermines the ability to monitor progress and optimize waste management practices. Even though all countries are now speeding to adopt regulations concerning climate change, there are still

some regulatory gaps, such as limited EPR systems and the absence of criteria that restrict the development of markets for secondary materials.

5 Conclusion

In this report, we briefly describe the current situation in the pilot cities concerning the CDW and how to accelerate the circular economy ecosystem. Based on the identified gaps, we will proceed with the formulation of different policy scenarios at both the national and municipal levels so as to provide a roadmap for policy recommendations which will be tailored to their needs. In the second deliverable of the WP5, we will present the scenarios, the methods and the results while we will provide the roadmap for the policy recommendations.

References

Caro, D., Lodato, C., Damgaard, A., Cristóbal, J., Foster, G., Flachenecker, F., & Tonini, D. (2024). Environmental and sociCaro, D. *et al.* (2024) 'Environmental and socio-economic effects of construction and demolition waste recycling in the European Union', *Science of the Total Environment*, 908. doi: 10.1016/j.scitotenv.2023.168295.

Colmenero Fonseca, F. *et al.* (2023) 'Diagnosis of the Economic Potential within the Building and Construction Field and Its Waste in Spain', *Buildings*, 13(3), p. 685. doi: 10.3390/buildings13030685.

Damgaard, A. and Lodato, C. (2022) 'Background data collection and life cycle assessment for Caro, D. *et al.* (2024) 'Environmental and socio-economic effects of construction and demolition waste recycling in the European Union', *Science of the Total Environment*, 908. doi: 10.1016/j.scitotenv.2023.168295.

Damgaard, A. and Lodato, C. (2022) 'Background data collection and life cycle assessment for construction and demolition waste (CDW) management', in. doi: 10.2760/772724.

European Commission. (2016). EU Construction and Demolition Waste Management Protocol

European Union, Publications Office of the European Union, Luxembourg, 2024, https://doi.org/10.2760/721895, JRC135470.

European Comission. (2018). *B DIRECTIVE 2008/98/EC*.

García, C. *et al.* (2024) *Techno-economic and environmental assessment of construction and demolition waste management in the European Union Status quo and prospective potential*. Luxembourg. doi: 10.2760/721895.

Gherman, I.-E. *et al.* (2023) 'Circularity Outlines in the Construction and Demolition Waste Management: A Literature Review', *Recycling*, 8(5), p. 69. doi: 10.3390/recycling8050069.

Karachaliou, T. and Paralika, M. (2019) 'Progress and Challenges in C&D Waste Management in Greece', *International Journal of Environmental Planning and Management*, 5(2), pp. 32–41. Available at: http://www.aiscience.org/journal/ijepmhttp://creativecommons.org/licenses/by/4.0/.

OECD, 2019. Global Material Resources Outlook to 2060, Global Material Resources Outlook to 2060. https://doi.org/10.1787/9789264307452-en.

Osmani, M. and Villoria-Sáez, P. (2019) 'Current and Emerging Construction Waste Management Status, Trends and Approaches', in *Waste*. Elsevier, pp. 365–380. doi: 10.1016/B978-0-12-815060-3.00019-0.

Padilla, P., Eggert Hansen, M., Szuppinger, P. et al. (2018). Development and implementation of initiatives fostering investment and innovation in construction and demolition waste recycling infrastructure. European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. Publications Office. https://data.europa.eu/doi/10.2873/11837

Papamichael, I. *et al.* (2023) 'Construction and demolition waste framework of circular economy: A mini review', *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 41(12), pp. 1728–1740. doi: 10.1177/0734242X231190804.

Purchase, C. K., Al Zulayq, D. M., O'Brien, B. T., Kowalewski, M. J., Berenjian, A., Tarighaleslami, A. H., & Seifan, M. (2021). Circular Economy of Construction and Demolition Waste: A Literature Review on Lessons, Challenges, and Benefits. *Materials*, *15*(1), 76. https://doi.org/10.3390/ma15010076

Ricardo Energy & Environment (2019) 'Assessment of the Long-Term Strategies of EU Member States- Estonia Summary of main findings', (December), pp. 1–2.

Ricardo Energy & Environment (2020a) *Assessment of the LTRS - Greece -Summary of main findings*, *Assessment of the Long-Term Strategies of EU Member States*. Available at: https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en.

Ricardo Energy & Environment (2020b) *Assessment of the LTRS - Spain - Summary of main findings*. Available at: https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en.

SCP/RAC (2020) *Spain : Country Profile*.

Zhang, C. *et al.* (2020) 'Upgrading construction and demolition waste management from downcycling to recycling in the Netherlands', *Journal of Cleaner Production*, 266, p. 121718. doi: 10.1016/j.jclepro.2020.121718.