CREATE Embedding advanced urban material stock methods within governance processes to enable circular economy and cities resilience

Governance context analysis of the 4 Living Labs

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Abstract	The deliverable presents the result of the governance context analysis of the 4 Living Labs of the CREATE project describing the different policy instruments that exist at different level (European, national, local). The policy instruments are classified in 3 different types: legal, economic and `soft` (voluntary use instruments such as networking or pilot project). The description of the governance context of each Living Lab gives a clear overview of the different approach of the implementation of the circular economy in the built Environment but also the common points. Hence, this governance context analysis can be inspiring for each Living Lab and for other European municipalities.
Keywords	Governance context; policy instruments; circular economy; built Environment; France; Sweden; Austria; The Netherlands

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1 INTRODUCTION

Since the last decade, the circular economy has been identified by the European Commission as a key to reduce the environmental impact of the construction sector. This sector is therefore one of the 5 pillars of the Action plan for a circular economy of the European Commission (2019). This Action Plan proposes a regulatory framework and suggests policy interventions that local, regional, and national authorities should implement, giving them a key role in the development of a circular built environment (Ghisellini et al., 2016). In this context, a lot of European countries (such as France, the Netherlands and Sweden) defined their circular economy policy with a focus on the construction sector (Augiseau et Monfort, 2023). This European Union (EU) policy orientation led to a diversity of policy instruments at the national and local level being developed in many countries.

To be able to distinguish different strategies, it is important to identify what sort of instrumentation is deployed at the national and local level to enable circular economy in the built environment (CEBE). Therefore, we want to present an analysis of the governance context of the 4 countries and Living Lab (LL) partners of the CREATE project: Sweden/Göteborg, France/Rennes Metropole, The Netherlands/Nijmegen and Austria/Vienna.

The objective is to obtain an understanding of the CEBE approach in each state and city, and the policy instruments deployed for its implementation. The description of the different policy instruments in each LL provides WP4 and the whole consortium with a better understanding of the local situation and levers available for the CEBE. It will also support the next WP4 tasks, especially concerning the recommendations for governance arrangements. The comparison of each LL governance context has led to the identification of common points but also to specifics that can be inspiring for the other LLs and probably for other European (local) governments.

To identify the existing instruments to enable CEBE, we conducted a policy document analysis for each LL related to the circular economy in general, and to the construction sector and waste management in particular. We did this for the European, national, and local level. We also used some academic literature about the instrumentation of the CEBE related to the European level or to the national context of the CREATE LLs. We analysed the documents and classified the type of instrument by using the typology of Borras et Edquist (2013) which distinguish 3 types of instruments:

- Regulatory and legislative instruments: legal framework and rules, obligatory by nature.
- Economic instruments: such as tax incentives, direct financial support, or public procurement.
- Soft instruments: voluntary use to support, such as network, pilot project development.

We also classified, when possible, the instrument by the level of governance: national, regional, local. The following list of policy instruments to enable the Circular Economy in the Built Environment is based on our research between September 2023 and April 2024 and might not be exhaustive.

Moreover, we want to specify that the WP4 members first conducted this research in the LLs of Nijmegen, Rennes Metropole and Göteborg. Our colleague Sophia Pibal from WP5 supported us in the data collection and analysis of the policy documents for the case of Austria and Vienna. We therefore decided to co-write this deliverable and let our colleagues from WP5 write the section about the governance context of Austria.

First, the document contains a global description of the evolution of the circular economy policy orientations at the European level. Then the governance context of each LL is provided by outlining the different type of policy instruments (legal, economic, soft) at different levels (national and regional/local). In the conclusion, a cross analysis of the four governance contexts is introduced to highlight the common approach, the specificity of some instruments that could be inspiring for other cities, and the key issues that the cities are facing with the implementation of the instrumentation of the circular economy in the built environment.

2 POLICY ORIENTATION FOR A CIRCULAR BUILT ENVIRONMENT AT THE EUROPEAN LEVEL

For the past decade, the EU has been actively implementing a series of circular economy policies that member states are required to adopt, rooted in the principles of the green economy (Rask, 2022; Beulque et al., 2016). The concept of Circular Economy was formalized in a new policy package introduced by the European Commission in 2014, with the aim of reducing waste and promoting resource efficiency through a circular approach (Zepeda, 2023). In 2015, the European Commission launched the Circular Economy Package (European Commission, 2015), which was reviewed in 2018[1]. This package includes a wide range of policy instruments that address, among other things, waste management and recycling at the municipal level, with specific attention to construction and demolition waste, all designed to stimulate the growth of the circular economy (Rask, 2022; Beulque et al., 2016).

The circular economy is presented as a competitive framework capable of generating value by creating new job opportunities in emerging sectors and by turning waste into valuable resources. This not only supports economic growth but also helps reduce dependence on imported resources from outside the EU (Cramer, 2020). Moreover, the European Circular Economy Package requires member states to integrate these objectives into their national

[1] Le Parlement européen adopte le paquet économie circulaire (actu-environnement.com)

policies, reinforcing the EU's commitment to sustainable development and resource efficiency (Turcu & Gillie, 2020).

In parallel, in 2019, the European Commission adopted the European Green Deal, setting ambitious targets to reduce greenhouse gas (GHG) emissions by 55% by 2030 (compared to 1990 levels) and to achieve climate neutrality by 2050[2]. In this context, all actions must focus on reducing GHG emissions, and the development of effective tools to assess progress is crucial[3]. To this end, the EU introduced the Circular Economy Monitoring Framework to track member states' efforts in implementing circular economy policies.

The circular economy is recognized as a vital strategy for achieving greenhouse gas (GHG) reduction goals, alleviating resource pressures, and fostering economic growth. This is particularly relevant for the construction sector, which accounts for 50% of resource extraction and use, and 40% of energy consumption within the EU[4]. As such, the construction sector has been identified as one of the five priority sectors by the European Commission (European Commission, 2020). The New Circular Economy Action Plan is a cornerstone of the Green Deal and the EU's agenda for sustainable growth, with significant implications for various sectors, including construction.

The New Circular Economy Action Plan focuses on reducing waste, creating new markets for secondary raw materials, and promoting circular design, product reuse, and Extended Producer Responsibility (EPR) policies (Cramer, 2020). According to Cramer (2020), most of the proposed measures consist of legislative instruments and mandatory criteria designed to establish a sustainable product policy framework. However, the European Commission also supports voluntary initiatives, such as green public procurement, which can drive market demand for sustainable products.

In addition, the European Commission introduced the new Ecodesign Framework Directive in 2024[5] (Regulation (EU) 2024/1781), which is expected to play a pivotal role in advancing circular economy goals within product development. This directive takes a holistic approach by considering the entire lifecycle of products, further supporting the transition from a linear to a circular economy (Institut National de l'Économie Circulaire, 2022). One of the key features of this directive is the potential to introduce product and material passports. These passports would provide valuable information about a product's material composition,

[2] Pacte vert pour l'Europe - Consilium

[3] Loi européenne sur le climat: accord provisoire entre le Conseil et le Parlement (communiqué de presse, 5 mai 2021)

[4] Circular economy - Consilium (europa.eu)

[5] Ecodesign for Sustainable Products Regulation - European Commission (europa.eu)

environmental impact, lifecycle, and origin, thereby facilitating better resource management and promoting sustainability.

As part of the Green Deal, a proposal for a mandatory digital product passport for building materials is set to be introduced in 2025[6]. Under this initiative, producers will be required to provide detailed information on each sub-product within a construction product sold on the European market[7]. The introduction of a digital passport for construction materials will be integrated into the revised construction products regulation, which aims to harmonize rules across EU member states, facilitating smoother market access and trade.

The construction products regulation is designed to promote the development of more sustainable, recyclable, and repairable products[8]. In addition, the new regulation will establish mandatory sustainability requirements for construction materials used in public procurement, ensuring that public sector projects adhere to higher environmental standards. To allow for a smooth transition, the regulation includes a 15-year phase-out period to replace the existing legal framework, ensuring that the construction industry can adapt effectively to these new sustainability criteria.

The European Commission has also developed a new **Strategy for a Sustainable Built Environment** to ensure coherence across various policy areas, including climate, energy, and waste management, while promoting circular principles within the sector (European Parliament, 2024). This strategy aims to advance and measure the sustainability and adaptability of building design, integrate life cycle assessments into public procurement processes, and explore the potential for carbon storage in buildings.

Another key focus of the strategy is the revision of EU legislation on construction and demolition waste, with the goal of enhancing the reusability of waste materials. These initiatives are critical for driving sustainable practices in the built environment and ensuring that the construction sector aligns with the EU's broader environmental objectives.

Furthermore, efforts to enhance the coherence between the EU's circular economy, waste management, and energy efficiency policies will be further developed. Several existing legislations already reflect this dynamic and can drive the adoption of circular building practices with high energy efficiency, such as the revised European Energy Performance of

[6] The digital product passport (DPP) - SRC

[7] https://eeuropa.blog/2023/12/15/eu-introduces-a-digital-passport-for-all-construction-materials/

[8] Parliament and Council agree on new rules for the construction products sector | Actualité | Parlement européen (europa.eu)

Buildings Directive (2022 and 2024) (European Parliament, 2024). This directive aims to achieve nearly zero-energy buildings, aligning with the EU's broader sustainability goals (Henrotay et al., 2017; Attia et al., 2021). By promoting the use of circular materials and other sustainable practices, these legislative measures support the transition to a more energy-efficient and circular built environment.

Finally, the EU places significant focus on ensuring coherence between waste management and circular economy policies. Ghisellini et al. (2016) argue that, in the 2000s, EU policies initially focused on developing an efficient and effective waste management system to improve recycling rates across Europe. Over time, this approach evolved to include waste prevention as a central component. Today, the Waste Management Directive (2008/98/EC[9]) is closely linked to the circular economy framework, built upon the waste hierarchy of reduce, reuse, recycle, and recover.

According to Beulque et al. (2016), waste management policies and related instruments, such as Extended Producer Responsibility (EPR), are designed not only to reduce waste generation but also to mitigate disposal costs. In alignment with this strategy, the Circular Economy Package of 2015 set an ambitious goal of reducing landfill usage by 10% for all types of waste by 2030, including construction and demolition waste.

Thus, the circular economy approach offers a dual benefit: it reduces waste production while simultaneously lowering waste management costs by preventing waste generation and enabling the reuse of materials. EU directives play a crucial role in shaping national policies, as member states are required to align their national frameworks with EU regulations (Christensen, 2021).

3 POLICY INSTRUMENTS TO ENABLE CIRCULARITY IN THE BUILT ENVIRONMENT IN THE 4 LIVING LABS OF CREATE

3.1 Policy instruments to enable circular economy in the built environment in Sweden

3.1.1 National level

Regulatory and legislative instruments

Like the EU, Sweden has strong ambitions in terms of climate and energy policies and has identified the circular economy as a key strategy to reach these ambitions. Since 2014, Sweden is developing a new regulatory framework to reach climate and energy goal as the country is planning to be one of the first without net GHG by 2045 and be a pioneer in circular economy development (Niskanen and al., 2020). The global approach is related to the green

[9] Waste Framework Directive - European Commission (europa.eu)

economy paradigm, as the main issue defined by the government is to preserve the resources of the planet in the long term while it benefits industry and creates new jobs[10]. In that context, in 2016, the circular economy was identified by the government as a solution for the environmental and social challenges 'as well as bring competitive advantages and opportunities for sustainable growth' (Government office Sweden, 2016, in Niskanen et al., 2020). The strategy therefore focusses on the change of consumption and production practices to reinforce the value and efficiency of resources, develop the recycling and biobased material market. In the same year, the government set up a special circular economy committee to propose a new regulatory framework to support waste management and reuse.

This committee suggested the development of **the commission of circular economy** to support the government and the private sector in the transition to a circular and bio-based economy (Niskanen and al. 2020). The commission[11] had a diverse expert group and proposed new political instruments and identified the regulatory obstacles to the development of a circular economy on diverse themes, including bioeconomy, material flow, recycling, and public procurement.

This initiative led the government to present in 2020 its first **strategy for the transition-circular economy** (Miljödepartementet, 2020) and, in 2021, its Action plan, that reinforced the necessity to develop the circular economy to reach climate goals. The strategy focusses on efficient waste management (reuse, recycle, reduce) and the production of more sustainable products. The Action plan contained 100 measures targeting production, consumption, and innovation.

Moreover, in 2022, **a Committee for Economic policy** has been created to support the government in the identification of areas and economic policies to develop that could enable circular economy transition[12]. Based on the recommendations of the committee, in July 2023, the government refined this strategy and presented the **National strategy for a circular economy** to enable a sustainable transition and reduce climate and environmental impact. The strategy aims to achieve efficiency of resource use 'in a toxic free and raw material substitution circular flow; [13].

Finally, the National strategy for a circular economy has four pillars:

1. A circular economy through sustainable production and product design
2. A circular economy through sustainable consumption and sustainable use of materials, products, and services

[10] Ministry of Climate and Enterprise - Government.se

[11] Delegationen för cirkulär ekonomi (delegationcirkularekonomi.se)

[12] ekonomiska-styrmedel-for-att-framja-omstallningen-till-en-cirkular-ekonomi-dir.-202267.pdf (regeringen.se)

[13] Sweden transitioning to a circular economy - Task 36 (ieabioenergy.com)

3. A circular economy through toxin-free and circular eco-cycles
4. A circular economy as a driving force for the business sector and other actors through measures that promote innovation and circular business models (European Environment Agency, 2022).

The strategy defines 6 priorities for material streams, including renewable and biobased raw materials and construction materials. Regarding the construction sector, the national strategy (2020) is therefore focusing on the use of renewable and biobased materials. The global strategy for circular economy contains a strong focus on the construction and built environment sector because of their important environmental impact while the country is facing a housing shortage. The construction sector must therefore integrate new reuse and recycled material use practices[14].

At the same time, the effort for a sustainable built environment must contribute to the reduction of the CO2 emissions by reducing 50% of the climate impact of the production and maintenance of the sector by 2025, and 90% by 2030.

In this context, new policy and regulatory frameworks emerged to enable circular economy in practice but also to assess the impact on CO2 emission reduction by developing measurement tools (Chalmer University, 2024). The regulatory instruments related to this circular economy strategy are registered in the *Boverket*[15] platform which contains all the legislations of the construction sector. Among others there is the **Planning and Building Act** (2010)[16], which contains all the requirements for construction and materials, especially the obligation to indicate the materials that can be reused and the waste treatment and destination. **The act for the climate declaration for buildings from 2021** ("Klimatdeklaration för byggnader")[17] reinforced this Act by forcing the developers to conduct a diagnosis of the climate impact of every new building (since 1st January 2022) and to submit it to *Boverket* (including the extraction phase, construction, transport, and end of life of the materials). This declaration is mandatory to obtain a building permit. **A Database** exists with a reference to all the climate impact of the diverse materials (CO2/kg). The goal of this legislation is also to assess the efforts of the construction sector in terms of climate impact reduction.

The **Environmental code** from the National Environmental protection Agency[18] is also a regulation instrument that enables circularity in urban planning. The Environmental code promotes sustainability on different topics (such as health and nature) and stimulates the

[14] Sveriges miljömål - Sveriges miljömål (sverigesmiljomal.se)

[15] Start - in English - Boverket

[16] Plan- och bygglag (2010:900) | Sveriges riksdag (riksdagen.se)

[17] Klimatdeklaration av byggnader - Boverket

[18] The Swedish Environmental Code - Government.se

[18] Laws and regulations (naturvardsverket.se)

sustainable use of resources such as soil and water and the reuse and recycling of raw materials and energy. Other legislation concerning the waste management emerged as a lever for CEBE, such as the Waste Ordinance (Avfall Sverige, 2022) which made the waste sorting of demolition/construction waste mandatory.

The National Environment Agency also proposed the National waste plan and waste prevention program 2018-2023[19] that fits the national waste directive. The program aims to reduce the waste production through better waste management and by encouraging the activities of reusing and recycling of waste construction material up to 70% by 2025.

Economic instruments

To implement the national circular ambitions for the built environment, the Swedish government published some action plans and regulations with economic instruments. For instance, the government created new regulations to support companies to have more circular practices, such as fiscal incentive to reuse and recycle (less waste, less tax). Another example is financial support for the development of innovative companies and for research and development to find solutions for sustainable production or waste management (Niskanen and al, 2020). The national strategy for circular economy also mentioned other economic levers such as the development of a policy to facilitate the development of circular, reused, or recycled products markets and to encourage the use of public procurement as a tool to enable circularity. The Swedish National Public Procurement Agency is promoting public procurement as a tool to achieve Sweden's climate and environmental goals and to contribute to the transition to a fossil-free and more circular economy (European Environment Agency, 2022). This agency developed criteria in different areas including the construction sector. However, these recommendations are not yet official policy or a regulation and are therefore not mandatory.

Soft instruments

The Swedish government set up a large diversity of soft instruments, voluntary to use, to enable CEBE, aligned with their national strategy. To identify the crucial issues of the circular economy transition, the government encouraged Public-Private Partnership via facilitation and knowledge platform exchange development (Niskanen et al 2020). In this context, in 2022, the Circularity Gap report has been published by the Platform for Accelerating the Circular Economy (PACE[20]) that includes private stakeholders, government and civil society, to stimulate the circular economy transition (Chalmer University, 2024).

Concerning especially the construction sector, some initiatives have been developed to reduce the waste production and to assess circularity. One of the ideas is to produce a

[19] The National Waste Plan and the Waste Prevention Program | One Planet network

[20] Platform for Accelerating the Circular Economy (pacecircular.org)

database for building materials to trace the waste production, identify the stock and flow of construction and demolition materials, and to support reuse and recycling. There are several existing databases in Sweden (BASTA, Byggvarubedömningen and SundaHus) but for now they are used to assess the sustainability of building materials and facilitate decision-making, contributing to the national targets in terms of reduction of environmental impact of the built environment (European Environment Agency, 2022).

Some circularity indicators and assessment tools are in development to measure the environmental impact of the construction sector. These databases and tools can be developed based on the new regulatory framework about waste management or National circular economy strategy and/or European regulation. There is therefore different certification schemes at different levels (national, sub national, international) (Chalmer, 2024), for instance: Mijöbyggnad, CityLav, NollCO2, Ecolabel Cygne Nordique, LEED (Leadership in Energy and environmental Design) or the BREEAM-SE (Building Research Establishment Environmental Assessment Method Sweden) (Chalmer University, 2024). However, their use is not mandatory and there is, for now, no certification in Sweden related with circularity. Certification and measurement tools aim to promote sustainable construction and can include the circular economy.

Finally, other initiatives to promote CEBE are taken by private stakeholders. For instance, the Center for Circular Construction (CCBuild[21]) is an initiative from different Swedish industries and research centers that promotes the circular construction and the reuse and circular material flows. The Center is proposing a digital marketplace for the reuse of construction material and a digital inventory tool. Moreover, in 2022, stakeholders of the construction sector assessed their carbon emissions and set up climate goals. The sector, together with Fossil Free Sweden, proposed a roadmap for fossil free competitiveness to become neutral by 2045 (Fossil Free Sweden, 2021).

Finally, the Ecocycle Council for the Building sector published in 2017 a resource and waste guideline for construction and demolition to reduce the waste quantity in landfill as indicated in the environmental program for the construction sector (Byggföretagen, 2017). In 2019, the Swedish Construction federation published its last version and emphasized the need for collaboration between all the stakeholders involved in a construction/demolition project throughout the value chains and proposed a common language for all phases of the building life cycle to enable circularity.

3.1.2 Regional and local level

The Swedish government defined its national policy and action plan for a sustainable transition at the regional level with the Action Plan 2022-2024 of the National strategy for sustainable regional development (European Environment Agency, 2022). The main

[21] CCBuild - Center for Circular Building

orientation of this Plan is to include the regional perspective in the investment's grants and research about circularity, and to support regional economic development related to circularity. Therefore, "the Swedish Agency for Economic and Regional Growth supports small and medium-sized enterprises (SMEs) in their transformation to becoming more circular businesses" (European Environment Agency, 2022).

There is also an ambition to coordinate urban planning, building permits and waste management to enable CEBE. Therefore, the act on urban planning and construction has been modified to take into consideration waste management in local urban planning. However, there is no regulation about waste prevention for the regional level.

Moreover, the National Environment Protection Agency attributes the responsibility of the waste prevention and management to municipalities (NFS 2017:2). Section 15 of the environmental code indicates that municipalities are responsible for the treatment of municipal waste, including construction and demolition waste coming from professional activities. However, the regulation also encourages cooperation between municipalities, administration, and companies. Hence, the 13 municipalities of the region of Göteborg elaborated a waste plan until 2030[22].

In this context, if the municipalities can set up circular ambitions, they do not have the responsibility of the waste prevention and management which belong to the regional level and can lead to lack of coordination in the ambitions. For instance, the city of Göteborg has a policy orientation for climate ambition 2021-2030 (Municipality of Göteborg, 2021) that has 3 main foci (nature, climate, people) and 7 strategies including the circular economy, especially for the construction sector with the goal to reduce : 50% CO2 emissions by 2025 and 90% by 2030. To reach these ambitions, the strategy focusses on new construction which is responsible for 50% of the climate impact of the sector, with the willingness to reduce the material flow, optimise the use of buildings, support reuse and recycled, biobased material use, and reduce the waste of the sector of 40% by 2030. However, the responsibility for waste management belongs to the 13 municipalities, so the municipality does not have an assessment tool of the impact of their effort on waste reduction (See Deliverable 2.2 of CREATE).

However, the city of Göteborg is developing a strategy for implementation of circular economy policy by focusing on different levers. The city of Göteborg has the ambition to be one of the most progressive cities in the world in terms of CO2 reduction. The city set up a Environment and Climate commission to pilot the implementation of different goals including to become an (almost) Net Zero Emission city via a circular economy strategy and sustainable construction. This objective is in line with the national strategy. The city identified a few levers such as improving the municipal governance of sustainable construction (resource

[22] Gothenburg focusing on reducing emissions from waste collection - European Commission (europa.eu)

management and environmental impact), testing new construction methods or materials, using innovative procurement, and setting requirements to reduce environmental impacts in the construction. Rask (2022) highlights the fact that Göteborg is one of the rare Swedish cities that takes into consideration the consumption of materials in their carbon emission inventory. Most of the time, circular economy policy at the municipal level focuses on the recycle principle and neglects the reduction principle (Kirchherr et al., 2017). The reduction of the construction waste is therefore a lever for CO2 reduction.

To reach these ambitions, the city deploys a public-private partnership (PPP) approach to stimulate collaboration and sharing experience and knowledge between different stakeholders (city, companies, citizen, real estate companies, universities, other municipalities, etc.). In this context, the city is coordinating the **Platform for climate neutral construction**[23], a network of 140 local stakeholders to stimulate a local market for reused material and promote a circular construction, created in 2022 by the Business Region Göteborg. The Platform is searching for solutions to develop the market and exchange information about regulation and good practices[24]. Moreover, the Declaration of sustainable construction has been signed between the city and 50 public and private building owners agreeing on the reuse of materials as a first choice by 2025. This declaration is part of the Göteborg Climate Partnership with public and private stakeholders to stimulate the market and a collaboration with CCbuild. Göteborg is also member of a national cities network, Sharing Cities (Stockholm, Malmo, Umea) to find resources to collaborate with private and public stakeholders on circular economy [25].

Beyond the networking between PPP to enable circularity, the city supports the use of public procurement following the national orientation. The municipality therefore defined requirements about the reused amount of material to reduce the climate impact of their buying from 90%[26].

Finally, the ambition is also to develop the offer of recycled products and to employ the approach of reused and preserved building. The city developed a program for a construction respectful for the environment (municipality of Göteborg, n.d). The city requests the developers a guarantee on the quality of the entire construction project to enable sustainable management of the building for its entire lifetime. The program covers 8 aspects of the building quality including one on environmental impact and resource management.

The city of Göteborg is also engaged with the Chalmers University for the mapping of material stocks and flows of residential buildings in the city and an LCA analysis by using the data and

[23] Climate-neutral construction | Invest in Gothenburg

[24] Din partner i näringslivet | Business Region Göteborg (businessregionGöteborg.se)

[25] Climate competitiveness - Viable Cities

[26] common procurement requirements

calculation tool of the LCA of the Swedish construction sector[27] (mandatory for CO2 and energy emissions for new projects). The data are important but is still underused or used too late in the decision-making process. Governance efforts should be made to use them in an earlier stage to improve the decision-making process, for instance by adding these data in the building construction permit and sharing the information earlier and faster between services.

To implement the circular strategy, the municipality also focuses on its internal governance of the circular economy. The urban administration set up some agreements such as the development of skills and work methods to enable the reuse of materials, aligned with urban planning and the building permit delivery service, or to develop more coherence between climate goals and the waste plan. However, there is a need to study the implementation of these agreements and identify the specific needs of this department[28].

Moreover, the environment and climate program has set up a coordination committee for each of the 7 strategies, including one about circular economy development and one about sustainable construction. Each committee pilots and coordinates its strategy under coordination of the environmental administration. Concretely, Göteborg Statds Leasing AB is responsible for the development of a strategy for circular economy. The committee is cooperating with other strategy committees and with the waste plan of the region. The focus is on all types of material flows including waste from construction/demolition activities.

The committee for the strategy of a sustainable construction is coordinated by **Förvaltnings AB,** which is also working with the Business Region Göteborg, the urban committee, and the environmental committee**.** The main goal is to impose higher requirements in the construction method to have less environmental impact and to upgrade the global governance of the city in term of sustainable construction in the long term.

Moreover, since 2nd of January 2023, there is a new department for the urban development to improve the coherence of actions. The new urban development service joined the activities of diverse services such as urban planning, real estate agency, traffic office, administration of parks and nature. It aims to coordinate and manage urban planning of the city by being responsible for the regulation at the city level of the building, soil, water, and housing. It coordinates also the strategic urban planning.

The new committees and associated departments have clearer competences from strategic planning to the development/construction phase and building management. However, this organisation needs a redistribution of operational responsibilities and roles because 5 committees do not exist anymore and 4 new ones appeared. An assessment of the impact of

[27] Byggsektorns miljöberäkningsverktyg - IVL.se

[28] Ny organisation för stadsutveckling 2023 - Göteborgs Stad (Göteborg.se)

internal governance of urban planning on the development of the circular economy would be interesting, as this new service does not explicitly mention the circular economy as a strategy.

3.2 Policy instruments to enable circular economy in the built environment in France

3.2.1 National level

Regulatory and legislative instruments

In France, the circular economy was mentioned for the first time during the National assembly of the environment in 2007[29] and recognised as a priority with the Act for the Energy Transition for the Green Growth in 2015 (LTECV loi n° 2015-992, 17 août 2015)[30]. At first, the government set up diverse groups of various stakeholders (political, academic, economic, civil society) to brainstorm about the vision and barriers for a circular economy in order to institutionalise it, such as the Circular Economy Institute created in 2013. In parallel, a circular economy administration emerged with the creation of a department of waste and circular economy at the Ministry of Ecological and Solidary Transition, in charge of the coordination of the circular economy policy of the Ministry, and a direction of circular economy and waste at the ADEME, the French Environmental and Energy Agency (Gerardi, 2019). This context led to the development of new legislative and reglementary instruments that started with the LTECV that recognised the circular economy as a key engagement for a sustainable development.

The LTECV defined circular economy as a tool to reduce GHG emissions and to create value. The act aims at reducing 40% of the GHG emission by 2030 (compared with emissions in 1990) and to use 30% renewable energy in the global energy consumption by 2030, by amongst others properly manage waste and enabling circular economy. The act also inscribed an official definition of the circular economy in the Code of the Environment (article L. 110-1-1) (Institut Paris Region, 2021). Gerardi (2019) highlights that the LTECV also explicitly connects the circular economy with economic (green) growth, as it is recognised that circular economy can create value, development, and work.

The LTECV was used to design the **National Low Carbon Strategy** (SNBC) in 2015, revised in 2020, the roadmap of the country to mitigate climate change (Ministère de la transition écologique et solidaire, 2020). The strategy defines actions to implement in diverse sectors, including precise goals about the waste reduction (such as obtaining a 65 % recycling rate and reduction of 50% of landfilling by 2025) and specific orientations for the building sector by

[29] Assemblée nationale - Le Grenelle de l'environnement

[30] Loi relative à la transition énergétique pour la croissance verte (TEPCV) | Ministère de la Transition écologique et de la Cohésion des territoires (ecologie.gouv.fr)

encouraging the use of low-carbon construction products with good energy and environmental performance (biobased material for instance). Hence, the strategy supports the development of the circular economy in the industry sector via waste valorisation, eco-conception, waste redution, use of recycled materials and increase in the rate of product recyclability and reparability.

However, the circular economy remained a means and not an end until 2018 when the roadmap for a circular economy and the anti-waste for circular economy act (AGEC) (2019) were published. These two documents defined the circular economy policy with a focus on the construction sector (Augiseau, Montfort, 2023).

The circular economy roadmap[31] (Ministère de la transition écologique et solidaire, 2018) aims to achieve a reduction of 30% of resource consumption by 2030 (compared to 2010), and to reduce 50% of the waste amount put in landfill by 2025 (compared to 2010). Many actions are encouraged, such as adding recycled materials in products, developing the offer of stakeholders in the reuse and repair sector, or techniques to assess the performance of reused or recycled material. At the same time, France aligned with European directives about the waste management hierarchy (2019) (prevention, reuse, repurpose, recycling, valorisation, elimination) by setting up a National Plan for waste management (Ministère de la Transition et de la cohésion des territoires, 2021). The Plan aims to make recycling and recovery operations more competitive than landfilling. The waste framework directive is also revised and proposes a mandatory separated collection for biowaste and textile and invites the waste construction sector to do the same.

Moreover, the circular economy roadmap was used to set up the **anti-waste for a circular economy act of the 10th February 2020 (AGEC[32])**. The act aims to implement the circular economy roadmap and to apply the European circular economy package directive of 2018. The purpose of the AGEC act is to accelerate the change of production and consumption model to limit waste and preserve natural resources, biodiversity, and climate. There are 5 main aspects in the act including one about anti-waste by reusing material and developing more environmentally friendly production in different sectors including the construction sector.

Concerning the construction sector, the aim is to valorise more than 70% of material and construction waste . In this context, another act published in the 1st of July 2021 renders **the diagnostic Product, Material, Waste (PEMD)** [33] mandatory for all operations of demolition or

[31] In French : Feuille de Route pour l'Economie Circulaire, FREC.

[32] In French : Loi relative à la lutte contre le gaspillage et à l'économie solidaire LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire (1) - Légifrance (legifrance.gouv.fr)

[33] In French : Diagnostic PEMD - Diagnostic Produits Équipements Matériaux Déchets | AC Environment (ac-environment.com)

renovation[34]. The PEMD diagnostic tool can improve the traceability of materials and their valorisation, as it can give information such as the type of material, the quantity, its localisation, its management, or the reusable parts. The diagnosis reports need to be centralised at the ADEME (French Environmental Agency). The PEMD diagnosis can therefore be a tool to enable the reuse of materials and face the shortage of raw materials.

Moreover, **the Climate and resilience act of the 24th of August 2021[35]** aims to stimulate austerity in the building material resources use and the reuse of buildings. This act is a tool to fight climate change by focusing on (among others) housing and on a Net Zero Artificialization (Zero Artificialisation Nette, ZAC) of the soil by 2050. The law sets an intermediate target of halving the rate of land consumption over the next ten years (2021 – 2031)[36].

Finally, the new environmental regulation of 2020, **named RE2020,** introduced by the housing, urban planning, and numeric evolution act (ELAN[37]), can enable CEBE (Ministère de la transition écologique, 2024). The construction sector in France is responsible for 25% of the GHG emission and for 44% of the national energy consumption. Therefore, RE2020 aims to reduce the carbon impact and to improve the energy performance of new constructions. The assessment of carbon impact can be done with Life Cycle Analysis (LCA) of the building, from the construction phase until the end-of-life of the materials. The regulation therefore encourages using low environmental impact materials and circular construction approaches[38].

Economic Instruments

To implement laws and regulations related to CEBE, the government deployed different types of economic instruments. The AGEC act enables the use of public tenders to develop the use of reused material. The environmental code explains that in the domain of building construction and renovation, public tenders must take into consideration requirements in terms of reducing GHG emissions and carbon storage and therefore use reused or renewable materials (Institut Paris Region, 2021).

Moreover, the reuse of materials is motivated in the AGEC act by the development in 2022 of the new Extended Producer Responsibility (ERP) material supply chains including one about construction products and materials (such as windows, concrete or carpets). The ERP is a European instrument used by the government to implement circular economy policies and

[34] For surfaces bigger than 1000 m2

[35] LOI n° 2021-1104 du 22 août 2021 portant lutte contre le dérèglement climatique et renforcement de la résilience face à ses effets (1) - Légifrance (legifrance.gouv.fr)

[36] Loi portant lutte contre le dérèglement climatique et renforcement de la résilience face à ses effets. https://www.ecologie.gouv.fr/artificialisation-des-sols.

[37] LOI n° 2018-1021 du 23 novembre 2018 portant évolution du logement, de l'aménagement et du numérique (1) - Légifrance (legifrance.gouv.fr)

[38] https://www.ecologie.gouv.fr/reglementation-environnementale-re2020

reduce the waste in various sectors (plastic package, sport activities, etc.). The construction sector supply chain must organise the collection of the waste and their end/second life [39], which will at the same time reduce the cost of local government with waste management.

According to the French Ministry of Ecology, Energy and Territory, the building sector supply chain generates 35 million tonnes of inert waste that is not sufficiently valorised and a big part of it ends up in unauthorised dumping sites[40]. The cost of removing unauthorized dumping is borne by local authorities (340 to 420 million euros per year, according to the Ministry). The AGEC act would therefore reduce these costs by giving the producers responsibility for waste management.

The ERP construction sector supply chain applies the concept of polluter-payer to the producer, importer, and distributor of a product. These stakeholders must pay a contribution to an eco-organization depending on the environmental quality of the product, to support a selective collection of the waste and the second life of the product. Assessment criteria are diverse: material use, rate of recycled material, recyclability, etc. The more the product has a low environmental impact, the more the producer will get a high bonus on the cost, and if the product has a high environmental impact, the producer will get a penalty. The eco-organization must also trace the waste from the collection to the treatment and make a report to the government if the waste is leaving the area[41]. Finally, the information will be available for the customer to encourage the use of low environmental products and materials.

In addition, the government proposes different subsidies as economic instruments to support CEBE[42]. For instance, there are subsidies to any project which has the aim to reduce waste and enable the reuse and recycling activities (support and subsidies for zero waste project and circular economy), to develop awareness or educational campaigns about the theme (subsidies action for zero waste and waste reduction), in line with the AGEC act ambitions (support and subsidies for zero waste project and circular economy). Other subsidies are specifically related to the support of the reused/repair materials supply chain or to building projects that integrate circular economy principles by using reused or biobased materials for instance.

[39] Produits et matériaux de construction du secteur du bâtiment (PMCB) | Ministères Écologie Énergie Territoires (ecologie.gouv.fr)

[40] Produits et matériaux de construction du secteur du bâtiment (PMCB) | Ministères Écologie Énergie Territoires (ecologie.gouv.fr)

[41] Loi anti-gaspillage économie circulaire | Ministères Écologie Énergie Territoires (ecologie.gouv.fr)

[42] Aides et subventions pour projets zéro déchet et économie circulaire (fonds-publics.fr)

Financial support to innovation is also a key economic instrument, to develop new circular material supply chains or waste management organisation and techniques. The ADEME is for instance managing different calls to finance innovation, research, and development in different domains such as industry, recycling, biobased products, sustainable cities, etc. Globally, 9 billion euros will be deployed until 2030 to support innovative projects, industrialisation and implementation activities that contribute to the ecological and energy transition[43]. The ADEME is also managing the circular economy aspects of the Future Investment Program from the government[44] which is the main financing tool for innovation on the circular economy theme (ADEME 2018 in Gerardi, 2019).

Moreover, the Circular Economic Fund of the ADEME aims to support local governments in the implementation of the waste and circular economy national policy[45]. The fund's goal is to stimulate stakeholders' behaviour in investing in selective recycling installations. The ADEME is also managing the Waste Fund to support the implementation of the waste and circular economy policy. This fund is for local government, companies or for the civil society[46].

The circular economy roadmap also proposed different economic instruments that still need to be developed such as a reduction of the VAT rate to 5.5 % for the prevention, collection and valorisation of waste to reduce its cost or a raise of the tax on polluting activities (TGAP) applicable to all activities that are not inscribed in the prevention or valorisation of waste (Institut National d'Economie Circulaire, 2020). Also, the circular economy roadmap has the ambition to create value and 300,000 jobs[47]. Gerardi (2019) highlights the fact that the French circular economy policies embrace the green economy approach by combining economic growth and positive environmental impact.

Soft Instruments

Finally, to enable CEBE, the government stimulates the discussion between different sorts of stakeholders, and especially with private companies (Beulque et al., 2016). The circular economy ambitions therefore enable an innovation in the instrumentation that leads to stimulating the involvement of society (Gerardi, 2019). The Ministry of Ecological transition deployed information and communication tools about best practices and labels to different stakeholders of the construction sector. It aims to enable competitiveness and a willingness

[43] Financement des projets | Ministère de la Transition Écologique et de la Cohésion des Territoires (ecologie.gouv.fr)

[44] Programme d'Investissement d'Avenir

[45] Financer - Agence de la transition écologique (ademe.fr)

[46] Financement des projets | Ministère de la Transition Écologique et de la Cohésion des Territoires (ecologie.gouv.fr)

[47] économie circulaire (ecologie.gouv.fr)

to engage in circular economy. For instance, the CEREMA[48] and the National Institute of Circular Economy[49] are publishing information about new regulations or policies about the circular economy and their inscription in public tender. Hence, adapted public tenders are encouraged (such as competitive dialogue procedures) but not mandatory.

3.2.2 Regional and local level

The new territorial organisation act in 2015[50] gave regions the competence of planning waste management. The French regions therefore had to develop a Regional Plan for Waste Prevention and Management (PRPGD[51]) (Bahers et al, 2017). The PRPDG of the region Bretagne 2020-2032 aims first to reduce and valorise waste by a circular economy approach (18 goals to reach by 2025 and 2030). One of the most critical issues of the area is the lack of space for waste storage. The Plan therefore aims for 'zero waste landfilling' and the integration of a circular economy approach in the production phase, based on the hierarchy of waste treatment defined by the Environmental code (Région Bretagne, 2020 a,b). The region also promotes the use of recycled or reused material in its public tenders.

The PRPGD of the Region Bretagne and the national regulation corpus must be integrated in the waste policies at the metropolitan level (Rennes Metropole, 2022). Since the act of the Energy Transition for the Green growth of 2015, the Public Establishments for Intercommunal Cooperation (EPCI) must present a Climate Air Energy Territorial Plan (PCAET). In this context, Rennes Metropole is the coordinator of the energy transition and of the PCAET and aims to give priority to energy performance, circular economy and the development of recycled and biobased material supply chains (Rennes Métropole, 2019).

Moreover, since 2018, Rennes Métropole has a Scheme to promote responsible purchasing for public procurement (Rennes Métropole, 2018) in line with the ecological transition, in particular by having a circular economy approach and supporting the development of local recycling, treatment, and waste recovery chains from construction sites. The plan proposes to develop partnerships with the stakeholders of the Social and Solidarity Economy (SSE), to sign green worksite charters between local authorities and companies, to clarify the legal rules governing the donation of materials, to impose a minimum percentage of recycled materials in specifications, and so on.

[48] Cerema, French public expertise agency for the ecological transition and regional planning

[49] Page d'accueil - Institut National de l'Économie Circulaire (institut-economie-circulaire.fr)

[50] law NOTRE, Nouvelle Organisation Territoriale de la République LOI n° 2015-991 du 7 août 2015 portant nouvelle organisation territoriale de la République (1) - Légifrance (legifrance.gouv.fr)

[51] Plan Régional de la Prévention et de gestion des Déchets

Rennes Metropole also set up a **circular economy roadmap** in 2023 based on the participation of the local stakeholders of the SSE (Rennes Métropole, 2023). Fifty companies and associations joined to contribute to defining a strategy and an action plan for circularity and identified the main challenges and motivation of the stakeholders to change their practices. A commitment charter for a circular economy action plan should be signed. Moreover, the circular economy roadmap with global ambitions for 2030 and 2050 has been developed, based on the PCAET and its goal for carbon emissions reduction.

Furthermore, in 2023, a group of professionals designed the vision of a circular building value chain by 2050 and identified 2 mains goals: constructive austerity and the eco-conception to build less and better. Aligned with the Zero Net Artificialization of soil, the ambition is to have building activities that focus at first on rehabilitation and reuse of existing buildings, instead of a new construction. The roadmap therefore focuses on the austerity of the economy by improving the efficacy of materials, to reduce waste production. The goal is to halve the material footprint of the area by 2050, and concerns 4 domains, including the building sector. Concerning the building sector, it aims to develop constructive austerity with a better distribution and use of the building surface (reuse of material and building instead of demolition and construction when it is possible for instance), improvement in the valorisation of building waste and supporting the reuse of material and products, developing new material supply chains (biobased, reused, recycled) by reusing 5% of the rehabilitation or demolition material, recycling 80% of the building waste by 2030 and producing 10% of new housing from housing recycling (Rennes Métropole, 2023).

To implement these ambitions, Rennes Métropole is planning to use mandatory instruments in their existing urban planning documents[52], such as setting up quantified objectives for reuse/recycle or biobased material, or the systematic use of resource diagnosis in urban project (PEMD, see above).

The stimulation of the reuse and biobased material supply chain is therefore a priority for Rennes Métropole. The region has 8 existing biobased materials in the area (wood, line, straw, etc.). The Metropole is planning to have 36 kg of biobased material/m2 minimum in building construction and is already developing support for the wood supply chain since 2017. More effort will be put in for the other supply chains, aligned with the Regional Plan for Economic and social transition of the Brittany Region which also aims to support the development of biobased and recycle material value chains (Région Bretagne, 2023).

Rennes Métropole also deploys different economic and soft instruments to stimulate CEBE. The Metropole stimulates exchange about good practices and knowledge about circular economy between local stakeholders of the building sector. For instance, Rennes Métropole

[52] Such as the Guide de l'Aménagement des Espaces Publics, Le réferentiel Energie Bas carbon (for ZAC project), leCahier Technique Sante Environment.

made an inventory of the efforts and projects from local stakeholders that support CEBE. The Metropole also capitalised and shared knowledge about waste management and use of local material in 12 pilot sites.

Moreover, Rennes Métropole supports different pilot projects by direct financial support or provision of land and buildings with a low rental cost. The metropole especially supported the development of a platform for reused building materials[53] or waste storage or innovative projects for eco material production and use to reduce waste. A metabolism study of the area has also been financed, leading to the development of an application to visualise the type of materials, their localisation, and the different stakeholders of the area (Circul App[54]). Other tools to support the decision-making process of urban projects are tested as pilots, such as Urbamap/Urban Rennes[55] which is a database of all the urban projects of the area or Urbanprint[56], a calculation tool of the environmental impact of urban project (see Deliverable 2.2).

Finally, beyond the practical aspects, in organizational terms, Rennes Métropole has created a team specifically dedicated to circular economy in 2021 (`mission économie circulaire`). Comprising 3 employees, the group is linked to the waste department and the vice-presidency for waste and the circular economy.

In September 2021, Rennes also set up a circular economy governance group bringing together various elected representatives and departments to coordinate their decision-making and monitor Rennes Metropole's actions concerning the circular economy: planning, economic development, climate, waste, and SSE. The team dedicated to the circular economy mission works both on technical issues with the economic and planning departments, and at a political level, coordinating the 5 elected representatives to steer the project. The structure enables exchanges and dialogue between elected representatives to find a global approach to the strategy to be pursued. Circular economy governance is attached to the "ecological transition, urban services" thematic commission. It is made up of a territorial committee, a technical committee, a project team, and the coordination of elected representatives. The latter is the political body. However, their role is ambiguous, as they are not part of official commissions or specific working groups. In the case of the Technicentre project (LL), for instance, it is related to a working group and therefore to another and more official form of governance, raising the complexity of decision-making in the case of an urban project with the ambition of circularity.

[53] Bati Recup - Bati Recup

[54] Home (circulapp.fr)

[55] URBA-Rennes \ Carte 3D interactive sur l'urbanisme à Rennes

[56] Efficacity - UrbanPrint

3.3 Policy instruments to enable circular economy in the built environment in The Netherlands

3.3.1 National level

In her book, **Jacqueline Cramer (2020)** traces the evolution of circular economy policies in the Netherlands, emphasizing their roots in the waste management policies of the 1970s. In 1979, the Dutch government introduced an environmental policy based on the waste hierarchy: **reduce, reuse, recycle, energy recovery, incineration, and landfill.** Over time, incineration became more widely used than landfilling as a method of waste disposal.

In the 1990s, the concept of **Extended Producer Responsibility (EPR)** was introduced for certain resources, such as paper and vehicles. The EPR framework places the responsibility on producers to finance the end-of-life management of their products and materials, with penalties (malus) applied to products that have a significant negative environmental impact.

Additionally, in 1989, the Netherlands launched its **National Environmental Policy Plan**, which integrated the principle of reducing the environmental impact of products throughout their entire lifecycle—from extraction and production to use and disposal. This approach encouraged companies to produce more sustainable products and is a foundation for the **National Waste Management Plan of 2002**, which introduced **a supply chain-oriented material policy** aimed at closing material loops (Cramer, 2020).

In 2014, the Netherlands launched the **From Waste to Resource (VANG)** program, which integrates circular economy principles into product design. The program aims to reduce material waste, promote the use of more sustainable resources, improve resource efficiency, and extend the lifespan of materials. As a result of these efforts, the Netherlands has made significant progress in waste management, recycling 78% of its waste, incinerating 19%, and landfilling only 3% (Cramer, 2020).

Regarding the construction sector, the Dutch Ministry of the Interior, in collaboration with key industry stakeholders, established the **Agenda for Innovation** in 2014 (Bouwteam, 2012). This agenda focused on three key themes: sustainable energy, material use, and building adaptability. As part of this initiative, the report **"Building with Future Value"** (Brink Groep and CPI, 2014) introduced an **integrated assessment method for adaptive building**, emphasizing circularity in the built environment (Cramer, 2020). This approach to measuring circularity has been instrumental in shaping current policies aimed at promoting sustainability within the construction sector (Cramer, 2020).

The initial steps toward implementing circular economy principles in the built environment were followed by a 2015 study on circularity and market potential within the construction sector (Ministry of Infrastructure and Environment, 2015). The study revealed the sector's

commitment to using high-quality reused materials and rethinking building design to extend the lifespan of structures, incorporating circular economy approaches. However, stakeholders also identified challenges related to these ambitions, particularly the need for long-term environmental performance assessments of buildings.

This study supported the development of the **Circular Economy Program** in 2016 (Ministerie van Infrastructuur en Milieu en Ministerie van Economische Zaken, 2016), aligned with European directives. The program sets ambitious goals, including achieving 100% circular economy by 2050 and reducing the use of primary materials by 50% by 2030. It focuses on five key sectors, including construction, with objectives aimed at improving raw material efficiency, replacing primary materials with sustainable alternatives where possible, and fostering the development of new production methods.

In this context, the **Agreement on Raw Materials (Grondstoffakkord)** was signed in 2017 by 180 stakeholders, including government representatives, companies, and environmental organizations. This agreement outlines the key steps for the transition to a circular economy and emphasizes the need for collaboration to implement the **Circular Economy Program**.

In 2018, the **Agenda for the Circular Economy Transition** was launched, with a specific focus on the built environment[57]. The **Circular Construction Economy Transition Agenda 2018-2021** set an ambitious goal for the sector to achieve 100% circularity by 2050 (Government of the Netherlands, 2018). This agenda was updated in 2020, 2021, and again in 2023, with the introduction of the **New National Program on Circular Economy Implementation 2023-2030** (Ministry of Infrastructure and Water Management, 2023). The updated program proposes a series of actions aimed at limiting raw material use and reducing the country's carbon footprint, further advancing the Netherlands' circular economy goals.

The **Circular Construction Economy Transition Agenda 2018-2021** outlines the strategies necessary to achieve its ambitious goals, encompassing legal, instrumental, and voluntary measures. These objectives align with the overarching target of reducing CO2 emissions by 49%, as set out in the **National Climate Agreement** (Government of the Netherlands, 2019). Specifically, the construction sector aims to become 100% circular by 2050. Key strategies include improving construction methods for greater efficiency, reducing raw material usage, designing buildings with long lifetimes in mind, incorporating adaptive and detachable design approaches, and increasing the use of recycled materials.

Regarding the legal aspects, the initial approach focused on developing circular legislation and identifying existing regulations that could hinder circular construction practices. To address this, the **Ministry of Economic Affairs and Climate** and the **State Secretary of Infrastructure and Water Management** established a task force to review waste material laws, involving

[57] https://www.government.nl/topics/circular-economy/accelerating-the-transition-to-a-circular-economy

representatives from local and national governments, inspectors, NGOs, and the business community. The task force's primary focus was to create a legal framework for **Extended Producer Responsibility (EPR)**, ensure material quality, and develop certification standards. A key challenge identified was the classification of materials into three categories under current law—**products, resources, and waste**—which poses a significant barrier to circular economy practices.

The next step was to plan new regulations that would support circularity in the built environment. One proposal was to make the **Material Passport** mandatory by 2022. This tool would allow for the collection of data on the materials used in a building, enabling better management and reuse.

Additionally, a critical legal initiative involved developing a framework to assess the circular economy's impact—specifically tracking material use and associated greenhouse gas emissions in the built environment. This would provide essential data to evaluate progress in both circularity and GHG reduction at the national level.

In this context, the **Building Decree** (updated in 2020) (Ministry of the Interior and Kingdom Relations, 2020) plays a central role in regulating the environmental performance of materials used in construction. To obtain a building permit, the decree mandates compliance with the **Milieuprestatie Gebouwen (MPG[58])**, or **Environmental Performance Assessment Method for Construction Work**. The MPG measures various environmental impacts, including CO2 emissions, raw material usage, environmental pollution, and biodiversity effects, throughout both the construction process and the entire lifecycle of a building.

The MPG method relies on data from the **National Database of Products and Materials (Milieu Database[59])**, and the results are compared against the MPG of a standard building. To obtain a building permit, the environmental performance score must fall below a specific limitation[60].

The **Building Decree** also makes mandatory the **BENG certification** (Bijna EnergieNeutraal Gebouw / Nearly Zero-Energy Building) for all new constructions, which ensures high energy efficiency. The decree gives to local authorities the capacity to impose waste management conditions to promote the recycling of demolition waste, further supporting circular economy goals.

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[58] MilieuPrestatie Gebouwen - MPG (rvo.nl)

[59] https://milieudatabase.nl/en/.

[60] A building's MPG is the sum of the LCA of all materials, including the one that will be replaced during the building's lifetime, expressed in cost/m2/year. A lower MPG indicates a lower negative environmental impact. In 2021 the MPG must be under 1, then, in 2023 under 0.8 and must be under 0,6 from 2025. MilieuPrestatie Gebouwen - MPG (rvo.nl).

Moreover, an important goal of the Dutch government is to improve coordination between public authorities on environmental and urban planning matters to foster circularity. In pursuit of this, the government revised the **Dutch Environmental and Planning Act (Omgevingswet[61])** in 2022, with the aim of simplifying urban planning and environmental regulations by combining them[62]. This new framework, which came into effect in 2024, replaces 26 existing laws—including the **Water Act**, **Crisis and Recovery Act**, and **Spatial Planning Act**—thereby reducing the number of regulations and required studies for project facili**tating the decision-making procedures. The Dutch Environmental and Planning Act** also introduces provisions for long-term project data storage, reducing the need for repeated studies and further facilitating future projects. By creating stronger connections between different areas of planning—such as urban development, environmental protection, and nature conservation—the revised law aims to improve the coherence of planning efforts. The consistency of this legislative framework will help ensure that actions align with a unified national, provincial, and local strategy, ultimately supporting more effective and coordinated circular economy initiatives.

The **Dutch Environmental and Planning Act** will also empower local governments to set specific requirements for circular construction and demolition, as they hold responsibility for urban planning strategies within their territories through the **Environmental Plan** (NautaDutilh, 2017). This will enable municipalities to incorporate circular economy principles more effectively into local development projects. Additionally, the Act will replace **100 land-use plans** at the municipal level, simplifying the administrative procedures for building construction. The new building permit system will centralize submissions on a single platform, allowing developers to submit their requests to a single authority, further simplifying the process and improving efficiency.

Moreover, the **Dutch Environmental and Planning Act** will simplify the application of the **Environmental Performance Assessment Method (MPG)** for buildings, making it easier to integrate into the decision-making process. Currently, the MPG is often viewed as a burdensome, mandatory administrative requirement rather than a tool for enhancing quality and promoting circularity. The revised Act aims to shift this perception and make the MPG a more effective lever for sustainability.

[61] Omgevingswet | Rijksoverheid.nl

[62] Simpler and Better: The environmental planning act, the main changes (4pages) Environment and Planning Act of the Netherlands | Informatiepunt Leefomgeving (iplo.nl)

Additionally, the **Dutch Housing Act (Woningwet[63])** of 2022 give to local governments the authority to incorporate rules on energy efficiency and sustainable construction into their **Environmental Plans**, including requirements for the use of sustainable and circular materials.

In terms of economic instruments, the program proposes financial support for companies to develop a circular public market. This initiative aims to stimulate both demand and supply for products designed for circular construction by supporting innovation and pilot projects. To further boost the market and address the country's housing shortage, the government also plans to build **1 million houses over the next 10 years,** highlighting its commitment to integrating circular economy principles into large-scale construction projects.

Another key economic strategy is to promote **circular procurement and tendering** by regulating the use of reused and recycled materials in construction through the central government's procurement procedures[64]. The goal is for public tenders to be circular by 2030, where feasible, to drive market demand for sustainable solutions. Several existing instruments support circular public procurement, such as **Sustainable Public Procurement**, the **Circular Procurement Acceleration Network**[65], and **Rapid Circular Contracting (RCC)** [66].

The **RCC** allows contracts between developers and clients based on shared ambitions, even in the absence of existing solutions, encouraging the co-creation of innovative solutions post-contract. Other procurement mechanisms, such as the **Innovation Partnership Procedure**, enable the co-creation of innovative solutions with various partners from the outset of the process, while the **Competitive Dialogue**[67] fosters collaboration to develop creative circular solutions for the built environment. Furthermore, in 2022, all Dutch ministries signed the **Manifest for Socially Responsible Commissioning and Procurement (MVOI Manifest)** for the 2022-2025 period. This agreement commits the government to developing an action plan to promote socially and environmentally responsible procurement practices.

Also, in 2022, **financial institutions** and the **government** established the **Circular Economy Working Group** within the **Sustainable Finance Platform[68]**, which published a **Roadmap for Circular Finance 2030**. The goal is for **circularity** to become an integral part of how financing applications are assessed, directly influencing investment decisions by 2030 (Platform voor duurzame financiering, 2022). Four strategic axes have been defined including the systemic assessment of the linear and circular risk, the use of transparent circular metrics in the

[63] wetten.nl - Regeling - Woningwet - BWBR0005181 (overheid.nl)

[64] Central government procurement procedures | Public administration | Government.nl

[65] Versnellingsnetwerk Circulair Inkopen: Ikwilcirculairinkopen.nl | Hét platform dat je verder helpt.

[66] Over ons – Rapid Impact Contracting

[67] CircuLaw - Bouw

[68] Circular Economy Working Group (dnb.nl)

decision-making and the development of financial instruments to make the circular finance the new `business as usual`. The creation of a financial framework for the circular economy will start with removing all financial instruments that are inconsistent with circular market initiatives.

Finally, the national strategy for implementing the circular economy includes a set of **soft instruments** aimed at developing a common language for assessing the circularity of buildings and supporting knowledge exchange between stakeholders. The idea of creating a uniform circularity assessment method was first introduced in the **Agenda for Innovation in the Construction Sector** (Bouwteam, 2012, as mentioned above). The primary objective is to measure not only the circular impact but also the reduction of CO2 emissions, environmental effects, health outcomes, and quality across all building projects. This approach can help stimulate market demand by demonstrating the added value of circular construction.

However, to establish a standardized calculation tool, there is a need to harmonize the definitions of circular criteria. To address this, since 2018, the government has initiated experimental projects, leading to the creation of **Het Nieuwe Normaal (HNN[69])**, or **The New Normal** (developed by the Ministry of the Interior and Circkelstad). HNN defines a common language for circularity in the construction sector, covering four key themes: **waste management**, **environmental impact**, **adaptation capacity**, and **health materials**. The goal is to provide a framework to assess the circularity of building designs and foster fair competition within the market. A pilot was tested in 2023, and the results will be used to inform the development of new regulations.

The government also aims to invest in educational programs for circular construction, targeting various trades involved in the sector. Additionally, it plans to establish a **knowledge institute for circular construction**, focused on research and innovation, to address the evolving needs of the market.

Another strategy is to utilize **communication tools** to promote circular construction and facilitate collaboration between public and private stakeholders. In this regard, the **Circular Netherlands Accelerator Portal[70]** was created in 2019. This portal supports companies in their circular economy projects by scaling up the best initiatives, practices, and business models. It also provides access to valuable knowledge and advice on circular economy practices in the built environment, particularly regarding regulatory and legislative aspects. Additionally, the portal helps expand the network of relevant stakeholders.

Furthermore, another knowledge platform, **Circulaw**, has been developed to make both European and national legal information easily accessible to stakeholders involved in the

[69] Het Nieuwe Normaal | Cirkelstad

[70] Versnellingshuis Nederland Circulair! | Hulp bij circulair ondernemen (versnellingshuisce.nl)

circular economy in the Netherlands. This platform supports the broader dissemination of legal frameworks and guidance to help accelerate the adoption of circular practices.

The government also encourages the use of **Green Deals** as instruments to stimulate local initiatives among stakeholders. In this context, several innovative projects have been developed to foster the circular economy in the built environment. One notable example is **Circular City (CirkelStad)**, a knowledge platform designed to promote and support a circular construction sector. This platform facilitates collaboration and knowledge sharing among stakeholders to drive the transition towards circular practices in urban development.

3.3.2 Regional and local level

In the Netherlands, there are two levels of local government: **provinces** and **municipalities**, both of which began incorporating circular economy goals into their agendas in 2016 (Cramer, 2020). At their respective levels, provinces and municipalities can set political ambitions and strategies for the circular economy, identify legal barriers, and communicate these issues to the national government. They also play a key role in stimulating networking, supporting innovation across product chains, and promoting circular procurement practices.

The management of **construction and demolition waste** falls under the responsibility of the regional level, while the collection and sorting of other types of waste are handled at the local level.

Furthermore, each local government is required to provide a vision and strategy for their area under the new **environmental and urban planning act**[71] **(Omgevingswet)**. This law offers a tool for implementing circularity in territorial development, as it can include regulations on environmental protection, land use, water management, and nature conservation. For example, a province may designate specific areas where only **biobased construction** is permitted[72].

Gelderland Province

In 2020, the **Gelderland province** proposed an **action plan for circular economy**, introducing various instruments to promote circularity within its area (Province of Gelderland, 2020). The province aims to identify restrictive laws and regulations, providing feedback to the national government, and revising its own circularity vision to integrate it into provincial programs on energy transition, spatial planning, the built environment, infrastructure, and more. As part of this effort, Gelderland developed a new **regional raw material strategy**.

[71] De omgevingsvisie | VNG

[72] CircuLaw - Regelgeving voor een circulaire economie

Regarding economic instruments, the province has adjusted its financial mechanisms and is advocating for regulations on **emission trading** and **CO2 pricing**. It seeks to reduce taxes on the use of circular materials and promote the integration of circular criteria, such as the use of **recycled materials,** in public procurement tender procedures.

One of the primary goals of the province's strategy is to **connect** various stakeholders across the region, including **businesses, knowledge organizations, government entities, and the financial sector.** To achieve this, the province employs a combination of **economic and soft instruments**, such as gathering best practices from entrepreneurs, promoting collaboration between different types of stakeholders, facilitating cooperation with other local governments, and organizing circular construction events. It also encourages participation in pilot and demonstration projects.

The province has developed **funding programs** specifically aimed at supporting circular activities within the region, with a focus on fostering collaboration between stakeholders. These programs also seek to accelerate the market by leveraging **public procurement** and supporting **knowledge development** across the value chain and beyond. Additionally, Gelderland is a member of the European **Interreg project CirCE**[73], which provides valuable insights into effective circular economy policy instruments.

Finally, the **Gelderland province** is tasked with building **80,000 new homes by 2030** and intends to leverage this opportunity to integrate its circular economy ambitions into the built environment. For example, the housing development program will set goals such as **raw material savings** and the use of **biobased** and **reused materials**. Demolition waste could be repurposed in the construction of new buildings, fostering a local supply chain for **recycled materials** and enhancing the coordination of supply and demand for construction and demolition materials at the local level.

As part of this strategy, **renovation projects** will also incorporate circular economy principles to facilitate the reuse of materials. To pilot these efforts, specific projects will be developed to test and demonstrate the circularity of construction processes.

Additionally, the province is developing a program to **reuse vacant buildings** within its area, where feasible, further supporting the goal of reducing waste and optimizing material use[74]. To promote the use of **biobased materials**, Gelderland plans to collaborate with a range of stakeholders, including **project developers, housing associations, municipalities, businesses, architects, contractors,** and **raw material providers.** Together, they will conduct a study to

[73] CircE | Interreg Europe

[74] SteenGoed Benutten (gelderland.nl)

identify the **quality and quantity requirements** for biobased materials, assess market demand, and foster the development of a **circular material supply chain**[75].

Groen Metropool Regio Arnhem Nijmegen

The **Region Arnhem-Nijmegen** is also committed to implementing circular economy practices at the regional level. Comprising **18 municipalities**, the region was awarded the title of **Best Circular Region** in the Netherlands in 2018 and is the country's first **Green Metropole Region**[76] **(GMR),** with ambitious sustainability goals. The GMR aims to be a pioneer and leader in circularity, particularly in the **built environment.**

In addition to its circular ambitions, the **Arnhem-Nijmegen region** is also facing significant **housing shortages**. To address this, the **Woondeal** was signed in March 2020 between the region, the province, the 18 municipalities, and the Ministry of the Interior and Kingdom Relations. The agreement, updated in 2022, aims to construct **60,000 new homes**, with **25% of these homes** incorporating circular principles by **2040**.

The Woondeal is a key part of the Green Metropole Region's broader objectives, which focus on four main domains: **sustainable urbanization, raw material and waste supply chains, climate-proof green and water management,** and the **energy transition**. Within this framework, the region has prioritized **circular construction innovation** as a central strategy to address both housing needs and sustainability goals.

To achieve these ambitious goals, the **Green Metropole Region (GMR)** organized a series of sessions with key stakeholders in the construction sector and urban development to create a concrete circular strategy. The stakeholders collectively agreed on two primary objectives: developing a **circularity assessment tool** and **supporting the reuse of local materials** to foster a local circular market.

To achieve these goals, the GMR invested in the development of the **Circular Impact Ladder**[77] **(CIL, Circular Impact Scale in English)**. This tool aligns with national circularity standards set by the Dutch government (such as **Het Nieuw Normaal**, as mentioned earlier) and was tested on **24 projects** in 2023. The **CIL** provides a transparent and measurable approach to assessing circularity in housing development.

The tool assigns a **circularity score** that evaluates both the **origin** and the **future value** of materials used in construction. By tracking these elements, the CIL aims to stimulate **material**

[75] At the time of writing, there are national government changes in the Netherlands that might impact the province's ambition in terms of circularity for the built environment.

[76] Home | Groene Metropoolregio Arnhem-Nijmegen (gmr.nl)

[77] Circulaire impactladder - Groene Metropoolregio (gmr.nl)

reuse and reduce **CO2 emissions** throughout the construction process. Additionally, it supports **decision-making** by offering clear insights into the circularity of projects at each stage of development.

The results from the CIL tool will not only help improve local projects but also provide an opportunity to measure and demonstrate the region's contribution to the **national circular economy goals.** The GMR is positioning itself as a **pioneering example** for the entire country, setting a benchmark for **circular construction** practices.

Since 2023, the **Green Metropole Region (GMR)** has also become actively involved in an **Interreg project** focused on **carbon pricing** in public procurement. This initiative aims to integrate **carbon pricing** into the **tender procedure** for urban development projects, with the goal of reducing **CO2 emissions**. The project, called **Decarb-Pro**[78], explores how to effectively implement carbon pricing mechanisms in urban projects, driving greater sustainability and climate-conscious decision-making.

Finally, the GMR has been putting significant effort into fostering collaboration with its municipalities to implement its **circular economy ambitions**. To achieve this, the region has been organizing **monthly workshops** to facilitate dialogue, share knowledge, and promote best practices among stakeholders. These workshops cover various thematic areas related to circularity, such as **energy, climate adaptation, closing resource loops**, and **regulation**. They also provide a platform for municipalities to exchange insights and strategies for advancing their local circular economy initiatives.

Through these initiatives, the GMR is not only promoting **circularity in urban development** but also working towards creating a **collaborative ecosystem** that empowers municipalities to adopt and implement circular solutions more effectively. The **Green Metropole Region (GMR)** is collaborating closely with key regional institutions, such as the **Economic Board of the Arnhem Nijmegen Region** and **Rijk Van Nijmegen (RVN@**[79]**)**, to support small and medium-sized enterprises (SMEs) in their transition toward circularity and sustainability. These institutions are pivotal in fostering innovation and driving the **circular economy** within the region, especially in the **built environment**.

To stimulate private sector engagement, the **Economic Board** employs a **collaborative approach** involving **knowledge institutions, government, and businesses**. This collaborative strategy encourages innovation, knowledge sharing, and the development of sustainable solutions. One of the key approaches used is the **Living Lab** model, which provides a real-

[78] Home | DeCarb-Pro (nweurope.eu)

[79] Home - RvN@ (rvnhub.nl)

world testing ground for circular solutions, enabling stakeholders to experiment with innovative ideas in a controlled yet practical environment.

Additionally, the **RVN@** has established a **specific circular council** to oversee and guide the region's circular economy initiatives. The RVN@ also organizes the **Lifeport Circular Festival**[80] on an annual basis, bringing together businesses, governments, and the broader community to celebrate and promote circular economy practices at the regional level. This event serves as a platform to showcase innovative projects, share knowledge, and stimulate collaboration among stakeholders committed to a circular and sustainable future.

City level

Concerning the city level, the municipalities have several instruments to use to enable circularity in the built environment such as the Environmental and urban planning act (Omgevingwet), tender procedure or land property law[81].

The **Environmental and Urban Planning Act (Omgevingswet)**, which came into effect in 2024, is a critical tool. Under this law, municipalities must define their local ambitions for sustainability and circularity through a document called the **Omgevingsvisie** (environmental vision). This document outlines the municipality's long-term spatial and environmental strategy, including the integration of circularity goals into the urban development process.

Circulaw, a platform for circular law and regulations, helps municipalities by listing the various legal instruments they can use and providing guidance on the **Omgevingswet** rules. Based on these regulations, municipalities have the flexibility to set specific rules and frameworks that encourage circularity in the built environment. For example, they can[82]:

- **Create programs for circular construction**, promoting the use of renewable, reusable, and recyclable materials.
- **Designate areas** where only **biobased construction materials** are allowed, encouraging the use of sustainable, renewable resources.
- **Implement circular construction procedures** for obtaining building permits, ensuring that new buildings are designed and built with circular principles in mind (e.g., modularity, recyclability).
- **Set design directives** for the external aspects of buildings, such as the use of biobased materials in facades or roofing.

[80] Lifeport Festival Circulair 2024 - Lifeport@

[81] Kompas Circulaire Gebiedsontwikkeling maakt gemeenten wegwijs in circulair bouwen - Arcadis | Over Morgen

[82] CircuLaw - Regelgeving voor een circulaire economie

In terms of implementing the **Omgevingsvisie** (environmental vision), municipalities in the Netherlands can create **extra performance agreements** with housing companies to enforce circularity principles in the built environment. These agreements act as a mechanism to ensure that sustainability and circularity goals are met throughout the construction and life cycle of a building. Some key elements that may be included in these performance agreements are:

-Low MPG (Environmental Performance) Rate:

Housing companies may be required to ensure that construction projects meet low **MPG (Milieuprestatie Gebouwen)** standards. This involves reducing the environmental impact of building materials, construction processes, and operational energy use. The MPG score measures a building's environmental impact, including CO2 emissions and the raw material consumption during construction and operation.

- Circular Waste Management:

A **common responsibility for circular waste management** can be established, meaning that both the housing company and the municipality work together to minimize waste generated during construction and demolition, and ensure that materials are reused or recycled. This includes defining the responsibilities for sorting, collecting, and processing construction and demolition waste to close the loop on material use.

-Material Passport:

A **mandatory material passport** can be introduced, which tracks the materials used in a building throughout its lifecycle. This passport would document the type, quality, and origin of materials, making it easier to reuse materials at the end of a building's life. It can also aid in future renovations or demolitions by providing a detailed inventory of materials for recycling or re-use.

-Detachability of Buildings:

A specific **level of detachability** may be required for buildings, meaning that buildings are designed with easy disassembly in mind. This ensures that materials can be reused or recycled at the end of a building's life. The goal is to design buildings that can be easily adapted, renovated, or repurposed without generating significant waste.

-Use of Biobased or Reused Materials:

The agreement could specify a **percentage of biobased or reused materials** to be used in the construction of buildings. By prioritizing the use of materials such as bioplastics, timber, recycled aggregates, and other sustainable materials, municipalities can encourage a shift away from traditional resource-intensive materials.

These performance agreements allow municipalities to directly influence how housing companies approach circular construction and waste management, ensuring that national and regional sustainability goals are met at the local level.

Municipalities have several tools at their disposal to promote a **circular approach** in urban projects through the **tender procedure** and **land property policies**. Indeed, the legislation gives municipalities capacities to influence the public procurement process to promote circularity by integrating sustainability criteria into **eligibility and attribution** requirements. By doing so, municipalities can direct the market toward more circular practices. Some ways they can leverage the tender procedure include:

-Quality Criteria: Municipalities can define **quality criteria** in tenders that prioritize **circular materials.** For example, they could require that the materials used in the project be reusable, recyclable, or sourced from sustainable or circular supply chains.

-Technical Specifications: Specific technical requirements can be included in tenders, such as a **low MPG rate** (Milieuprestatie Gebouwen, or Environmental Performance Assessment for buildings) to minimize environmental impact. Other specifications might include the **percentage of reused materials** or a requirement to use materials with sustainability or **low CO2 emissions labels**, such as products certified by environmental standards[83] (e.g., Cradle to Cradle, FSC-certified timber).

-Incentivizing Circular Solutions: Municipalities can incentivize developers to adopt circular strategies by favoring proposals that demonstrate innovative circular approaches, such as adaptive reuse of existing structures or use of biobased materials.

Municipalities can also leverage **land property policies** to promote circularity in urban development. These policies allow municipalities to influence the way land is used and developed, encouraging circular practices in building and infrastructure projects. Some key actions municipalities can take include, according to Circulaw website:

-Land Sale Criteria: When selling land to developers, municipalities can incorporate **selection criteria t**hat require developers to integrate circularity into their projects. For example, they could mandate that projects meet specific circular construction standards, such as using sustainable or recycled materials, adhering to energy efficiency targets, or ensuring buildings are designed for long-term adaptability and reuse.

-Financial Contributions and Incentives: Municipalities can offer **financial incentives** for circular projects. For example, they may reduce the **financial contribution to the recovery fund** (which is mandatory for urban public spaces) for developers that commit to

[83] Regelgeving voor een circulaire economie - CircuLaw

implementing circular practices. This can act as a reward for those who go above and beyond in terms of sustainability.

-Designating Areas for Circular Projects: Municipalities can reserve certain **areas of land** specifically for **circular activities** or **innovative projects**. This can include setting up **dedicated zones** where developers are encouraged to experiment with circular economy principles, such as the use of recycled materials, adaptive reuse of existing buildings, or development of green infrastructure.

By embedding these principles in the tender procedure and land sale policies, municipalities can significantly influence the adoption of circular practices in urban development, promoting sustainability at the local level and contributing to the broader circular economy goals. These tools also ensure that the built environment remains aligned with national and regional sustainability targets, creating a robust foundation for long-term circular urban development.

Finally, municipalities can use economic instruments to enable circularity in the built environment. They can propose financial support such as low rent for circular companies or direct subsidies for sustainable construction. Another way is to propose reduction of the cost of the obtention of building permit if the project is sustainable and circular.

Nijmegen

The city of **Nijmegen** is making significant strides towards achieving its ambitious **circular economy** and **housing development goals**. With a growing population of **175,000 i**nhabitants, Nijmegen has outlined a comprehensive approach to meet both housing demands and sustainability targets. Indeed, the city is part of the *Woondeal* (see above) that aims to build 60 000 housing by 2030, including 10 000 just in Nijmegen. Moreover, the municipality formulates an ambition to reach 25% of circular construction by 2025, 50% by 2030 and 100% circular by 2050 with 0% loss of raw materials as part of its political coalition agreement. This ambition to become a city fully circular by 2050 is also inscribed in the Omgevingvisie 2020-2040 as a first goal (municipality of Nijmegen, 2020). Every new urban project in Nijmegen must therefore reach this objective.

To reach the regional ambition, the municipality is developing a pilot project: the redesign and refurbishment of the train station area[84]. Apart from the railway area including its station, 2000 new apartments will be built, and the public green space should increase from 5 to 22 %, within the coming decade and in line with the principles of the circular economy (28 sub-project in total). In this context, various technical and non-technical innovation are needed. Hence, Nijmegen is involved in a Living Lab set and manage by the Economic Board and the

[84] Stationsgebied Nijmegen

RVN@[85] to accelerate these innovations by synergizing brain power and cash flows of the regional and local public authorities, entrepreneurs, academia and citizens and NGOs (quadruple helix).

In 2022, **Nijmegen** embarked on an ambitious **pilot project** within the **Hezelpoort project**[86], aiming to build a **high double tower** with nearly **400 apartments**, with a **25% circularity** target. This initiative is a significant step toward achieving the city's broader goal of **100% circular construction by 2050**. To ensure that the Hezelpoort project aligns with its circular economy goals, the municipality developed an innovative tool to assess and enforce circularity in the design and construction process: the **Dashboard**. This tool was integrated into the **tender procedure** and uses **five Key Performance Indicators (KPIs)** to measure and guide the project's circularity:

1. **MPG (Environmental Performance Assessment Method for Construction)**: A mandatory KPI that evaluates the environmental impact of the building, focusing on factors such as CO2 emissions and raw material usage.
2. **Adaptivity of the Building**: This assesses the building's ability to be adapted, reused, or transformed in the future, a key principle of circular design.
3. **Construction Method**: The chosen method of construction must reflect circular economy principles, such as modularity, disassembly, or minimal waste production.
4. **Use of Biobased Materials**: Emphasizing the use of sustainable, renewable materials in the building process.
5. **Use of Circular Materials**: Materials that can be reused, recycled, or repurposed at the end of the building's life cycle.

The **Dashboard** has proven to be highly effective and informative for both the municipality and the developer. It enables the circularity in the urban project by pushing the participant in the tender procedure to refine their design with a precise circular method in an early stage, it secures the realisation of the circular promises in the long term. However, the use of the dashboard also limits the creativity of the developer by forcing the design and put pressure in the necessity to reach the KPI scores.

Despite these challenges, the **Hezelpoort project** and the use of the **Dashboard** represent a promising approach to integrating circular economy principles into large-scale urban development. It is expected that lessons learned from this project will contribute to future

[85] Kennistafels Stationsgebied Nijmegen: klimaatadaptatie & bouwlogistiek - RvN@ (rvnhub.nl)

[86] Gemeente Nijmegen gunt woontoren Hezelpoort aan ontwikkelaar VanWonen | VanWonen

circular construction initiatives in Nijmegen and other cities aiming for sustainable urban development[87].

The municipality is also engaged in several projects to enable the circular economy in urban development, aiming to develop the use of biobased materials in housing construction and promote construction innovation, for example. In 2020 and again in 2024, the city contracted an external company to conduct a stock and flow analysis of materials at the city level.

Moreover, the City of Nijmegen is a member of various networks to exchange knowledge and develop projects that support circularity in the built environment. The city is part of the Circular Council organized by RVN@, along with companies, the province, and the university. The aim is to support the local ecosystem of stakeholders, particularly small and medium-sized companies, in developing circular projects. As a result, many pilot projects are discussed and developed by the council. The municipality also visits companies to discuss the implementation of circularity and the challenges they face, which are then addressed in meetings at the council. Therefore, the council serves as a learning platform for all stakeholders. Nijmegen also participates in the GMR platform meetings, along with the 18 other municipalities and the region (see above), which are highly informative.

At the national level, Nijmegen is part of a frontrunner group of municipalities focused on sustainable and circular cities (CirkelStad[88]). Together, they share best practices and exchange knowledge. They also identify key legal barriers and engage in lobbying efforts to change or create circular laws at the national level (e.g., tax regulations related to circular efforts or laws enabling repairs). Additionally, the city is a member of CirkelStad, a platform dedicated to circular urban development[89]..

Internally, the municipality of Nijmegen has developed a team dedicated to the circular economy. As the city's activities related to circular economy have increased, the team was expanded in 2024 by adding two new employees. One employee is specifically responsible for managing sustainability and circularity in urban development, while the other employees focus on business, infrastructure, and legal aspects of implementing the circular economy. The main goal of the team in 2024 is to propose a specific policy ambition for circular economy, as the current policy agenda is still very broad. The document will serve as an action plan outlining how the municipality will concretely implement its ambition of becoming 100% circular by 2050 (including procurement rules, spatial planning regulations, etc.).

[87] To know more about the tender procedure of the Hezelpoort project, see a dedicated article that we published earlier in 2024: How to decide upon circular cities: The role of evidence in local tender procedures - ScienceDirect

[88] Sustainable Development Goals | VNG (vng-international.nl)

[89] Cirkelstad, hét platform voor koplopers in de bouw - Cirkelstad

3.4 Policy instruments to enable circular economy in the built environment in Austria

In this chapter, we have chosen not to separate the discussion into national and regional levels. This decision is based on Austria's demographic and administrative structure, where policies and initiatives at the national level are tightly integrated and often uniformly applied across regions. Given the relatively small size of the country and the centralized approach to legislation, waste management, and circular economy practices, the distinctions between national and regional levels are often minimal. This integration allows for a cohesive and comprehensive framework that is effectively implemented throughout Austria, ensuring consistent application of laws, regulations, and initiatives across all regions.

3.4.1 Regulatory and legislative instruments

The foundation of Austria's waste management system is built on a robust legislative framework. The **Waste Management Act of 2002 (Abfallwirtschaftsgesetz - AWG)** is a cornerstone of this framework, providing detailed regulations for the classification, management, and disposal of waste. It establishes a systematic approach to waste management that prioritizes precaution and sustainability, ensuring that recycled materials are as safe as primary materials and that waste disposal does not pose risks to future generations ("Abfallwirtschaftsgesetz - AWG," 2002). To track and monitor waste effectively, the **Austrian Ordinance for Tracking Waste (Abfallnachweisverordnung)**, implemented in 2004, requires waste owners to maintain detailed records of waste types, quantities, origins, and destinations. This ordinance is crucial for the construction sector, where detailed waste records are mandatory to ensure transparency and accountability ("Abfallnachweisverordnung," 2004). In 2011, Austria introduced the **Federal Waste Management Plan (Bundes-Abfallwirtschaftsplan - BAWP)**, which provides a strategic overview of waste management in the country. This plan is updated regularly, with the latest update in 2023, to ensure that Austria continues to meet its waste management objectives. The BAWP outlines specific strategies and measures for waste separation, recycling, and disposal, aligning with the principles of the Waste Management Act ("Bundes-Abfallwirtschaftsplan," 2011; updated 2023).

Specialized Ordinances for Waste Management

Austria has developed several ordinances to address specific aspects of waste management and recycling. The **Waste Incineration Ordinance (Abfallverbrennungsverordnung)**, amended in 2013, sets out guidelines for waste incineration processes. This ordinance addresses environmental concerns by ensuring that waste incineration complies with updated standards, minimizing the release of harmful emissions ("Abfallverbrennungsverordnung," 2013).

The **Landfill Ordinance (Deponieverordnung)**, established in 2008, defines the state-of-the-art practices for landfill operation in Austria. This ordinance categorizes landfills into four types based on the waste they receive: excavated soil landfills, construction waste landfills, residual waste landfills, and bulk waste landfills. The ordinance aims to ensure that landfills are operated safely and efficiently, with a focus on minimizing environmental impact ("Deponieverordnung," 2008).

An amendment to the Landfill Ordinance in 2021 further tightened regulations by prohibiting the landfilling of recyclable materials such as bricks, asphalt, and road demolition waste from January 2024 onwards. This amendment reflects Austria's commitment to promoting the recycling of construction materials and reducing landfill use ("Deponieverordnungsnovelle BGBl. II 144/2021," 2021).

Recycling and Circular Economy Initiatives

The **Austrian Recycling Building Materials Ordinance (Recycling-Baustoffverordnung)**, introduced in 2015, plays a pivotal role in promoting the recycling of construction and demolition waste. This ordinance ensures that recycled materials meet stringent quality standards, thereby facilitating their safe and effective use in new construction projects ("Recycling-Baustoffverordnung," 2015). In addition, the **Recycled Timber/Wood Ordinance (Recyclingholzverordnung - RHV)**, enacted in 2018 and updated in 2020, regulates the recycling of waste wood. The ordinance ensures that recycled wood used in the wood-based materials industry does not pose a higher environmental risk than comparable primary materials. This regulation is part of Austria's broader efforts to promote source sorting, processing, and recycling in accordance with the waste hierarchy outlined in the Waste Management Act ("Recyclingholzverordnung - RHV," 2018; updated 2020). To further support the recycling of construction materials, Austria has developed specific guidelines such as the **Guideline for the Treatment of Contaminated Soils and Building Components (Richtlinie für die Aufbereitung kontaminierter Böden und Bauteile)**. First published in 2004, this guideline sets out the testing procedures for reprocessed soils and components to ensure they meet environmental and quality standards. It is crucial for maintaining consistency in the treatment of contaminated soils and building components across the country ("Richtlinie für die Aufbereitung kontaminierter Böden und Bauteile," 2004). Similarly, the **Guideline for Mobile Processing of Mineral Construction Waste (Richtlinie für die mobile Aufbereitung von mineralischen Baurestmassen, 2nd edition, 2013)** sets quality standards for mobile recycling plants. These plants play a crucial role in processing construction waste on-site, reducing the need for transportation and promoting the efficient use of resources (Richtlinie für die mobile Aufbereitung von mineralischen Baurestmassen, 2013). The **Guideline for Recycled Building Materials (Richtlinie für Recycling-Baustoffe)**, updated in January 2023, ensures that recycled materials comply with stringent environmental and construction standards. This guideline is part of a broader effort to integrate recycled materials into the construction industry, thereby supporting the circular economy (Richtlinie für Recycling-Baustoffe, 2023). Austria's commitment to a circular economy is evident in its national strategies and alignment with European initiatives. The **Austrian Circular Economy Strategy (Kreislaufwirtschafts-Strategie - Österreich auf dem Weg zu einer nachhaltigen und zirkulären Gesellschaft)** outlines the country's approach to achieving sustainability goals, including climate neutrality by 2040. This strategy is closely linked to the **EU Circular Economy Action Plan (EU-Aktionsplan für die Kreislaufwirtschaft)**, which sets specific targets for resource efficiency, waste reduction, and recycling in the construction sector (Kreislaufwirtschafts-Strategie, 2022; EU-Aktionsplan, 2020).

Standards and Guidelines for Construction and Demolition

Austria's commitment to sustainability extends to the construction and demolition sectors through a variety of standards and guidelines. The **ÖNORM B 3140** standard, updated in 2020, provides detailed specifications for the disposal of construction waste. This standard outlines the requirements for recycled aggregates used in unbound and hydraulically bound mixtures for civil engineering and road construction, ensuring that recycled materials meet the necessary quality standards for these applications ("ÖNORM B 3140," 2020). The **ÖNORM B 3151** standard, first introduced in 2014, regulates the dismantling of buildings, a critical process in construction waste management. This standard provides guidelines for the separation of materials during demolition to maximize recycling and minimize waste. The goal is to obtain clean, unmixed waste fractions that are as free as possible from pollutants, thereby facilitating their reuse ("ÖNORM B 3151," 2014). Another important standard, **ÖNORM EN 12620**, specifies the properties required for aggregates used in concrete production. This standard ensures that the aggregates, whether natural or recycled, meet the necessary quality criteria for use in concrete, supporting Austria's broader goals of promoting sustainability in the construction industry ("ÖNORM EN 12620," 2014). Austria's approach to waste management and the circular economy is continually evolving to address new challenges and opportunities. The introduction of **Building Information Modeling (BIM)** standards, such as **ÖNORM A 6241-1** and **ÖNORM A 6241-2**, marks a significant advancement in how construction projects are managed digitally. These standards regulate the exchange and storage of building information throughout the lifecycle of a project, promoting efficiency and sustainability in construction practices (ÖNORM A 6241-1, 2015; ÖNORM A 6241-2, 2015).

Recent Developments and Future Directions

Austria continues to refine its waste management and circular economy strategies to address emerging challenges. The **Vienna Building Regulations Amendment 2023 (Wiener Bauordnungsnovelle 2023)** is a recent development that underscores the city's commitment to incorporating circular economy principles into urban development. This amendment is part of Vienna's broader strategy to reduce the ecological footprint of buildings by promoting the reuse and recycling of construction materials ("Wiener Bauordnungsnovelle," 2023). Looking ahead, Austria is set to introduce the **OIB Guideline 7 (OIB Richtlinie 7)** in 2024, which will further enhance resource efficiency and sustainability in the construction sector final in 2027. This guideline will provide a framework for the sustainable use of natural resources in construction, ensuring that buildings are designed, built, and demolished in ways that maximize resource reuse and minimize environmental impact ("OIB Richtlinie 7," 2024).

3.4.2 Incentives

Incentives and initiatives designed to promote the circular economy and sustainable waste management practices: These programs and organizations play a critical role in driving innovation, facilitating collaboration, and providing the necessary resources to transition towards more sustainable economic models. This chapter explores key initiatives that are central to Austria's efforts in waste management and the circular economy.

The **working group for Circular Economy** (AG Kreislaufwirtschaft) is a working group under the IG Lebenszyklus Bau, a broader organization focused on the entire lifecycle of buildings.

This group brings together stakeholders from various sectors to collaborate on circular economy projects, fostering innovation and the development of new models for sustainable construction and waste management. The collaborative nature of this working group helps integrate circular economy principles across distinct phases of the construction lifecycle (AG Kreislaufwirtschaft). One of the leading examples of regional initiatives beside those of the city of Vienna, in Austria's second largest state Styria, is the **Waste and Material Flow Management Styria** (Abfall- und Stoffflusswirtschaft Steiermark). The primary goal of this initiative is to optimize the control of material flows within the region. This involves creating closed material cycles that maximize the utilization of resources extracted from nature. By focusing on the efficient use of materials, this initiative supports the broader goals of reducing waste and promoting sustainable resource management in Styria (Abfall- und Stoffflusswirtschaft Steiermark). **Baubook** is an essential web portal that provides a range of digital tools and databases for ecological building and renovation. This platform offers validated data on building materials, facilitating the calculation of energy and ecological indicators. By simplifying the process of providing evidence for ecological tenders, building certifications, and subsidy systems, baubook plays a crucial role in promoting sustainable building practices across Austria. Its tools help builders, architects, and planners make informed decisions that align with environmental standards (baubook). **BauKarussell** is an initiative in Austria that combines recycling-oriented demolition with social value creation. This program focuses on "urban mining," where building components are carefully dismantled and either recycled or repurposed. **BauKarussell** sets itself apart by emphasizing social inclusion, offering employment opportunities to marginalized groups involved in the dismantling process. The initiative not only contributes to waste reduction but also promotes social sustainability, making it a model for circular economy practices in the construction industry (BauKarussell). The **Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Federal Ministry of Economics and Labour** are key governmental bodies that provide support for circular economy initiatives. These ministries are involved in setting policies, offering funding, and creating frameworks that encourage sustainable practices in various sectors, including agriculture, forestry, and industry. Their involvement ensures that Austria's transition to a circular economy is supported by strong regulatory and financial backing (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft; Bundesministerium für Wirtschaft und Arbeit). The **Circular Economy Forum Austria** is the largest independent platform in Austria dedicated to promoting the circular economy. This multi-stakeholder forum connects companies, policymakers, scientists, and other key players to exchange knowledge and develop innovative solutions for circular value creation. By fostering collaboration across different sectors, the forum plays a pivotal role in advancing circular economy practices in Austria. It also serves as a learning and development platform, helping businesses adapt to new sustainability challenges (Circular Economy Forum Austria). **Circular Innovation Labs** are cross-sectoral pilot projects that focus on developing new business models and value creation networks. These labs are designed to foster knowledge development, strategic reorientation, and the innovation of economic areas. By connecting different industries and promoting the exchange of ideas, Circular Innovation Labs help drive the transition to a circular economy. The labs also contribute to the creation of value ecosystems that extend beyond regional boundaries, supporting Austria's broader sustainability goals (Circular Innovation Labs). The **Future Building Agency** (Die Zukunftsagentur Bau), previously known as the Competence Centre for Construction Research, provides a focal point for Austrian construction companies to access research,

digitalization, and innovation resources. The agency supports the construction industry in addressing current and future challenges, with a particular focus on sustainability and circular economy practices. Its decentralized organization ensures that support is available across Austria, helping construction companies implement innovative solutions that align with circular economy principles (Die Zukunftsagentur Bau). The **Do Tank Circular Economy** (DoTank CE), also known as DTCC30, is an implementation program based in Vienna that aims to transition the city towards a circular built environment. This flagship project, part of Vienna's 2030 economic strategy, serves as a hub for developing and coordinating measures to reduce resource consumption and emissions in the construction industry. The program highlights the importance of practical implementation in achieving circular economy goals, providing a model that can be replicated in other cities and regions (Do Tank CE). Austria has developed several databases and guidelines to support funding for circular economy projects. The **Funding Compass Circular Economy** (Förderkompass Kreislaufwirtschaft) and the **Financing the Circular Economy** (Finanzieren Kreislaufwirtschaft) **databases** provide comprehensive information on available funding opportunities. These resources help businesses and organizations identify and access financial support for projects that promote sustainability and the circular economy. By facilitating access to funding, these databases play a crucial role in enabling the implementation of circular economy practices across Austria (Förderkompass Kreislaufwirtschaft; Finanzieren Kreislaufwirtschaft). **Land recycling** is a critical component of Austria's strategy to reduce land consumption from the current level of 10 hectares per day to 2.5 hectares by 2030. This initiative focuses on reusing formerly developed areas, known as "brownfields," to prevent the further consumption of natural land. Funding is provided for the development and reutilization of these areas, contributing to improved environmental status and more sustainable urban development (Flächenrecycling). **Material Nomads** offers expertise in circular design and architecture, focusing on the reuse of materials and building components. The initiative evaluates the potential for reuse and develops limited edition products from reclaimed materials. By providing consulting services and creating feasibility studies, Material Nomads demonstrates the value of integrating circular processes into the construction industry (Materialnomaden). The **ÖGNI (Austrian Sustainable Building Council)** is an NGO dedicated to establishing sustainability in the construction and real estate industry. Founded in 2009, ÖGNI promotes building certifications that ensure environmentally and resource-friendly buildings with high economic and social efficiency. The organization is a key player in advancing sustainable building practices in Austria and beyond, contributing to the global green building movement (ÖGNI). The **Austrian Recycling Market (Österreichische Recycling Börse)** provides a platform for individuals and businesses to buy and sell usable mineral building materials. This service helps connect supply and demand for recycled materials across Austria, supporting the circular economy by facilitating the reuse of construction materials (Österreichische Recycling Börse). In Styria, the guide titled **"The Realisation of the Circular Economy in the Building Industry - A Guide for Municipalities" (Die Umsetzung der Kreislaufwirtschaft im Bauwesen)** provides practical advice for municipalities on how to implement circular economy principles in construction. This guide helps local governments develop strategies to reduce waste and promote the reuse of materials, contributing to regional sustainability goals (Die Umsetzung der Kreislaufwirtschaft im Bauwesen). The **Municipality of the City of Vienna (Magistrat der Stadt Wien)** is actively involved in promoting circular economy practices within the urban environment. Vienna's city administration is dedicated to reducing waste and enhancing resource efficiency through various programs and initiatives. These efforts are part of the

broader strategy to transform Vienna into a sustainable, circular city, contributing to the overall goals of reducing environmental impact and improving urban living standards (Magistrat der Stadt Wien). The **Federal Ministry of Agriculture, Forestry, Environment and Water Management, known as the Ministry of Life (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft - Das Lebensministerium)**, plays a central role in shaping Austria's environmental policies. This ministry is responsible for overseeing initiatives related to the circular economy, including regulations that govern waste management, recycling, and sustainable resource use. The ministry's programs are designed to support Austria's transition to a low-carbon, resource-efficient economy (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft - Das Lebensministerium).

The **FFG Call for Proposals Circular Economy (FFG Ausschreibung Kreislaufwirtschaft)** is a significant funding initiative that supports research and innovation projects aimed at advancing the circular economy in Austria. Managed by the Austrian Research Promotion Agency (FFG), this program provides financial support for projects that develop innovative technologies, processes, and business models that contribute to resource efficiency and waste reduction. The initiative is a key driver of innovation in Austria's circular economy landscape (FFG Ausschreibung Kreislaufwirtschaft). The **IBO (Austrian Institute for Building Biology and Ecology)** is an independent, non-profit scientific organization dedicated to researching the interactions between people, buildings, and the environment. The IBO provides expertise in ecological building and healthy living, offering resources and support for individuals, experts, and companies interested in sustainable construction. Through its research and educational efforts, the IBO plays a vital role in promoting sustainable building practices across Austria (IBO). Founded in 2011, the **IG Life Cycle Built Environment (IG Lebenszyklus Bau)** aims to integrate the various phases of a building's lifecycle—planning, construction, management, and financing—into a cohesive, lifecycle-oriented approach. The organization brings together around 100 companies to develop cross-trade and cross-phase models and standards. These efforts are designed to optimize the entire lifecycle of buildings, ensuring that they are designed, built, and managed in a sustainable and resource-efficient manner (IG Lebenszyklus Bau). The **Austrian Federal Environment Agency (Umweltbundesamt)** is the country's leading expert institution for environmental protection and environmental control. It provides critical data, assessments, and recommendations to support the development and implementation of environmental policies. The agency plays a key role in monitoring Austria's environmental performance and ensuring that circular economy practices are effectively integrated into national policies (Umweltbundesamt).

3.4.3 Soft Instruments, Tender and Reports

Reports provide insights into best practices, challenges, and opportunities within the construction and demolition sectors, highlighting Austria's efforts to transition towards a more sustainable and resource-efficient built environment.

The report **"Circular Economy: Material Flows in Austria in 2021 (Kreislaufwirtschaft Materialflüsse in Österreich im Jahr 2021)"** provides an in-depth analysis of Austria's

consumption of natural resources, focusing on four major material flows: biomass, metals, non-metallic minerals, and fossil fuels. The report highlights the current state of resource use in Austria and identifies opportunities for improving material efficiency and reducing waste, supporting the country's circular economy goals (Kreislaufwirtschaft Materialflüsse in Österreich im Jahr 2021). The report "FAQs on the Re-use of Building Components" (FAQs zum Re-Use von Gebäudekomponenten) authored by Markus Meissner, Roman Borszki (pulswerk GmbH), Thomas Romm (romm ZT), Irene Schanda, and Matthias Neitsch (RepaNet Re-Use- und Reparaturnetzwerk Österreich), focuses on the re-use and preparation for re-use of building components. It provides practical answers to frequently asked questions related to the re-use of materials in construction, offering guidance for stakeholders involved in the process. The report was commissioned by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK), specifically the department focused on waste prevention, recycling, and assessment. This document serves as a crucial resource for promoting the reuse of materials, a core component of circular economy strategies in the construction industry. **Report on Circular Building Economy (KreislaufBAUwirtschaft**) The "Circular Building Economy" report was developed with the goal of creating a comprehensive white paper concept for implementing circular economy practices in the construction sector. Authored by experts from the Environment Agency Austria (Umweltbundesamt), an architectural research and planning firm (ZT Architekturbüro forschen planen bauen), the Austrian Construction Material Recycling Association (Österreichischer Baustoff-Recycling Verband), and the Federal Real Estate Company (Bundesimmobiliengesellschaft m.b.H.), this report involved 21 qualitative interviews with representatives from seven stakeholder groups. The study identified seven key stakeholder groups within the construction and building materials sector, each playing a distinct role in shaping industry practices. These groups include the construction industry, building material manufacturers, developers/investors, the public sector, associations, planners, and research institutions. To capture a comprehensive perspective, stakeholders were categorized into "Experts", comprising authorities, scientific organizations, associations, and specifically selected architects, and "Practitioners", including construction companies, building material manufacturers & suppliers, and developers. While experts provide insights based on regulations, academic research, and industry standards, practitioners offer a hands-on, business-oriented perspective from their direct involvement in construction projects and material production. This division ensures a balanced understanding of both theoretical frameworks and real-world applications in the sector. The study identified key barriers and levers for the circular economy in construction and compiled good practice examples. The report was supported by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK) and contributes significantly to understanding the challenges and opportunities of circular construction in Austria. The expert interviews highlighted ten key areas essential for the successful implementation of a circular economy in the construction sector. A circular economy must start with integrated planning and design, where the choice of building materials and construction methods ensures future deconstructability. Buildings should not only serve their primary function but also be regarded as material reservoirs. Ideally, Building Information Modelling (BIM) supports this integrated planning by documenting relevant data throughout a building's entire life cycle. Additionally, end-of-life strategies and circular economy principles must be incorporated into a comprehensive life cycle assessment (LCA) to aid decision-making. Efficient material flow management on construction sites helps minimize waste, but the most effective way to

conserve resources is by extending the lifespan of buildings and repurposing existing structures. The challenge lies in creating enabling conditions to facilitate these objectives. While discussions on the circular economy in the construction sector indicate increasing awareness among stakeholders, practical implementation remains limited. The primary barriers include economic factors, such as the absence of viable business models, and legal frameworks that do not yet fully support circular practices. To drive progress, scientific institutions must advance recycling technologies, collaborate with industry and trade partners, and further develop BIM applications and material passports. Moreover, ensuring effective knowledge transfer through education and training will be crucial in translating these insights into real-world practices. The **Construction and Demolition Waste Management** in Austria (Bau- und Abbrucharbeiten Abfallwirtschaft in Österreich) report provides a national overview of construction and demolition waste (CDW) management in Austria. It analyzes the performance of CDW management systems and offers insights into how Austria handles the substantial amounts of waste generated by the construction sector. This document is crucial for understanding the current state of waste management practices and the effectiveness of existing regulations and initiatives aimed at improving sustainability in the construction industry. **Guidelines for Circular Economy Planning and Construction** (Leitfaden für ein kreislaufwirtschaftliches Planen und Konstruieren) developed by the AG Kreislaufwirtschaft der IG Lebenszyklus Bau, this practical guide is tailored for clients, planners, and building contractors involved in circular economy projects. The guidelines provide actionable advice on how to integrate circular economy principles into the planning and construction phases, promoting sustainable design, resource efficiency, and waste reduction. These guidelines are a key resource for professionals looking to align their projects with Austria's circular economy goals. **Climate Neutrality and Circular Economy in Construction** (Klimaneutralität und Kreislaufwirtschaft im Bauwesen), this report by IG Lebenszyklus Bau addresses the intersection of climate neutrality and circular economy in the construction sector. It discusses how current legal frameworks, particularly waste law, impact circular economy activities. The report emphasizes the importance of considering materials as potential waste at the point of dismantling and ensuring that these materials are managed in compliance with the Waste Management Act. The document highlights the challenges posed by existing regulations and suggests ways to overcome them to achieve a more sustainable construction industry. **Funding in the Circular Economy** (Förderungen in der Kreislaufwirtschaft) authored by V. Reinberg, M. Wirth, M. Lorbek, and J. Kisser, compiles an overview of funding opportunities available for circular economy projects in Austria. The report is part of a broader project aimed at supporting the implementation of Austria's circular economy strategy. It includes a database accessible online, where stakeholders can search for suitable funding channels. Additionally, the report features a graphical overview of funding opportunities, making it easier for businesses and organizations to navigate the financial aspects of circular economy projects.

<u>Tender processes and related aspects in construction and demolition projects with the principles of the circular economy:</u>

The role of a **Demolition Expert (Rückbaukundige Person)** is critical within the framework of Austria's Recycling Building Materials Ordinance (Recycling-Baustoffverordnung). A demolition expert is a certified professional with specialized knowledge in construction or

chemistry, demolition work, waste management, construction chemistry, and waste legislation. These experts are responsible for conducting disturbance or pollutant investigations, creating demolition concepts, and preparing approval reports for projects involving up to 3,500 m³ of enclosed space. The necessary qualifications can be acquired through specific courses, such as the BRV demolition course, ensuring that demolition activities are conducted in a manner that minimizes environmental impact and maximizes material recovery for recycling. The **Federal Act on the Award of Contracts (Bundesvergabegesetz 2018 - BVergG 2018)** provides the legislative foundation for procurement in Austria. The 2021 Council of Ministers resolution, based on this act, introduced mandatory criteria for sustainable procurement in building construction and civil engineering. The act, along with the newly standardized service description LB-VI, offers options for recycling-friendly tendering and awarding processes. This approach ensures that public procurement in Austria contributes to the circular economy by prioritizing the use of recycled materials and environmentally friendly practices in construction projects. The **Standardised Service Description (LB-VI) Version 6** is an essential tool in Austria's construction industry, particularly for incorporating recycling considerations into construction projects. LB-VI 06 ensures that the service specifications used in tenders include clear guidelines for recycled materials and sustainable practices. This standardized description helps contractors and project managers implement recycling-friendly processes, aligning their work with Austria's broader circular economy objectives. **ÖNORM A 2063** is a critical standard that governs the **Exchange of data in electronic form for the tendering, awarding, and invoicing phases (AVA)**. This standard regulates how data is structured and exchanged automatically between all parties involved in a construction project, including planners, modellers, clients, cost estimators, and contractors. By facilitating the efficient exchange of information, ÖNORM A 2063 supports transparent and streamlined processes, ensuring that sustainability and recycling criteria are consistently applied throughout the project lifecycle. The **Service Description for Building Construction (Leistungsbeschreibung Hochbau)** provides standardized service descriptions that form the basis for creating service specifications in building construction projects. These descriptions ensure that all stakeholders involved in construction projects have a clear understanding of the requirements, particularly regarding sustainability and the use of recycled materials. By adhering to these standardized descriptions, contractors can better align their projects with the principles of the circular economy. The **Austrian Recycling Building Materials Ordinance (Recycling-Baustoffverordnung)** is a pivotal regulation that promotes the recycling of construction and demolition waste. The ordinance mandates the separation and treatment of waste generated during construction and demolition activities, ensuring that these materials are processed into high-quality recycled building materials. This ordinance supports the broader goal of reducing waste and encouraging the reuse of materials in new construction projects, thereby contributing to Austria's circular economy. **ÖNORM B 3151** and **ÖNORM B 2251** are standards that regulate the dismantling of buildings as a standard method for demolition. ÖNORM B 3151 focuses on the organizational and technical aspects of dismantling structures, ensuring that materials are separated by type for recycling or disposal. The goal is to produce waste fractions that are as free as possible from pollutants and impurities, facilitating their reuse in new construction. **ÖNORM B 2251** complements this by providing procedural and contractual guidelines for demolition work, ensuring that these processes are carried out safely, efficiently, and in compliance with environmental regulations.

4 CONCLUSION: COMPARATIVE ANALYSIS OF THE INSTRUMENTATION OF THE CIRCULARITY IN THE BUILT ENVIRONMENT IN THE 4 LIVING LABS

This governance context analysis in the 4 countries and the Living Labs of the CREATE project gives us a better understanding of the common points and specificities of existing policy instruments to enable CEBE. The 4 countries based their national strategies on the European directives with a green economy approach. The circular economy is presented to create value with a low environmental impact. In this approach, the strategies and goals for CEBE are ambitious, but the policy instruments are limited to a few mandatory instruments (legal or economic) and rely on the willingness of the public and private stakeholders to use soft policy instrument (networking, pilot project, etc.) to enable innovation.

At the national level, The Netherlands proposed a strategy for the circular economy in an early stage (2016), compared to the other countries (2020). Still, their strategies are almost similar, aligned with the European one. The global approach is to improve raw material use and waste management efficiency and to develop the circular economy industry by supporting the production of new sustainable products and materials. France formulated a willingness to develop the reuse and the repair sector as well.

Moreover, France, the Netherlands and Sweden started to set up a committee to identify the legal barriers to developing a regulatory framework for the CEBE. We can underline that in 3 countries, the main regulatory instrument developed for the CEBE is a mandatory assessment of the environmental impact of new buildings (PEMD in France, MPG in the Netherlands, the climate declaration in Sweden). In Austria, these mandatory assessments are mentioned in the Federal act on the awarding of contract. This is not directly connected with a specific tool, but some criteria must be filled for any building construction project such as energy efficiency assessment, waste and emission avoidance demonstration for instance. Also, Austria developed mandatory reporting to do in the context of demolition for an efficient waste management.

The development of an assessment method for the environmental impact of a building is also correlated to the link at the national level between the circular and climate policies. Especially in Sweden, Austria and the Netherlands, circular economy is explicitly presented as a tool to reduce GHG emissions of the countries, leading to the need to develop measurement tools.

In terms of economic instruments, the governments propose a variety of subsidies for research and development programs for private and public sectors to stimulate innovation in terms of waste management, business models or sustainable products. Circular or public procurement is also identified as a tool to enable CEBE but these recommendations are not translated into mandatory rules. The exception is Austria, which developed mandatory

criteria for sustainable procurement that could enable circularity, such as the obligation to draw up a dismantling and recycling concept or the specification of a minimum proportion of recyclable raw material for instance.

Moreover, even though the strategies focus on the development of the use of reused material in the construction sector, there are at the moment no legal or economic instruments (such as economic incentives, tax reduction, etc.) to reach this goal. However, we can highlight in some countries a willingness to work on this question, with some economic instruments being discussed. Sweden is developing a new regulation for fiscal incentive for reusing and recycling (less waste, less tax), the Netherlands created a circular economy working group of sustainable finance to create a financial framework for circular economy, and France is discussing the possibility of a VAT reduction for circular products. The Extended Producer Responsibility for construction material is also in discussion in the Netherlands and Sweden and has been implemented by law in France.

The 4 countries also encourage the development of Public and Private Partnerships (PPP) and knowledge platforms to develop innovation but also to stimulate the market for circular construction (to develop reused recycled or biobased material chain). This is especially a main goal in the Netherlands, where the shortage of housing is leading to a policy focus on the construction of new buildings, which can be an opportunity to have visibility on the market demand. The Netherlands is also the only country until now that developed a common language of circular economy in the construction sector to facilitate its assessment, its design and to enable fair competition (Het Nieuwe Normaal). This necessity to develop a standardization of the criteria of assessment of the circularity is a leitmotiv at the European level but also in the other countries. We can also emphasize the particular approach of Austria that developed a platform dedicated to all the funding opportunities for circular projects. Austria also has a program to integrate the social inclusion aspect in circular economy construction projects.

The national ambitions and strategies generally give the responsibility for implementing the CEBE goals to the local level. In the 4 countries, the regional level has the responsibility to manage construction waste while the municipalities must integrate a circular approach in the urban development plan. Therefore, the local level must innovate, and coordination between the levels of governance must be developed.

At the local level, the general strategies are aligned with the national ones, especially in Sweden, Austria and in the Netherlands. In these three countries, the ambition for a CEBE is high and related to the climate goals and reduction of GHG emissions. In France, the regional and local levels propose a strategy in coherence with the specific nature of the area. The region has a lack of landfill space and therefore plans to reduce the production of waste by constructive austerity. Hence Rennes Métropole gives priority to rehabilitation and reuse.

Moreover, the municipalities mostly use soft instruments to enable CEBE at the local level and are characterized by a diversity of approaches. Göteborg and Nijmegen play a key role in developing public and private collaboration and give support to SME (with the Platform for Climate Neutral in Göteborg and the circular economy council in Nijmegen) to develop a local chain of reuse material or innovation for a CEBE. In Austria, this is done at the national level but applied at the local level as well, with the development of the Austrian reusing market platform. Rennes Metropole also gives direct or indirect financial support to circular and local initiatives. We can also emphasize the variety of pilot projects and assessment tools of circularity and sustainability being developed and tested at the local level, based on the willingness of the local government to engage themselves in circular solutions for the CEBE. For instance, 3 of the 4 cities (Nijmegen, Rennes Métropole, Göteborg) financed a stock and flow analysis of construction material, and invested in innovative tools to support their decision-making process for a circular urban project (Circulapp or Urbanprint in Rennes Métropole, Circular Impact Ladder or the dashboard in Nijmegen, etc.).

The 4 municipalities also put efforts into their internal organization to enable a governance of the circular economy. In recent years, the cities created a dedicated team for a circular economy with a focus on the construction sector and urban planning and developed internal coordination between different departments. Göteborg went further in 2024 by developing a new urban development department to simplify the effort for sustainable urban development. Vienna deployed a specific internal program to enable CEBE.

Finally, all the municipalities are members of networks dedicated to the circular economy and its application to the built environment. Their membership of different networks aims to provide information, exchange best practices and learn about the CEBE issues. The cities are members of local, regional, national, and European networks. These networks consist of a group of cities or a diversity of stakeholders.

The diversity of the approaches to CEBE at the local level demonstrates the innovation capacity of the local government and a plurality of interpretations of what circularity for urban development means. Globally, the local approach is targeting the use of reused and recycled material at first, followed by biobased material and on efficient waste management. The municipalities are willing to try different pilot projects and approaches that can fit their context. This is possible because the national framework of circular economy policy is wide. This phase of innovation at the local level is necessary to learn. However, we do believe that this should be only a phase and lead to the elaboration of the strategic framework of the CEBE to enable territorial coherence in diverse urban projects with circular ambition. This local strategy should also be supported by a standardization of the definition and method of assessment of circularity at the national level.

Moreover, the national legal framework could be strengthened with regulatory and/or economic incentive instruments to enable the reuse of material, the development of local

chains or the use of biobased material. Although the national ambition for a CEBE is high, the policy instruments remain mostly voluntary. There are, for instance, no tax deductions for using reused material. Adding to this, some legal barriers exist in the 4 countries such as a categorization of the waste that should change to simplify the reusability of material. Currently, only Austria has a law that can transform the waste status of recycled material, but only of the material reach some specific quality criteria. Additionally, there is the lack of opportunity to identify who is a local producer in a tender procedure, which is breaking the development of a local chain of circular construction materials.

Globally, the policy instruments for a CEBE appear complex and presents a lack of implementation orientation for the local government. We can also underline the lack of a national program to support the local government, beyond the subsidies, in their responsibility in the implementation of a CEBE (courses about the CEBE regulatory framework for instance, technical support to develop knowledge and circular projects, etc.). The municipalities also miss a good and complete database about the material stock and environmental impact of the built environment. Hence, the Material passport should also become a mandatory instrument to enable such a database. Finally, access to knowledge about the CEBE for the local government should be a priority in the context of constant change of policy instruments at European and national level.

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Din partner i näringslivet | Business Region Göteborg (businessregionGöteborg.se)

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common procurement requirements

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Ikwilcirculairinkopen.nl | Hét platform dat je verder helpt.

Over ons – Rapid Impact Contracting

CircuLaw - Bouw

Circular Economy Working Group (dnb.nl)

Het Nieuwe Normaal | Cirkelstad

Versnellingshuis Nederland Circulair! | Hulp bij circulair ondernemen (versnellingshuisce.nl)

De omgevingsvisie | VNG

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CircE | Interreg Europe

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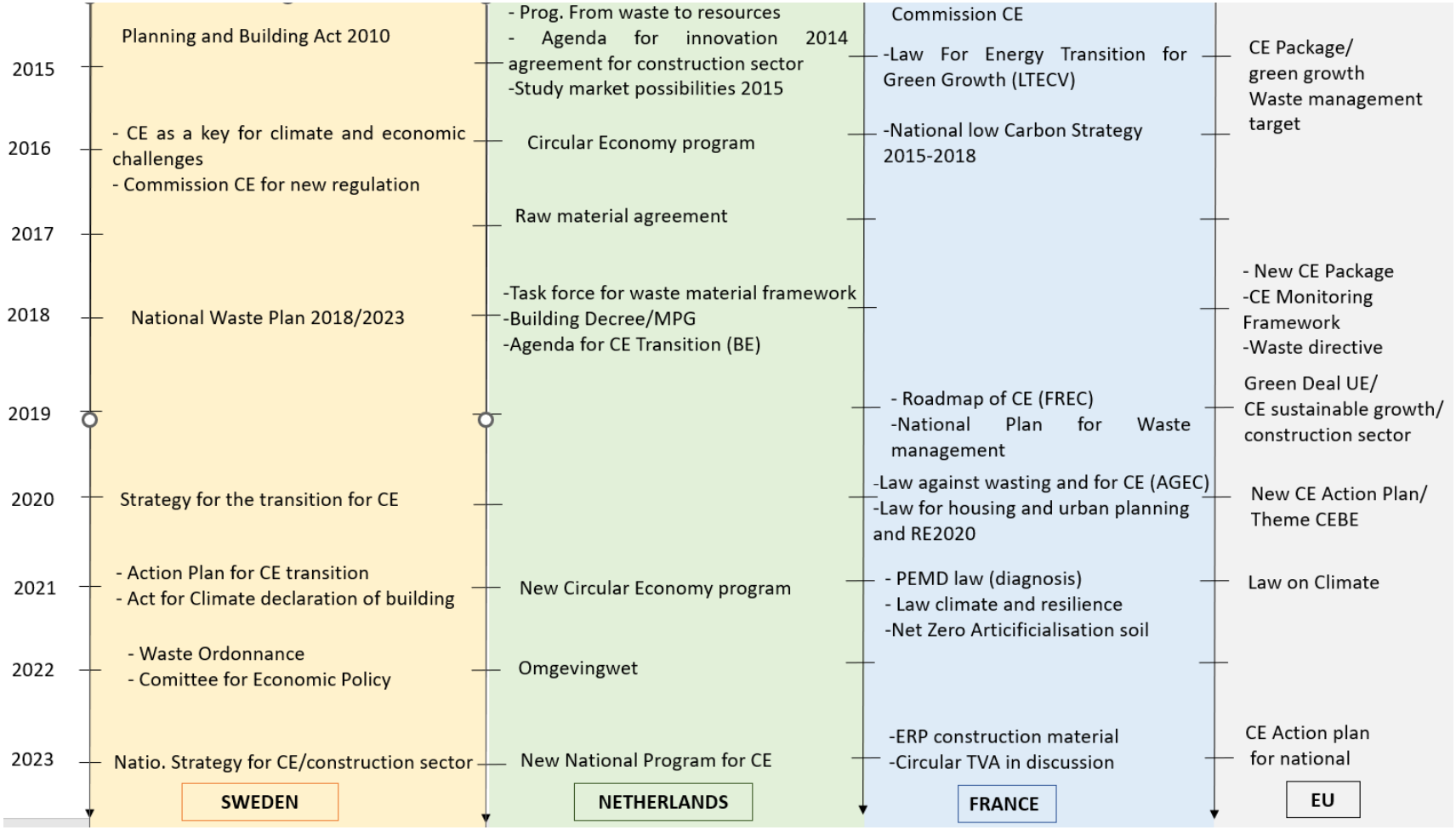
Gemeente Nijmegen gunt woontoren Hezelpoort aan ontwikkelaar VanWonen | VanWonen

Sustainable Development Goals | VNG (vng-international.nl)

Cirkelstad, hét platform voor koplopers in de bouw - Cirkelstad

6 ANNEXES: FIGURES

6.1 Chronology of the policy orientations for circular economy in France, Sweden and the Netherlands and at the European level



6.2 Strategies and Regulatory/legal instruments to enable circular economy in the built environment in France, Sweden and the Netherlands

	SWEDEN	NETHERLANDS	FRANCE
AMBITIONS AND STRATEGY	-CE to reduce half of the CO2 emissions of construction sector by 2025; 90% by 2050 (National Strategy for CE 2023) Context housing shortage: focus new construction -Efficient waste management -Efficiency of Ressource use -Production of more sustainable product by supporting business sector	-100% circular economy by 2050, including for the BE - -50% use of primary material --49% CO2 emission (2019) (circular economy program, 2016, Agenda for CE transition, 2018) Context housing shortage: focus new construction -Develop adaptivity of building -Raw material use efficiency -Develop new sustainable product/material -Reduction of raw material use	-LTECV 2015: - 40% GHG by 2030 via CE -Roadmap of CE: -30% ressources comsumption by 2030; - 50% quantity waste in landfill by 2025, 65% recylcing -AGEC act: 70% waste valorisation -Use low carbon construction products and development of CE industry by developping offer of reuse and repair sector
LEGAL INSTRUMENTS	-Planning and Building act 2010: obligation to indicate the reusability of material and waste production destination -Act for climate declaration of Building 2021: diagnosis mandatory about the climate impact of the building -Waste ordonnance 2022: Mandatory waste sorting of demolition/construction waste	-Building Decree 2018 and creation of the MPG, environmental impact assessment tool, mandatory to use -Omgevingwet, Dutch Environmental and Planning Act 2024: regulation simplification, and capacity for local authorities to describe Omgewingvisie with CE	-2021: Net Zero Articificialisation soil by 2050, reduction land consumption and more reuse of building -PEMD act: diagnosis Product, Material, Waste to obtain information on material type, quantity and tracability to enable reuse -RE2020: regulation for carbon impact assessment of all lifecycle of building

6.3 Economic and soft instruments to enable circular economy in the built environment in France, Sweden and the Netherlands

	SWEDEN	NETHERLANDS	FRANCE
ECONOMICAL INSTRUMENTS	-New regulation for fiscal incitation for reusing and recylcling (less waste, less tax) -Subsidy R&D innovation for sustainable construction and waste management -Public procurement	-Subsidy to R&D to private stakeholders to develop a circular market of material -Subsidy for housing construction, give visibility -Circular public procurement -Creation of Circular Economy working group of sustainable finance to create a financial framwork for CE	-Public tender to enable use of reused material -Subsidy to project and R&D for innovation about: waste reduciton, reue, recycling activities, training, repair/reuse chain (waste fund, circular economy fund, etc.) -Extended Producer Responsability for construction material -Circular TVA in discussion
SOFT INSTRUMENTS	-PPP support: network, knowledge platform - Assessment tool -Database building material to trace the waste production -Private sector intiatives: research center to develop reuse, circular material or digital marketplace. CCBuild center for circular construction -Swedish Construction Federation: agreement to develop a common language of all phases of building life	-Development of a common language: Het Nieuw Normaal, standaridisation of circular definition, vocabulary to assess CE of design (Waste management, environemental impact, adaptivity, health material) -Education, institute CE construction -Communication PPP: Circular NL accelerator Portal (2019), CirkelStad	-PPP, networking -Information communication tools about best practices -National Institute for CE

6.4 Policy instruments to enable circular economy in the built environment at the local level in Göteborg, Nijmegen and Rennes Metropole

	GOTEBORG	NIJMEGEN	RENNES METROPOLE
AMBITION AND STRATEGY	-Environmental and climate program 2021-2030: - 50% Co2 by 2025; - 90% by 2030 -Focus on new constructions: reduction material flow, - 40% waste by 2030; more reuse, recycle and biobased material	-GMR: for circular construction innovation and development of local reused material market -Nijmegen : 25% circular construction by 2025; 50% by 2030; 100% by 2050 and 0% loss raw material -Action plan for CE in 2024	-Region Plan of waste prevention management 2020-2032: reduction and valorisation of waste by Ce approach -Zero waste landfill -Rennes M.: 2023 Roadmap for CE: Constructive sobriety; Eco conception to build less and better. - Reduction half of material footprint by 2050 -Reuse/recycle 80% building waste by 2030 -Production 10% of new houses from housing recycling
INSTRUMENTS	- strategy for regional developement and growth: financial support to SME -Coherence for waste management 13 municipalities -Coherence between departments with creation of urban development service -Use innovative procurement -Commission environment and climate -PPP: Platform for Neutral construction 2022 for local market of reused material -Network: other cities in sweden, North Europe for CE -Parntership with university	-GMR: Circular Impact Ladder assessment tool -Public tender: case of Hezelpoort and Dashboard; carbon pricing -Collaboration between municipalities -Circular Economy Council (RVN@) for SME -PPPP and LL approach -Omgevingvisie: land properties, cost reduction for building permit with circular ambition -Pilot project -Networking: regional and national scale -1 growing team dedicated to CE with one focus on BE	-Net Zero Artificialisation law: 1st rehabiliation and reuse -Collaboration differents stakeholders , identification key stakeholders, sharing knowledge -Subsidy direct or indirect to project for CE (platform of reused material) -Use of tool: Circulapp, Urbamap, Urbanprint -A dedicated team that is developping the CE strategy.

6.5 Figures Austria/Vienna

Key Austrian waste management laws, regulations, and guidelines can be found in the annex.

Law/Regulation Title translated	Law/Regulation Title German
Austrian Ordinance for Tracking Waste	Abfallnachweisverordnung
Waste Incineration Ordinance	Abfallverbrennungsverordnung AVV amendment 2013
Waste prevention programme	Abfallvermeidungsprogramm
Waste Catalogue Ordinance	Abfallverzeichnisverordnung
Waste Management Act 2002	Abfallwirtschaftsgesetz - AWG
Remediation of Contaminated Sites	Altlastensanierungsgesetz (ALSAG)
Separation of Construction Waste Ordinance	Baurestmassentrennungsverordnung
Federal Waste Management Plan	Bundes-Abfallwirtschaftsplan (BAWP)
Landfill Ordinance	Deponieverordnung
Landfill Ordinance Amendment BGBl. II 144/2021	Deponieverordnungsnovelle BGBl. II 144/2021
The new guideline for recycled building materials, as of January 2023	Die neue Richtlinie für Recycling-Baustoffe, Stand Jänner 2023
EU Circular economy action plan	EU-Aktionsplan für die Kreislaufwirtschaft
Ordinance on the Determination of Hazardous Waste	Festsetzungsverordnung gefährliche Abfälle, BGBl. II Nr. 227/1997, zuletzt geändert durch BGBl. II Nr. 178/2000
Law to reorganize circular economy and waste law	Gesetz zur Neuordnung des Kreislaufwirtschafts- und Abfallrechts
QUALITY-ASSURED RECYCLED BUILDING MATERIALS AND MOBILE RECYCLING PLANTS	GÜTEGESCHÜTZTE RECYCLING-BAUSTOFFE UND MOBILE RECYCLING-ANLAGEN
The Austrian Circular Economy Strategy	Kreislaufwirtschafts-Strategie Österreich auf dem Weg zu einer nachhaltigen und zirkulären Gesellschaft -
Code of practice - Use of recycled building material products containing bricks, 1st edition, January 2022	Merkblatt – Verwendung von Ziegel-Hältigen Recycling-Baustoffprodukten, 1. Auflage, Jänner 2022
Fact sheet - Utilisation of reclaimed asphalt, 2nd edition, August 2020	Merkblatt – Verwertung von Ausbauasphalt, 2 Auflage, August 2020

Leaflet "Use and recycling of excavated soil", 4th edition, January 2023	Merkblatt “Verwenden und Verwerten von Bodenaushubmaterial”, 4 Auflage, Jänner 2023
Leaflet Interim storage for construction waste	Merkblatt Zwischenlager für Baurestmassen
OIB Guideline 1 to 6	OIB Richtline 1 bis 6
OIB Guideline 7 - Foundation document	OIB Richtlinie 7 - Grundlagendokument
ÖNORM A 6241-1	Digital building documentation - Part 1: CAD data structures and Building Information Modeling (BIM) - Level 2
ÖNORM A 6241-2	Digital building documentation - Part 2: Building Information Modeling (BIM) - Level 3-iBIM
ÖNORM A 7010-6	Object management - Data structures - Part 6: Requirements for data from Building Information Modeling (BIM) models over the life cycle
ÖNORM B 1801-1	Construction project and property management
ÖNORM B 1801-2	Construction project and property management - Part 2: Property follow-up costs
ÖNORM B 1801-3	Construction project and object management - Part 3: Object and usage typology
ÖNORM B 1801-4	Construction project and property management - Part 4: Calculation of life cycle costs
ÖNORM B 2251	Demolition work - work contract standard
ÖNORM B 3140	ÖNORM B 3140 is an Austrian standard that deals with the "Disposal of Construction Waste." Recycled aggregates for unbound and hydraulically bound applications as well as for concrete
ÖNORM B 3141	Production of recycled building materials from excavated materials (mainly natural aggregates) - requirements
ÖNORM B 3151	Dismantling of buildings as a standard method for demolition
ÖNORM EN 12620	Aggregates for concrete
ÖNORM EN 12620	Aggregates for concrete
ÖNORM EN 13055	Lightweight aggregates
ÖNORM EN 13139	Aggregates for mortar (consolidated version)
ÖNORM EN 13242	Aggregates for unbound and hydraulically bound mixtures for civil engineering and road construction
ÖNORM EN 13965-2	Characterization of waste - Terminology - Part 2: Management-related terms (multilingual version: de/en/fr)
ÖNORM EN 15643	Sustainability of buildings - General framework for the assessment of buildings and engineering structures
ÖNORM EN 15643	Sustainability of buildings - General framework for the assessment of buildings and civil engineering works
ÖNORM EN 15804	Sustainability of construction works - Environmental product declarations - Basic rules for the product category construction products (consolidated version)

ÖNORM EN 15804	Sustainability of buildings - Environmental product declarations - Basic rules for the product category Construction products (consolidated version)
ÖNORM EN 15941	Sustainability of buildings - Data quality for capturing the environmental quality of products and buildings - Selection and application of data
ÖNORM EN 15978	Sustainability of buildings - Assessment of the environmental performance of buildings - Calculation method
ÖNORM EN 15978-1	Sustainability of buildings - Methodology for assessing the quality of buildings - Part 1: Environmental quality
ÖNORM EN 16309	Sustainability of buildings - Assessment of the social quality of buildings - Calculation methods
ÖNORM EN 16485	Round and sawn timber - Environmental product declarations - Product category rules for wood and wood-based materials in construction
ÖNORM EN 16627	Sustainability of buildings - Assessment of the economic quality of buildings - Calculation methods
ÖNORM EN 16757	Sustainability of buildings - Environmental product declarations - Product category rules for concrete and concrete elements
ÖNORM EN 16783	Thermal insulation products - Environmental product declarations (EPD) - Product category rules (PCR) supplementary to EN 15804 for factory-made and site-made products
ÖNORM EN 16907-1	Earthworks - Part 1: Principles and general rules
ÖNORM EN 17200	Construction products: Assessment of release of dangerous substances - Analysis of inorganic substances in leachates and eluates - Analysis with inductively coupled plasma - Mass spectrometry (ICP-MS)
ÖNORM EN 17213	Windows and doors - Environmental product declarations - Product category rules for windows and doors
ÖNORM EN 17410	Plastics - Regulated recycling cycle of window and door profiles made of PVC-U
ÖNORM EN 17472	Sustainability of buildings - Assessment of the sustainability of civil engineering works - Calculation methods
ÖNORM EN 17662	Execution of steel structures and aluminum structures - Environmental product declarations - EN 15804 complementary product category rules for load-bearing products made of steel, aluminum, and metal for use in buildings
ÖNORM EN 17666	Maintenance - Maintenance Engineering - Requirements
ÖNORM EN 17680	Sustainability of buildings - assessment of the potential for sustainable modernization of buildings
ÖNORM EN 17680	Sustainability of buildings - assessment of the potential for sustainable modernization of buildings
ÖNORM EN 17861	This document defines circular economy terms used in the flooring industry.
ÖNORM EN 17902	Furniture - Circularity - Requirements and assessment methods for disassembly/reassembly
ÖNORM EN 17903	Definition and declaration of recycling content (organic and inorganic) in textile floor coverings
ÖNORM EN 18001	Curtain walling - Environmental product declarations - Product category rules for curtain walling
ÖNORM EN 197-6	Cement - Part 6: Cement with recycled building materials
ÖNORM EN 933-11	Test methods for geometrical properties of aggregates - Part 11: Classification of constituents in coarse recycled aggregates

ÖNORM EN ISO 16000-32	This part of ISO 16000 specifies requirements for the investigation of structures and their technical installations with regard to the presence of pollutants. These later serve as the basis for subsequent sampling of suspected areas and for determining the quantity and type of pollutants, which is described in other parts of ISO 16000.
ÖNORM EN ISO 19650-5	Organization of data for construction works - Information management using BIM - Part 5: Specification for safety aspects of BIM, digitalized buildings, and smart asset management
ÖNORM EN ISO 22014	Library objects for architecture, engineering, and construction and use
ÖNORM EN ISO 22057	Sustainability of buildings and civil engineering works - Data templates for the use of environmental product declarations (EPDs) for construction products in building information modeling (BIM)
ÖNORM EN ISO 24161	Waste collection and waste transportation management - Terminology
ÖNORM ISO 20400	Sustainable Procurement - Guide (ISO 20400:2017)
ÖNORM S 2126	Basic characterization of excavated material before excavation or removal work begins
ÖNORM S 2127	Basic characterization of waste piles or solid waste from containers and transport vehicles
ÖNORM S 2100	Austrian Waste Code Numbers
ONR 192130	Pollutant investigation of buildings before demolition work
ÖVE/ÖNORM EN 45560	Method for designing circular products
Austrian Recycling Building Materials Ordinance	Recycling-Baustoffverordnung
Recycled Timber/Wood Ordinance	Recyclingholzverordnung – RHV
Guideline for the treatment of contaminated soils and building components, December 2004	Richtlinie für die Aufbereitung kontaminierter Böden und Bauteile, Dezember 2004
Guideline for the mobile processing of mineral construction waste, 2nd edition, December 2013	Richtlinie für die mobile Aufbereitung von mineralischen Baurestmassen, 2. Auflage, Dezember 2013
Guideline for flowable self-compacting trench filling material with recycled, crushed material, September 2007	Richtlinie für fließfähiges selbstverdichtendes Künettenfüllmaterial mit recycliertem, gebrochenem Material, September 2007
Guideline for recycled building materials Excavated materials 2nd edition,	Richtlinie Recycling-Baustoffe Aushubmaterialien 2. Auflage,
Vienna Building Regulations Amendment 2023	Wiener Bauordnungsnovelle 2023