



Study on circular economy principles for buildings' design

Final Report

Written by Deloitte, Building Research Establishment, In Extenso Innovation Croissance
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Abbreviations

Abbreviations	Explanations
AGEC	French Anti-Waste Law for the Circular Economy
ARA	Housing Finance and Development Centre of Finland
BAMB	Buildings as Material Banks
BBCA	France's Association for the Development of Low Carbon Buildings
BC	Building Construction
BIM	Building Information Modelling
BREEAM	Building Research Establishment Environmental Assessment Method

Abbreviations	Explanations
BRPs	Building Renovation Passports
BWR	Basic Works Requirements
C&D	Construction & Demolition
CAD	Canadian Dollar
CAM	Criteri Ambientali Minimi (compulsory environmental criteria)
CDW	Construction and Demolition Waste
CE	Circular Economy
CEAP	Circular Economy Action Plan
CEN	European Committee for Standardisation
CEN/TC	Comité Européen de Normalisation/ Technical Committee
CO2	Carbon dioxide
CO2e	Carbon Dioxide emission
CoP-CITIES	Community of Practice on Cities
CPR	Construction Products Regulation
CSBR	Centre for Sustainable Building Research
CSTB	French Scientific and Technical Centre for Building
DBL	Digital Building Logbooks
DG	Directorate-General
DGNB	German Sustainable Building Council
DKK	Danish Krone
E+C-	Energy-plus & Carbon Reduction Buildings
EAP	Environmental Action Programme

Abbreviations	Explanations
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
ECI	Environmental Cost Indicator
EED	Energy Efficiency Directive
EFSI	European Fund for Strategic Investments
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ENCPE 2020	Portugal's National Strategy for Ecological Public Procurement
EPB Standards	The Energy Performance of Building Standards
EPBD	Energy Performance of Building Directive
EPC	Energy Performance Certificate
EPD	Environmental Product Declaration
EPR	Extended Producer Responsibility
ERDF	European Regional Development Fund
ESF	European Social Fund
ESI Funds	European Structural Investment Funds
EU	European Union
FD	Floods Directive
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GLA	Greater London Authority
GPP	Green Public Procurement

Abbreviations	Explanations
HGV	Heavy Goods Vehicles
IHP	Innovative Housing Programme
iisBE	International Initiative for a Sustainable Built Environment
IPO	Initial Public Offering
IPTS	Institute for Prospective Technological Studies
ISO	International Organization for Standardization
ITACA	Institute for Innovation and Transparency in Procurement and Environmental Compatibility
JRC	Joint Research Centre
K	Thousand
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
LEED	Leadership in Energy and Environmental Design
LQH	Long-Life Quality Housing
LTRS	Long-term renovation strategies
M	Million
m ²	Meter square
m ³	cubic meter
MJ	Megajoule
MS	Member State
NAPS	Member States National Action Plans
NBS	Nature Based Solutions
NECPs	National energy and climate plans

Abbreviations	Explanations
NGO	Non-governmental organization
NL	Netherlands
No.	Number
nZEBs	Nearly zero-energy buildings
OECD	The Organisation for Economic Co-operation and Development
OVAM	Flemish Public Waste Agency
PCDS	Product Circularity Datasheet
PCR	Product Category Rules
PREC	Be Circular
RAKLI	Finnish Association of Building Owners and Construction Clients
RC	Concrete with recycled concrete aggregates
SEA	Strategic Environmental Assessment
SI	International System of Units
SMEs	Small and Medium Enterprises
SPD	Supplementary Planning Documents
SPR	Site Plan Review
T	Tons
TBD	To be Defined
Toe	Ton of oil equivalent
UK	United Kingdom
US	United States
WFD	Water Framework Directive

Abbreviations	Explanations
WLC	Whole Life-Cycle Carbon
ZWS	Zero Waste Scotland

EXECUTIVE SUMMARY

Objectives of the study

Broadly, **circular economy principles** aim to design out waste and pollution, keep products and materials in use and regenerate natural systems¹.

The application of circular economy principles to buildings includes several building **design choices** that influence the longevity, durability and adaptability of buildings and the generation of waste at each building life cycle stage, and therefore influence the efficient use of resources in construction. Various parameters need to be considered such as: quality of materials; design of spaces and assembly of components; skills levels of designers/builders/installers/demolition contractors; environmental context; operating conditions; levels of maintenance. **Several socio-economic factors** also impact the longevity of buildings such as: costs of land ownership and long-term rental; trends towards new performances and functional requirements; urban development plans; preferences for new buildings versus existing buildings. As a result, the life span of a building can be shorter or longer than its originally foreseen service life.

In the context of the **European Green Deal**², the strategy for a **Renovation Wave for Europe**³ was unveiled in 2020 and facilitates a balanced approach to building renovation by integrating life-cycle thinking and circularity with energy performance improvements. The European Commission also developed **Level(s)**⁴, which is a common framework to measure and report on the sustainability performance of buildings across a series of indicators covering the whole life cycle. Data generated from the Level(s) framework and from other sources could potentially be stored in a **Digital Building Logbook**⁵ and facilitate circular approaches as well as other applications.

In light of these policy developments, **this study aims to assist the Commission with identifying policy options that support the uptake of "Circular economy principles for buildings' design" in European, national and local policies**. The goal is to increase the service life of buildings, facilitate the use of secondary materials i.e. reused and recycled materials and improve resource efficiency across the building life cycle.

The outcome of the study will enable Member State authorities and economic operators to take informed decisions with the aim of achieving durability, adaptability, resource efficiency and waste reduction and facilitating waste management. The study **also provides key insights and recommendations on actions for a roadmap** supporting the uptake and implementation of circular economy principles for buildings' design in the EU.

Approach

The draft EU policy options have been developed following the assessment of 30 case studies (of which 26 focus on EU Member States and 4 on non-EU OECD countries), an online survey and analysis of potential synergies with existing EU policies and initiatives. The identification of policy options considered the following:

- **Existing national and regional policies and approaches** (regulations, voluntary agreements, Green Public Procurement (GPP), strategy, local planning, business support, standards, financial measures)

¹ Ellen MacArthur Foundation, The concept of Circular Economy

<https://www.ellenmacarthurfoundation.org/circular-economy/concept>

² COM/2019/640 final, The European Green Deal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>

³ COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

⁴ https://ec.europa.eu/environment/topics/circular-economy/levels_en

⁵ <https://op.europa.eu/en/publication-detail/-/publication/40f40235-509e-11eb-b59f-01aa75ed71a1/language-en/format-PDF/source-search>

- **Ability to tackle key challenges and barriers** in relation to implementing whole life circular design in the built environment
- **Priority areas across the value chain** of buildings' design where further action at EU level presents potential for increased uptake and effectiveness
- **Potential synergies** with existing EU policies and initiatives that impact construction and buildings, including: European Green Deal⁶; Renovation Wave⁷; Circular Economy Action Plan⁸; Level(s) Framework⁹; Construction Products Regulation¹⁰; Energy Performance of Buildings Directive (EPBD)¹¹ and related EPBD standards; EU Construction & Demolition Waste Protocol¹²; New European Bauhaus¹³; EU Commission action plan on financing sustainable growth¹⁴; Sustainable Product Policy and Standards¹⁵; Ecodesign and Energy Labelling Directives and Standards¹⁶; Environmental Performance of Buildings (EPB) Standards¹⁷; EU Green Bond Standards¹⁸; Digital Building Logbooks¹⁹; EU criteria for Green Public Procurement (GPP Criteria)²⁰; EU framework programmes for Research and Innovation²¹.

This led to the identification of 8 broad policy options for review primarily based on their scalability and impact: Construction Products Regulation; Energy Performance of Buildings Directive; Energy Efficiency Directive; GPP criteria; Guidance for local and regional authorities; Extender Producer Responsibility (EPR); waste audit and selective demolition requirements; and fiscal instruments (business support).

After **assessing interlinkages between the options and taking into account issues of feasibility and appropriateness for EU action beyond the Member State level**, these options were further refined to a **final shortlist of 4 policy options**. These are:

- Potential revision of the **Construction Products Regulation**
- Potential revision of the **Energy Performance of Buildings Directive**
- Potential revision and expansion of **GPP criteria**
- Development of **guidance for local and regional authorities**

⁶ COM/2019/640 final, The European Green Deal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>

⁷ COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

⁸ COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

⁹ European Commission (2019), LEVEL(S), Taking action on the total impact of the construction sector

¹⁰ Regulation (EU) No 305/2011 laying down harmonised conditions for the marketing of construction products, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0305>

¹¹ Directive 2010/31/EU on the energy performance of buildings, https://eur-lex.europa.eu/legal-content/EN/ALL;/ELX_SESSIONID=FZMjThLLzfxmmMCQGp2Y1s2d3TjwtD8QS3pqdkhXZbwqGwlqY9KN!2064651424?uri=CELEX:32010L0031

¹² European Commission (2016), EU Construction & Demolition Waste Management Protocol, <https://ec-circular.com/wp-content/uploads/2017/05/Protocol-Ares20165840668-101016-3.pdf>

¹³ https://europa.eu/new-european-bauhaus/index_en

¹⁴ European Commission (2018), Renewed sustainable finance strategy and implementation of the action plan on financing sustainable growth, https://ec.europa.eu/info/publications/sustainable-finance-renewed-strategy_en

¹⁵ https://ec.europa.eu/growth/industry/sustainability/product-policy-and-ecodesign_en

¹⁶ https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/ecodesign_en

¹⁷ <https://epb.center/>

¹⁸ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-green-bond-standard_en

¹⁹ European Commission (2020), Study on the development of an EU framework for Digital Building Logbooks, https://ec.europa.eu/growth/content/study-developing-eu-framework-digital-logbook-buildings_en

²⁰ https://ec.europa.eu/environment/gpp/index_en.htm

²¹ <https://ec.europa.eu/programmes/horizon2020/>

The policy options were discussed at a webinar with stakeholders and subsequently refined. The options were also used to help generate a roadmap for implementing Circular Economy Principles for Building Design.

Outline description of the policy options

The four selected policy options are summarised on the next pages, including their objectives, policy context, relevant initiatives and rationale, potential delivery mechanisms, barriers and opportunities, and key success factors.

Policy option 1: potential revision of the Construction Products Regulation (CPR)

Objective(s): Revision of CPR (Construction Product Regulation) to integrate circularity aspects

Implementation approach: Mandatory (minimum level) & Voluntary (aspirational level)

Timeframe: Beyond 2021

Relevant national initiatives(s):

Finland: Low-carbon road map for buildings and building materials; Netherlands : Dutch Building Decree; Sweden: Roadmap for future regulation on Climate declarations; UK : New London Plan; Canada: Zero Emissions Building Plan, Vancouver; Israel: Green Building Standard; US: Minnesota Sustainable Building Guidelines; Luxembourg: Product Circularity Dataset Initiative

Relevant EU policies: Level(s); The Waste Framework Directive; Circular Economy Action Plan; Digital Building Logbooks; CEN/TC 350 Sustainability of Construction Works (harmonization)

Actor(s) involved: A large number of actors would be involved in the revision of CPR and would need to be cross cutting in terms of Member States and product life cycle stage representation.

Delivery mechanisms:

In terms of integrating circularity into harmonized technical specifications of the CPR for methods and criteria to assess and declare the performance of construction products, the following actions could be useful:

- 1) Map the various commitments, regulations, actions, initiatives, tools, standards, procurement criteria and voluntary agreements that require product level data linked to circularity to be effectively implemented. Involve the various stakeholders and policy makers in defining 'core/mandatory' and 'additional/aspirational' data fields that should be filled by construction product & material suppliers in a harmonised way.
- 2) Build consensus on the required data and information: Define the 'core' & 'aspirational' data and information (fields/attributes) that should be available for all construction products and materials to support circular design and implementation. This should build upon and align, where appropriate, with the harmonisation work of CEN/TC 350 – EN15804 in particular to avoid duplication of effort. It should also consider aspects of digitisation and ease of collation and updating throughout the asset/building life cycle. Define implementation mechanisms: Develop further the optimal mechanisms for reporting, transferring and updating such information by suppliers to their customers and tools that support more informed decision making, such as BIM alignment and whole life data access and updating.
- 3) Define implementation mechanisms: Develop further also the optimal mechanisms for reporting, transferring and updating such information by suppliers to their customers and tools that support more informed decision making, such as BIM uploads to provide instant LCA.

Rationale:

CPR is being considered for revision currently and provides a framework for potentially mandating the production of harmonised information relating to circular design attributes relevant at construction product & material level. In doing so, it could ensure the right information and data is readily accessible to understand and compare performance of products from circularity perspective.

Challenges:

- Gaining consensus as to what data should be captured to which level of detail – a balance of effort with impact of having such data
- Lack of data currently for established data requirements, such as for EPDs (Environmental Product Declaration)
- Future access to product data once installed, including updates during operational phase, such as replacement and maintenance.

Key success factors:

- A consensus should be sought with industry, related harmonisation committees, academia and other public sector activities.
- Minimise the collective administrative burden for national authorities and the industry.
- Align with existing methods and standards for data harmonisation.

Policy option 2: potential revision of the Energy Performance of Buildings Directive (EPBD)

Objective(s): This policy option entails a potential revision of the Energy Performance of Buildings Directive 2010/31/EU (EPBD) to include circularity principles throughout the lifecycle of buildings.

Implementation approach: Mandatory

Timeframe: Beyond 2021

Relevant EU policies: Energy Efficiency Directive (EED), Renovation Wave, Level(s)

Relevant national initiative(s):

Netherlands: Dutch Building Decree; Israel: Green Building Standard; Japan: Act for the Promotion of Long-Life Quality Housing; Finland: Low-carbon road map for buildings and building materials; Sweden: Roadmap for future regulation on Climate declarations; UK: New London Plan; Canada: Zero Emissions Building Plan, Vancouver

Actor(s) involved: Primarily, the EU and national authorities establish directives and strategies. There is involvement of the whole value chain to establish effective and efficient solutions.

Delivery mechanisms:

Specific aspects of the EPBD could embed the whole lifecycle carbon approach (embodied and operational energy) and circularity performance requirements for new and existing buildings, in alignment with other EU initiatives such as Level(s). A revision of the EPBD could seek to address these resource efficiency and circularity principles through aspects that might include the following:

- 1) Calculation of circularity performance of buildings: EPBD requires Member States to adopt the common general framework for the calculation of energy performance of buildings. There may be potential to incorporate circularity performance considerations such as potential for reuse and higher value recycling and calculations of GHG emissions produced in kgCO₂eq/(m².y) over the whole life cycle.
- 2) Circularity considerations for nearly zero-energy buildings (NZEBs) and beyond: There may be an opportunity to establish more ambitious definitions of buildings such as net-zero emission and plus energy buildings, incorporating circularity principles.
- 3) Financial measures linked to circularity performance: EPBD establishes criteria for linking energy efficiency financial measures to targeted or achieved energy savings. There may be opportunities for more sustainable financing through incorporating circularity considerations.
- 4) Information provision and awareness raising: EPBD requires owners or tenants of buildings to be informed of the purpose, objectives and potential financial instruments available for cost-effective energy efficiency measures. There may be potential to incorporate guidance on the importance of circular economy principles for building design. Exemplary construction and renovation projects could also be beneficial for awareness raising.

Rationale:

EPBD measures enable the reduction of energy consumption and associated GHG emissions that arise during building operation. Emissions also arise from other parts of the building lifecycle. There could be an opportunity for the EPBD to address some of these by considering the wider resource efficiency of construction materials and aligning with unified data collection approaches.

Challenges:

- Involvement of/acceptance from stakeholders
- Creating national databases
- Providing efficient technical tools and digital systems for streamlined data collection
- Investing in training and workshops
- Providing technical and economic business support, especially for SMEs

Key success factors:

- Coherence with other relevant policy initiatives, minimizing duplication and conflicts
- Synergies between stakeholders, developing a shared language and shared understanding through use of common tools
- Technical and economic support

Policy option 3: Development and revision of Green Public Procurement (GPP) criteria

Objective(s): Widespread implementation of Level(s), with the potential to develop further GPP criteria to support circular design and circularity in the built environment

Implementation approach: Voluntary (currently), but with a view to minimum mandatory green public procurement criteria and targets in sectoral legislation

Timeframe: Beyond 2021

Relevant EU policies: Green Public Procurement; Level(s); Green Deal; Sustainable Europe Investment Plan; EU Taxonomy; Circular Economy Action Plan; Renovation Wave; New European Bauhaus, Energy Efficiency Directive, Energy Performance of Buildings Directive

Delivery mechanisms:

GPP criteria and indicators for buildings are currently being developed based upon the Level(s) framework with scope to add a limited number of additional areas, such as adaptability to climate change. Accordingly, it is important to focus on the following for the next two-three years:

- 1) Wider stakeholder engagement : ensure that a wide variety of stakeholders...
- 2) Supportive evaluation tools and databases : supporting systems should enable the assessment of Level(s) based criteria and be regularly reviewed and updated based upon user experience. This is likely to require support for training, capacity building and further case study development. It is also important to connect with existing networks that operate at city level and provide EU level support for developing data at Member State level.
- 3) Knowledge transfer : lessons learnt and a review of minimum performance criteria at building level could be collated to feed into future revision of the EPBD. Data needed to support performance assessment can be cascaded to product level declaration of performance requirements via future revision of the CPR.

Subsequent to the implementation of Level(s) based criteria, additional GPP requirements could be considered to further support circularity such as the development of criteria for building sectors that have not yet been covered by Level(s) (healthcare, industrial, infrastructure, etc.). Regular consultation with public procurers is recommended to gain feedback on the necessity for further criteria development at EU level.

Relevant national initiatives(s):

Finland: Procurement criteria for low carbon buildings; Italy: GPP compulsory Minimum Environmental Criteria for Buildings; Netherlands: Green Deal 159: Circular Procurement; Netherlands: Roadmap for Circular Land Tendering (Amsterdam); Portugal: National System for Public Procurement and Decree-Law no. 73/2011; Canada Zero emissions plan

Actor(s) involved: Stakeholders involved should include representation from contracting authorities and suppliers.

Rationale:

- Public procurement and purchase of products, services and works account for 14% of the European GDP, so greening public Procurement can be an effective lever to stimulate the market demand for more sustainable goods and services in Europe.
- The Circular Economy Action Plan (CEAP) states 'Mandatory Green Public Procurement (GPP) criteria and targets'.

Challenges:

- The voluntary nature of GPP across the EU, Lack of resources/capacity and limited awareness and knowledge of the contracting authorities.
- Potential issues with costs of implementing the GPP requirements; Unreliable marketplace for 'greener' products.

Key success factors:

- Implementation of Level(s) based criteria as an integrated, detailed and comprehensive approach to GPP and circular construction.
- Supporting tools, databases, case studies and training, especially easier and more consistent life cycle assessment and whole life costing to streamline the assessment process.

Policy option 4: Provision of guidance on local and regional planning and requirements in planning and funding mechanisms

Objective(s): Mandating of circularity through EU funding policies; provision of guidance to regional and local planning authorities; influencing through various EU initiatives in the urban context.

Implementation approach: Mandatory and Voluntary

Timeline: TBD

Relevant national initiatives(s):

Denmark: Sustainability in Construction & Civil Works; Denmark: Architecture policy for Copenhagen; UK : New London Plan; Israel: Green Building Standard; France: Bâtiment bas carbone; Finland: Green Deal on Sustainable Dismantling; Vancouver: Zero Emissions Plan; Italy: ITACA Protocol; Wales: Innovative Housing Fund; Japan: The Act for the Promotion of Long-Life Quality Housing (LQH); UK: Welsh Innovative Housing Fund Programme; Dutch Building Decree (Bouwbesluit 2012); US: Dutch Building Decree (Bouwbesluit 2012)

Relevant EU policies: Urban Agenda; Level (s); Green Deal; Renovation Wave; New European Urban Initiative; European Bauhaus; Cohesion Fund; EIA Directive; Taxonomy Regulation

Actor(s) involved: Primarily local, regional and national planning authorities but the whole value chain should be involved for implementation and demonstration of best practices and examples; for EU Funding and initiatives the various institutions which are involved.

Delivery mechanisms:

This policy option proposes the setting of various requirements within local and regional planning which could be mandated through EU funding decisions as well as supported through the development of EC level guidance and related tools, aimed at various Government levels. There is a close relationship with this policy option and the one presented for GPP, whereby national, regional and local authorities are key players, which the EC can influence through a variety of mechanisms. Depending on the focus there are a number of delivery mechanisms:

- 1) Funding: The setting of circularity requirements in the form of requiring circularity assessments and/or Level(s) could be within the new Cohesion Funds which are part of the Renovation Wave funding. Extra funding could be given to support circularity innovation. This could also extend to some of the private financing mechanisms and the structural funds at the local level, under the new European Urban Initiative and the Taxonomy Regulation
- 2) Guidance: It is recommended that guidance is developed for local and regional planning for circularity in buildings. This guidance should be process oriented, providing a flexible framework which can be taken forward by planning authorities. This could also involve providing guidance on how Level(s) could be required.
- 3) There are many ways of influencing how some of this guidance could be adopted and also for the EC to communicate and exchange knowledge with cities within their urban planning processes, such as the CoP-CITIES; EuroCites, The European Green Capital, The Green City Accord and the EU Covenant of Mayors for Climate & Energy. Also through the various mechanisms of the Urban Agenda and the new European Urban Initiative and Bauhaus.

Rationale:

Circular economy could be woven into a different array of EU policies that focus on the urban environment, related initiatives and funding. This could be from mandating requirements through funding, providing guidelines for circularity regional and local planning and capacity building within many European Initiatives .

Challenges:

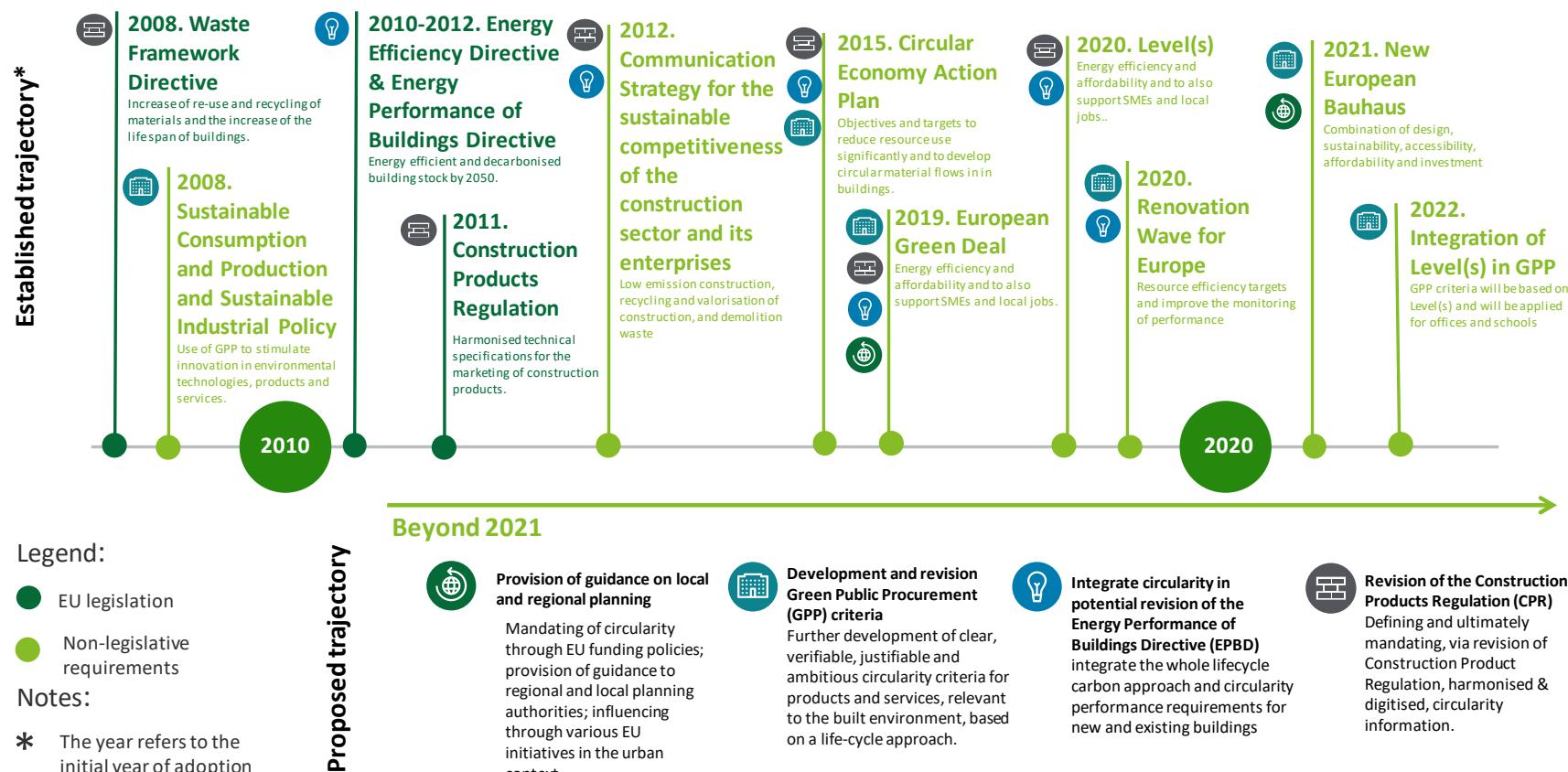
Whilst construction is a focus within many national circular economy strategies, it is often missing at a local level. A lot of capacity building is needed. It may be difficult to mandate requirements through local and regional planning. Setting strict circularity requirements/outcomes is difficult within funding. Alignment to current planning obligations is needed. Guidance is voluntary in nature.

Key success factors:

- The clear guidance throughout the funding/planning process to ensure a good understanding by the applicant
- Effective communication and recognition both economically and environmentally to be successfully implemented
- Streamline requirements where possible; are complementary to each other.

Interactions of policies and roadmap

Finally, the policy options were put into context alongside existing and proposed policy developments, using an indicative timeline. The roadmap illustration below outlines the suggested timeframe of implementation of the policy options (proposed trajectory). It also includes relevant existing and planned EU policy initiatives (established trajectory). As indicated in the roadmap illustration, there are several interlinkages to consider between the proposed policy options and other EU activities that are completed, underway or proposed. These are signified by the addition of an icon (for a specific policy option) next to the items in the established trajectory.



1. INTRODUCTION

The application of circular economy and resource efficiency principles to buildings to reduce resource use in the future is required more than ever. **The life cycle of buildings is associated with several environmental and socioeconomic impacts.** The full life cycle of buildings in the EU (including extraction, manufacture, transport, construction and end of life) accounts approximately for²²:

- 50% of the total energy use
- 40% of the total GHG emissions
- 50% of the raw material extraction
- A third of all water use

To this end, the EU Circular Economy Action Plan has established objectives and targets **to reduce resource use significantly and to develop circular material flows in buildings.** The application of circular economy and resource efficiency principles to buildings has been also reaffirmed more recently in the European Green Deal²³, which amongst other objectives calls for **doubling the annual renovation rate of the EU building stock.**

Simultaneously, **a net zero emissions economy by 2050** is targeted by taking into consideration the role of buildings as well as the industrial sectors that affect their environmental performance. Indeed, the Paris Agreement seeks a global decarbonisation of the building and construction sectors to be achieved by 2050, by tackling the global GHG emissions of the buildings energy (corresponding to 28% of the global emissions) as well as the embodied emissions (corresponding to 11%). The urban growth and the increasing demand for housing make this objective particularly challenging.

In parallel, **buildings represent one of the biggest investments that a household or an enterprise makes.** Therefore, the optimisation of the value created by buildings in terms of accessibility, efficiency, environmental sustainability, comfort, social life, productivity, health and safety is crucial.

It is therefore important to address the total impact of the building and construction sector by **promoting a radical culture shift towards measures and policies that target all stages of the life cycle of buildings and engages all actors of the buildings value chain.** Nevertheless, the implementation of resource efficiency and circular economy concepts is particularly challenging in that it entails several dilemmas including the following: structural durability versus easy dismantling, longevity versus flexibility, simple versus composite products and materials, renovations versus new sustainable buildings²⁴.

The key characteristics of building sector are presented in Annex 1.

There are many benefits that can be generated by a sustainable and competitive European construction industry²⁵. These include the development of buildings that are adapted to the constantly changing social and economic needs, the tackling of global challenges such as energy security and climate change and the provision of an attractive sector to work in. In parallel, the construction sector is affected by several policies, including environmental protection, energy efficiency, work safety, taxation, and public procurement. While the European Commission has been working towards the development

²² European Commission (2019), LEVEL(S), Taking action on the total impact of the construction sector

²³ COM/2019/640 final, The European Green Deal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX%3A52019DC0640>

²⁴ European Commission (2019), Circular Economy Principles for Buildings' Design

²⁵ European Commission (2020), Construction sector competitiveness, available at: https://ec.europa.eu/growth/sectors/construction/competitiveness_en

of a favourable environment to increase competitiveness and to enhance circular economy in the sector, **there are still significant challenges that need to be overcome.**

An online survey that was carried out in the context of the present study, revealed that there is not a single policy (or a specific set of options) to ensure circularity in buildings. **The measures that need to be implemented require a varied set of instruments to tackle the diverse nature of the barriers that characterise the building sector.**

The key barriers that were identified include the following:

- Lack of regulatory drivers;
- Unfavourable market conditions such as higher costs in the short term compared to conventional buildings;
- Unclear costs and benefits that can be generated through circular economy across the value chain;
- Lack of financial incentives such as environmental taxes and subsidies;
- Lack of awareness and skills across the value chain;
- Lack of incentive to design with the aim to reduce whole life impacts, especially at the end of life.

In addition, the current study revealed that some of the actors in the building sector believe that there is lack of standards for secondary materials, that there is a lack of technical performance verification of new products made with secondary materials and that there is a general lack of well-established standards and indicators to measure circularity in buildings.

The aim of this report is to identify a set of policy options that have the potential to tackle these barriers and have the potential to create the necessary conditions for the promotion of circular economy in the sector.

2. POLICY BACKGROUND

This chapter provides a description of key EU policies that affect the construction sector, an overview of socio-economic and environmental trends, and expected policy outcomes.

2.1 Key EU Policy Initiatives

Broadly, the principles of a **circular economy** indicate designing out waste and pollution, keeping products and materials in use and regenerating natural systems²⁶.

There are a number of **design choices** taken during the whole life cycle that influence the durability and adaptability of buildings and the generation of waste at each life cycle stage, and therefore influence the efficient use of resources in construction. There are different parameters that need to be taken into account, including the quality of materials, the design of spaces and the assembly of components, the skills levels of the designers/builders/installers/demolition contractors, the indoor and outdoor environments, the operational conditions and the maintenance level. Nevertheless, there are also **several socio-economic factors** which have a significant impact on the duration of the service life of a building and ultimately its life span. These include the cost of land ownership and long-term rental, trends towards new performances and functional requirements, urban development plans and a preference for new buildings versus existing buildings. To this end, under certain circumstances, the life span of a building is shorter than its originally foreseen service life. On the other hand, the service life of a building can be prolonged through (deep) renovation.

In 2012, the Commission published a **Communication Strategy for the sustainable competitiveness of the construction sector and its enterprises**²⁷ as part of the Europe 2020 initiative. The Communication focused on the promotion of favourable market conditions for sustainable growth in key areas of the construction sector: 1) financing and digitalisation (with a focus on energy efficient investments in the renovation of buildings); 2) skills and qualifications: (e.g. workforce and management training for job creation); 4) resource efficiency (focusing on low emission construction, recycling and valorisation of construction, and demolition waste); 5) the regulatory framework (with emphasis on reducing the administrative burden for enterprises, and particularly SMEs); and 6) international competition (e.g. through the promotion of new financial tools and contractual arrangements in non-EU countries).

Among the EU policies that significantly affect waste and the construction sector is the **Waste Framework Directive**²⁸ that promotes primarily the increase of re-use and recycling of materials. In particular, Article 11.2 stipulates that "*Member States shall take the necessary measures designed to achieve that by 2020 a minimum of 70% (by weight) of non-hazardous construction and demolition waste is prepared for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials*".

In addition, the **Construction Products Regulation** (CPR)²⁹ lays down harmonised technical specifications for the marketing of construction products in the EU and specifically harmonised standards defining the methods and the criteria for assessing the performance of construction products. Also, the **Energy Efficiency Directive**³⁰, together with the

²⁶ Ellen MacArthur Foundation, The concept of Circular Economy
<https://www.ellenmacarthurfoundation.org/circular-economy/concept>

²⁷ COM (2012/0433 final) COUNCIL Strategy for the sustainable competitiveness of the construction sector and its enterprises, [EUR-Lex - 52012DC0433 - EN - EUR-Lex \(europa.eu\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0433-EN-EUR-Lex.europa.eu)

²⁸ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098>

²⁹ Regulation (EU) No 305/2011 laying down harmonised conditions for the marketing of construction products, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0305>

³⁰ Directive 2012/27/EU on energy efficiency, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1399375464230&uri=CELEX:32012L0027>

Energy Performance of Buildings Directive³¹ promote a highly energy efficient and decarbonised building stock by 2050, the creation of a stable environment for investment decisions and establishes required information for consumers and businesses, designed to save energy and money.

More recently in the context of the **European Green Deal**³², a strategy on the **Renovation Wave for Europe**³³ was launched in 2020 which promotes, amongst an increase of the rate of building renovation for higher energy performance, consideration of life-cycle thinking and circularity. It also calls Member States to set energy and resource efficiency targets and improve the monitoring of performance through the establishment of more detailed and robust indicator systems.

In 2015, the European Commission started developing **Level(s)**, a framework of common European indicators that can assess the sustainability performance of buildings across their whole life cycle. This framework is expected to become a common tool for the whole EU value chain. Consequently, it will also generate data for the monitoring of the sector's performance, and it will provide the basis for the development and implementation of effective and efficient policies. Level(s) is built around six 'hotspots' of the life cycle of buildings: greenhouse gas emissions, resource efficiency, water use, health and comfort, resilience and adaptation to climate change, cost and value.

To a large extent sustainable practices in buildings in the EU are promoted through the development and adoption of **green building certificates**. Such certification schemes cover hundreds of millions of m² of space, mainly in the commercial and industrial buildings. Nevertheless, the development of life-cycle approaches to enhance circularity in the building sector is still at early stages. Overall, the existing certifications schemes do not tackle the environmental performance of buildings from a life cycle perspective³⁴.

2.2 Focussed policy areas

Section 5 details four policy related options that could have a significant impact in moving forward circular design in the built environment across the European Union. The key existing policies and their context is described in this section.

Overview of the Construction Products Regulation (CPR)

The Construction Products Regulation (CPR) was fully implemented by 2013 and provides a **common technical language to assess the performance of construction products**. It ensures that reliable information is available to compare the performance of products from different manufacturers in different countries. Annex I to the CPR lists a number of basic requirements for construction works, Basic Works Requirements (BWR). These basic works requirements constitute the basis for the preparation of standardisation mandates. One such BWR (7. *Sustainable use of natural resources*) is highly relevant in the context of circular design objectives. BWR 7³⁵ states 'The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following:

³¹ Directive 2010/31/EU on the energy performance of buildings, https://eur-lex.europa.eu/legal-content/EN/ALL/?FLX_SESSIONID=FZMjThLLzfxmmMCQGp2Y1s2d3TjwtD8QS3padkhXZbwqGwlqY9KN!2064651424?uri=CELEX:32010L0031

³² COM/2019/640 final, The European Green Deal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>

³³ COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

³⁴ European Commission (2019), LEVEL(S), Taking action on the total impact of the construction sector

³⁵ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0005:0043:EN:PDF>

- (a) reuse or recyclability of the construction works, their materials and parts after demolition;
- (b) durability of the construction works;
- (c) use of environmentally compatible raw and secondary materials in the construction works.

However, **basic works requirements do not impose any obligations**. They provide a categorisation of the requirements Member States have defined or may define for construction works on their territory, and potential harmonization. As such, BWR 7 has not really evolved in definition or been implemented to date. Two other BWRs also have relevant aspects, including BWR 3: Hygiene, Health & Environment; and BWR 6: Energy Economy & Heat Retention.

As detailed in *Refined Indicative Options for the Review of the Construction Products Regulation, Version 2 (2020)*, this presents the options regarding the potential revision of the Construction Product Regulation (CPR) going forward³⁶. **The scope of such potential revision is much broader than circular economy, taking on board many issues highlighted through impact evaluations, public and industry consultations**. Those options considered include:

- (Option A): Baseline scenario. No legislative change, but improving implementation through guidance / soft law
- (Option B): Repairing the CPR. Revision of the CPR, especially based the issues highlighted in preceding implementation, evaluation and impact assessment reports³⁷³⁸
- (Option C): Focussing the CPR. Limiting the scope to core areas and then improve the quality and comprehensiveness of the remaining harmonised sphere, also taking into account issues highlighted.
- (Option D): Enhancing the CPR. Introduce product requirements dealing with product inherent aspects in order to protect health, safety and the environment, also taking into account issues raised in the implementation report.
- (Option E): Repealing the CPR without any substitute.

Both options B and D, as detailed, are relevant to improving the provision and harmonisation of 'circular economy' related information on construction products and materials. For example, Option B "Repairing the CPR" specifically mentions '*Promoting circularity of construction products*', primarily to support the supply of reused/remanufactured construction products. It also refers to '*addressing environmental aspects of construction products (BWR7) by introducing a harmonised method for assessing and communicating construction products' environmental performance*'. Option D "Enhancing the CPR" proposes to complement the current common technical language approach by proper product requirements aimed at ensuring the health and safety of citizens and protection of the environment. Option D builds on the CPR as "repaired" under Option B and has the Common Technical Language⁴⁰ approach at its core. **There is still much debate around the proposed route for the revision of CPR** which will dictate

³⁶ <https://ec.europa.eu/docsroom/documents/40762> (Note: This document has not been adopted or endorsed by the European Commission. Any views expressed are preliminary views of the Commission services and may not in any circumstances be regarded as stating an official position of the Commission). Also, the options (A-E) have been highly paraphrased and other sub-options are not indicated.

³⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0445>

³⁸ <https://op.europa.eu/en/publication-detail/-/publication/1ccd704e-ed42-11e8-b690-01aa75ed71a1/language-en>

³⁹ <https://op.europa.eu/en/publication-detail/-/publication/e771a8cf-ed42-11e8-b690-01aa75ed71a1/language-en>

⁴⁰ Common Technical Language approach - harmonised technical specifications, particularly in harmonised product standards, developed in accordance to mandates or standardisation requests

the ability for CPR to become more influential in enabling and driving circularity throughout the built asset life cycle in the future.

Overview of the Energy Performance of Buildings Directive (EPBD)

The EPBD was introduced to promote policies that help **achieve a decarbonised building stock, create stability for investment decisions and raise public awareness around energy saving measures**. It was amended in 2018 within the 'Clean energy for all Europeans package' of eight legislative acts⁴¹. Directive 2010/31/EU amended by Directive 2018/844/EU⁴² therefore introduced stronger commitments to accelerate building renovations and modernise the building sector. Various policies and supportive measures are included such as: long-term renovation strategies (LTRS)⁴³ with milestones for 2030, 2040 and 2050; cost-optimal minimum energy performance requirements; energy performance certificate (EPC) requirements; nearly zero-energy building (NZEB) requirements for new buildings from 2021 (from 2019 for new buildings occupied and owned by public authorities); European scheme for rating a building's smart readiness; health and wellbeing considerations; and national financial measures towards energy efficiency improvement. The energy performance of buildings (EPB) standards were established to support the EPBD and are managed by the European Committee for Standardisation (CEN).

The EPBD has strong interconnections with the Energy Efficiency Directive 2012/27/EU (EED), which was also introduced for decarbonisation purposes. In addition to the previously mentioned motivations, the EED was established to specifically help reach the EU's 20% energy efficiency target by 2020. It was also amended within the 'Clean energy for all Europeans package'. Directive 2012/27/EU amended by Directive 2018/2002/EU⁴⁴ now accounts for 2030 and beyond. The key objective is a 32.5% energy efficiency target by 2030 (with potential upward revision) and Member States are required to develop 10-year national energy and climate plans (NECPs). NECPs were introduced to streamline planning and reporting and they include the LTRS that are now prescribed in the EPBD (LTRS were previously obligated under the EED). Other aspects of the EED are currently being reviewed to enhance energy efficiency efforts towards achieving 2030 climate targets and ensure synergy across the various directives and initiatives.⁴⁵ Building renovation (2019/786/EU)⁴⁶ and building modernisation (2019/1029/EU) recommendations were also published to expand on key aspects addressed in the EPBD and EED amendments.

Overview of the Green Public Procurement

Green Public Procurement requirements include **obligations defined by the public authorities and to be implemented for any public work**.

GPP across the EU

A report published by the European Commission in 2017⁴⁷ reviewed GPP practices across the Member States with respect to GPP requirements linked to better Construction and

⁴¹ https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

⁴² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010L0031-20210101>

⁴³ https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/long-term-renovation-strategies_en?redir=1

⁴⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02012L0027-20210101>

⁴⁵ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12552-Review-of-Directive-2012-27-EU-on-energy-efficiency>

⁴⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019H0786&from=GA>

⁴⁷ Resource Efficient Use of Mixed Wastes Improving management of construction and demolition waste. Final report August 2017, available at: https://ec.europa.eu/environment/system/files/2021-01/resource_efficient_uses_mixed_waste_Final_Report.pdf

Demolition Waste (CDW) management . This review found that CDW related GPP requirements were applied in 12 Member States in different forms, either as requirements for CDW management or requirements for recycled content in the construction materials used in new construction. The review of GPP criteria at national level indicated that **requirements for recycled content, the preparation of demolition and CDW management plans for construction projects and building standards seemed to be present in a voluntary manner** (as opposed to mandatory due to legislation) in the procurement of construction work in a limited number of MS. The list of identified environmental management best practices for GPP in the building /construction sector in this work included:

- Environmental capabilities of designers and contractors;
- Ecodesign of building structure;
- Environmental friendliness of construction materials and building elements;
- Restriction on construction materials;
- Recycled content and recyclability of construction materials;
- Environmental performance of the construction site; and
- Management of construction and demolition waste.

Other non-legislative initiatives that were identified as being used extensively in Member States for sustainable CDW management included:

- Requirement to submit waste management plans when preparing construction projects;
- Building certifications schemes;
- Technical specifications for recycled CDW materials e.g. for the use in highways;
- Technical guidelines for the proper treatment and management of CDW.

*Member States National Action Plans (NAPs)*⁴⁸

Since 2003, Member States have been encouraged to draw up publicly available National Action Plans (NAPs) for greening their public procurement. The NAPs should contain an assessment of the existing situation and ambitious targets, specifying what measures will be taken to achieve them. **The NAPs are not legally-binding but support the process of implementing and raising awareness of greener public procurement.** The latest status update was reported in March 2020 and provides a synopsis of 23 Member States that have responded with their progress against implementation of National and EU GPP requirements. This is a good source document to explore, in addition to the case studies discussed later when considering GPP requirements at EU level. By working from established requirements at a Member States level it should be more straightforward to apply for revision of existing EU GPP criteria and/or development of criteria for new product groups.

EU GPP criteria

At an EU level, there are a number of relevant requirements and criteria to consider, in terms of alignment and possible revision to support circular building design in publicly procured works. Since 2008, the Commission has developed more than 20 common GPP criteria and the EU GPP approach is to propose two types of criteria for each sector covered:

⁴⁸ https://ec.europa.eu/environment/gpp/pdf/200311_GPP_NAPs_March_2020.pdf

- 1) The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases.
- 2) The comprehensive criteria are for those who wish to purchase the best environmental products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality

Procuring authorities may choose, according to their needs and ambition level, **to include all or only certain GPP requirements in their tender documents**. The EU level work around GPP requirements also considers Ecodesign, Energy Label and EU Ecolabel.

Any EU GPP criteria⁴⁹ that is published will fulfil the following conditions:

- Take into consideration the net environmental balance between the environmental benefits and burdens, including health and safety aspects;
- Be based on the most significant environmental impacts of the product;
- Be based on sound data and information, representative of the EU market;
- Be based on life cycle data and quantitative environmental impacts;
- Take into consideration the views of all interested parties;
- Ensure harmonisation with existing legislation applicable to product group;
- Take into account relevant EU policies and other related product groups;
- Be easy to use, with simple and complete requirements;
- Take into account the different stages of the tendering procedure;
- Be broken down into "core" and "comprehensive" GPP criteria;
- Clearly identify the verification method.
- Be fully compliant with EU public procurement legislation.

Relevant product groups⁵⁰ that have EU GPP criteria (and/or Ecodesign, Energy/Eco label requirements), or work is underway to develop them or explore options are summarised in the table below:

Table 1: Product groups with GPP criteria

Title	Description	URL	Year published
Office Building Design, Construction and Management	Criteria associated with Resource Efficient Construction, such as recycled content and producing a waste management plan. Two basic approaches in carrying out Life Cycle Performance of the main building elements: 1) Core criteria: Aggregation of Environmental Product Declarations (EPDs); 2) Comprehensive criteria: Carry out a Life Cycle Assessment (LCA)	https://ec.europa.eu/environment/gpp/pdf/report_gpp_office_buildings.pdf	2016
Road Design, Construction and Maintenance	Criteria around recycled content, waste management plans plus extra focus on excavation and demolition waste management. Issues around durability and rehabilitation are also relevant in the context of circular economy design. There is also specific technical guidance relating to undertaking Life Cycle Costing	https://ec.europa.eu/environment/gpp/pdf/report_gpp_roads.pdf	2016
Paints, varnishes and road markings	Criteria mainly around hazardous substances and air pollution, with some relevant issues such	https://ec.europa.eu/environment/gpp/pdf/Technica	2018

⁴⁹ https://ec.europa.eu/environment/gpp/gpp_criteria_procedure.htm

⁵⁰ Note: the term 'product group' covers both products (such as paints) and services (such as cleaning services).

Title	Description	URL	Year published
	as efficacy of application, durability and packaging	I%20Report%20f or%20Paints%20 Varnishes%20an d%20Road%20M arkings%20(FINA L).pdf	
Heating systems	Primarily concerned with energy and air pollution issues but does have a section relating to product longevity	https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/437/documents	2014
Taps and showers	Ecolabelling options with respect to water and energy consumption, work is underway to analyse the potential to implement policy measures	https://susproc.jrc.ec.europa.eu/product-bureau//sites/default/files/content/type/product_group_documents/1581690298/Follow_up_Taps_Showers_v2.3_clean.pdf	underway
Solar Photovoltaics	A preparatory study for solar photovoltaic modules, inverters and systems was published in December 2020. Predominantly energy focussed, aspects of circularity have been considered, such as recycling, repair, refurbishment and reuse of systems and components	https://susproc.jrc.ec.europa.eu/product-bureau/product-groups/462/home	underway

Some other product groups that may have relevance include Public Space Maintenance, Furniture, Toilets & Urinals⁵¹.

It should be noted that the European Commission has started the revision of the EU GPP criteria for office buildings that had been published in 2016. The aim of the revision is that, **by 2023, EU GPP criteria will be based on Level(s) and the scope will be extended to schools and social housing for both new build and renovation**; however, the Level(s) framework will be voluntary and used as a guidance, so there will be no obligation for Member States public authorities to embed it and require it in their tendering process.

EU GPP guidance

In addition to the specific product groups and their detailed criteria, there are supporting guidance and tools. In particular:

- A suite of case studies⁵² focussed on the built environment, including those linked to circular design principles. For example, 'Increasing brick recovery for reuse when procuring demolition services - Hjørring Municipality (Denmark)'⁵³.
- GPP Training toolkit⁵⁴, including a module on *GPP and the Circular Economy*, Practical guidance for using GPP to support the transition towards a circular economy. Also has a module on *Office Building Design, Construction and Management*.

⁵¹ https://ec.europa.eu/environment/qpp/eu_gpp_criteria_en.htm

⁵² https://ec.europa.eu/environment/qpp/case_group_en.htm

⁵³ https://ec.europa.eu/environment/qpp/pdf/news_alert/Issue_91_Case_Study_174_Hjorring.pdf

⁵⁴ https://ec.europa.eu/environment/qpp/toolkit_en.htm

- Other guidance and resources, such as *Public Procurement for a Circular Economy Good Practice and Guidance*, published in 2017⁵⁵ and the 3rd edition of the *Buying Green Handbook*⁵⁶ published in 2016.

EU GPP projects

In addition, there are a number of pilot and best practice projects (EU funded via the Interreg programme) linked to GPP, these include:

- CircPro⁵⁷ – Smart Circular Procurement. 2018 – 2023. Has building related good practices e.g. recycled content ordinance in Bulgaria.
- ProCirc⁵⁸ – Circular Procurement for the North Sea Region. In total, 30 pilots to demonstrate procurement opportunities will be implemented. This has a construction focus, along with several other sectors.
- CircularPP⁵⁹ – The road to circular public procurement. 2017 – 2020 (furniture and other sectors).

Overview of Planning Requirements

Spatial planning is not a competence of the EU; the competences can lie at a national, regional or local level. There are a range of planning systems across the Member States, however, most are typically driven by national policies, with land use decisions implemented at the local level, making local decision making and local plans important. In some countries (such as Netherlands, Germany and France), municipalities are actively involved in trading and supplying land; others are more passive in their approach. Usually there is a middle tier, which sets guidance and provides planning principles for a region/province; in Germany and Spain this middle tier has the ability to set their own legislation. A summary of the various tiers is:

- National level – instruments such as national spatial plans set a visionary approach with general goals or principles.
- Regional level – ‘concrete’ policies are put in place within framework-setting instruments to provide a frame of reference for coordinated action
- Local level – regulative planning, with the instruments developed by the local planning authority and implemented by the municipality, such as land use plans, zoning and building permission

Although, **the EU has no competence in planning, there is indirect influence through existing EU legislation** and incentives e.g. EU funding and through the agendas of various European institutions and initiatives, much of which is related to cities.

Legislation

There are a number of Directives that will impact directly on the planning systems, through, for example, the protection of areas (Birds Directive 2009/147/EC and the Habitat Directive 92/43/EEC) and Water Framework Directive (WFD) 2000/60/EC and the use of planning as mitigation for flooding (Floods Directive (FD) 2007/60/EC). The most relevant to buildings and infrastructure is the Environmental Impact Assessment (EIA) Directive 2011/92/EU which requires an impact assessment for certain types of large-scale projects, including among others urban development projects, industrial development projects, motorways, railways and other transport infrastructure. **The assessment must include**

⁵⁵ https://ec.europa.eu/environment/qpp/pdf/cp_european_commission_brochure_en.pdf

⁵⁶ <https://ec.europa.eu/environment/qpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf>

⁵⁷ <https://www.interregeurope.eu/circpro/>

⁵⁸ <https://northsearegion.eu/procirc/>

⁵⁹ <http://circularpp.eu/wp-content/uploads/2020/12/Lessons-learnt-from-the-procurement-pilots-in-the-Circular-PP.pdf>

information on all relevant environmental effects on fauna, flora, biodiversity, human health, soil water, air, waste and cultural heritage. This Directive, which was amended in 2014, included the aim to enhance the role the assessment process makes in delivering sustainable resource management; for example: seeks to ensure that '*resource efficiency (is) increased*' and *confirms how 'resource efficiency (has) become more important in policy making'* and ...'*a description of the likely significant effects of the project on the environment resulting from ... the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources ... and the disposal and recovery of waste*'.

There is also the Strategic Environmental Assessment (SEA) Directive 2001/42/EC which requires an impact assessment to be conducted for certain plans and programmes prepared or adopted by national, regional or local authorities. This includes amongst others land use plans and other spatial plans. **The SEA assesses these plans according to the environmental effects especially in the fields of fauna, flora, human health, soil water, air, cultural heritage and waste etc.**

Funding

The **European Structural Investment Funds (ESI Funds)** play a significant role in various EU-policies, especially Cohesion, Rural Development and Territorial Cooperation. Their influence is exerted by incentives in the form of financing projects within the Member States. The implementation of the funds is achieved by national operational programmes based on a fund-specific regulation on an EU level as well as the Common Provision Regulation⁶⁰ for all ESI-funds. In the 2014-2020 programming period of the ESI Funds, 11 investment priorities (thematic objectives) were supported including: **Supporting the shift towards a low-carbon economy in all sectors and Preserving and protecting the environment and promoting resource efficiency**. These thematic objectives are funded through various funds such as the European Regional Development Fund (ERDF)⁶¹ which supports all themes; but has a number of priorities including low carbon economy. ERDF action is designed to reduce economic, environmental and social problems in urban areas, with a special focus on sustainable urban development. At least 5% of the ERDF resources are set aside for this field, through 'integrated actions' managed by cities.

The Cohesion Fund⁶², one of the ESI funds supports low carbon and resource efficiency and the European Social Fund (ESF)⁶³ mostly supports employment, social inclusion, training and public administration. For the next long-term EU budget 2021-2027, the EC proposes to modernise Cohesion Policy, the EU's main investment policy. An instrument of the Cohesion Policy is the **URBACT programme**⁶⁴ aiming to **foster sustainable integrated urban development in cities across Europe**. URBACT's mission is to enable cities to work together and develop integrated solutions to common urban challenges, by networking, learning from one another's experiences, drawing lessons and identifying good practices to improve urban policies. The most recent programme (URBACT III 2014-2020) has been developed to continue to promote sustainable integrated urban development and contribute to the delivery of the Europe 2020⁶⁵ strategy which focuses on growth and jobs. The main objectives are: capacity for policy delivery, policy design, policy implementation,

⁶⁰ <https://ec.europa.eu/digital-single-market/en/news/eu-regulation-common-provision-regulation-cpr>

⁶¹ https://ec.europa.eu/regional_policy/en/funding/erdf/

⁶² https://ec.europa.eu/regional_policy/en/policy/themes/urban-development/network/

⁶³ https://ec.europa.eu/regional_policy/en/funding/social-fund/

⁶⁴ <https://urbact.eu/>

⁶⁵ <https://www.eea.europa.eu/themes/sustainability-transitions/urban-environment/links/eu-strategies-and-policies/eu2020-strategy>

building and sharing of knowledge; with the following interventions: transnational exchanges, capacity-building, capitalisation and dissemination.

As part of the EC's commitment to financing sustainable growth, a number of initiatives are taking place. This includes the **Taxonomy Regulation**⁶⁶ which provides for a general framework that will allow for the progressive development of an EU-wide classification system for environmentally sustainable economic activities. This aims to provide guidance for policy makers, industry and investors on **how best to support and invest in economic activities that contribute to achieving a climate neutral economy**. To qualify as green, an investment would need to contribute to at least one of six objectives, including circular economy. There is also work developing a Green Bond Standard⁶⁷.

Policy

The **Urban Agenda for EU**⁶⁸ is an integrated and co-ordinated approach focusing on the urban dimension of EU and national polices and legislation, with a focus on improving the quality of life for citizens. It focuses on three areas; Better regulation, Better funding and Better knowledge. This was established from the 2016, Pact of Amsterdam⁶⁹. 12 Partnerships have been defined to date including one focusing on circular economy; these are voluntary and involve Member States, the EC, cities, stakeholders working together to **develop and implement actions that contribute to smart, sustainable and inclusive growth**. A single instrument, the European Urban Initiative⁷⁰, will replace several different instruments and initiatives in the area of urban policy.

The **Territorial Agenda 2030**⁷¹, seeks to contribute to **an inclusive and sustainable future for all places and people in Europe**. It underlines the importance of and provides orientation for strategic spatial planning and calls for strengthening the territorial dimension of sector policies at all governance levels. There are two overarching define two overarching objectives, a Just Europe and a Green Europe, which have six priorities for developing the European territory as a whole.

Leipzig Charter on Sustainable European Cities⁷² developed in 2007, describes commits the Member States Ministers responsible for urban development on a number of common principles and strategies for urban development policy. This includes commitments such as making greater use of integrated urban development policy approaches, creating and ensuring high-quality public spaces and pursuing strategies for upgrading the physical environment and the exchange of knowledge and experience between policy makers, practitioners and researchers at local, regional, national and European level. The new Leipzig Charter⁷³ provides a **framework for good and sustainable urban governance of cities and emphasises the pursuit of the common good using the transformative power of cities**. This includes elements related to a green city and actions related to active and strategic land policy and land use planning.

⁶⁶ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

⁶⁷ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-green-bond-standard_en

⁶⁸ <https://ec.europa.eu/futurium/en/urban-agenda>

⁶⁹ <https://ec.europa.eu/futurium/en/content/pact-amsterdam>

⁷⁰ https://ec.europa.eu/regional_policy/en/newsroom/news/2019/03/20-03-2019-european-urban-initiative-post-2020-the-commission-proposal

⁷¹ <https://territorialagenda.eu/home.html>

⁷² https://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf

⁷³ https://ec.europa.eu/regional_policy/sources/docgener/brochure/new_leipzig_charter/new_leipzig_charter_en.pdf

European Institutions and initiatives

Relevant institutions and initiatives include:

- **Community of Practice on Cities (CoP-CITIES)**⁷⁴- The mission is to tap the potential of an extended pool of expertise to improve information sharing and enhance collaborative work among relevant stakeholders, including with EU citizens. It offers a place and open platform for the exchange of knowledge and practice within the Commission, with other European institutions and beyond, adopting an operational and pragmatic approach. With reference to urban development, it contributes to the global actions on sustainable urban development, ensuring coherence with relevant EU actions for both internal and external dimensions; and the investigation and application of new technologies such as Artificial Intelligence and new Big Data sources that offer an unprecedented opportunity to investigate the urban phenomena but also new solutions to urban challenges.
- **Eurocities**⁷⁵ – a network of 190 cities in 39 countries, representing 130 million people. These have many ongoing projects, which are mainly funded by EU, in which they are a partner. As part of their goals for 'people progress in a prosperous local economy', a key action is to support the transition to a circular economy. In their response to the Circular Economy Action Plan, they recommend the EC '*develops guidance on building requirements to support building authorities in shifting to circular practices and provides funding for circular infrastructure projects in the construction sector as well as better public procurement rules, to enable the use of green public procurement tools and life-cycle assessment*'.
- The **Urban Development Network**⁷⁶ is made up of more than 500 cities/urban areas across the EU responsible for implementing the integrated actions based on Sustainable Urban Development strategies financed by ERDF. This Network helps to support information exchange between cities involved in integrated Sustainable Urban Development and in Urban Innovative Actions and to promote direct dialogue between the Commission and cities on Sustainable Urban Development. The Urban Innovative Actions initiative has been created **to identify and test new approaches to the challenges faced by cities** (through pilot projects); one call has included circular economy.
- The **European Green Capital**⁷⁷ is an initiative of the European Commission and 15 European cities which established an award to recognise cities that are leading the way with environmentally friendly urban living. Starting in 2010, one European city is selected each year as the European Green Capital of the year. Waste and sustainable land use and soil are two out of 12 indicators they are judged on. The European Green Capital Network, exclusively dedicated to the previous winners and finalists of the award has been developed, whereby members of the Network do not only exchange on best practices, challenges and potential solutions between each other, but they also encourage other European cities on their paths towards a more sustainable future by providing guidance and support. Toolkits and guidance developed includes waste, circular economy and future-proofing, covering elements of urban planning.
- The **European Green Leaf Award**⁷⁸ is open to all towns and cities across Europe with a population of between 20,000 and 100,000 inhabitants. hat recognises commitment to better environmental outcomes, with a particular accent on

⁷⁴ <https://ec.europa.eu/jrc/communities/en/community/cop-cities>

⁷⁵ <https://eurocities.eu/>

⁷⁶ https://ec.europa.eu/regional_policy/en/policy/themes/urban-development/network/

⁷⁷ <https://ec.europa.eu/environment/europeangreencapital/>

⁷⁸ <https://ec.europa.eu/environment/europeangreenleaf/>

efforts that generate green growth and new jobs. The European Green Leaf Award is presented on an annual basis by the European Commission in conjunction with the European Green Capital Award. Waste and Circular Economy is one of the six environmental topic areas they are judged on.

- **Green City Accord⁷⁹** - The Green City Accord is a movement of European mayors committed to making cities cleaner and healthier. It aims to improve the quality of life of all Europeans and accelerate the implementation of relevant EU environmental laws. By signing the Accord, cities commit to addressing five areas of environmental management: air, water, nature and biodiversity, circular economy and waste, and noise.
- The **EU Covenant of Mayors for Climate & Energy** brings together thousands of local governments voluntarily committed to implementing EU climate and energy objectives. The initiative now gathers 9,000+ local and regional authorities across 57 countries. When officially joining the Covenant of Mayors, signatories commit to developing a Sustainable Energy (and Climate) Action Plan within two years. Adopted by the local council, a signatory's action plan describes the steps towards its 2020 or 2030 targets.

⁷⁹ https://ec.europa.eu/environment/topics/urban-environment/green-city-accord_en

3. SELECTION OF POLICY OPTIONS

This chapter presents the approach that has been followed for the development of policy options to promote the wider uptake and implementation of circular economy principles across the different life cycle stages of building design at both EU and Member State level. The policy options are described in Chapter 4 and are based on the assessment of 30 case studies (of which 26 focus on EU Member States and 4 on non-EU OECD countries), an online survey, the proportionality principle and potential synergies with existing EU policy instruments.

3.1 Case Studies

During the inception phase of this study, 14 Member States (MS) were selected for the investigation of initiatives that promote circular economy principles in buildings' design. The selected Member States and corresponding regions include:

- **Scandinavia/Northern Europe:** Finland, Denmark, Sweden, Belgium, the Netherlands and Luxembourg
- **Eastern Europe:** Slovenia
- **Southern Europe:** Spain, Portugal, Italy
- **Western/Central Europe:** Austria, France, Germany, UK
- The following 4 OECD countries were also selected: USA, Israel, Canada and Japan.

The country coverage was established **based on the specific expert local knowledge of current initiatives, language and technical capabilities**. Furthermore, several external experts assisted in the review and development of case studies for a small number of countries particularly the OECD countries. These experts were identified for the recognised expertise in circular economy and building design for the countries concerned.

A **desk-based study** generated a long list of relevant initiatives and these were primarily assessed based on the circular economy for buildings' design principles and connectivity with local, regional, national or EU level policies/initiatives (i.e. direct result of policy to no obvious connection). To select the final list of 30 case studies for analysis (of which 26 focus on EU Member States and 4 on non-EU OECD countries), further considerations included **the availability of outputs, impact data, relevant stakeholders for interviews and sufficient coverage of different policy types**. Each stage of the selection process was completed in close collaboration with the Commission.

In addition to desk-based research, **at least two semi-structured stakeholder interviews** were conducted for each of the selected case studies to provide more detail on the background context, links to other policies/initiatives, applicable circular design principles, uptake, impact, replicability, challenges, opportunities, and lessons learnt. The overall approach to the study along with **the preliminary case study findings were discussed during a half day webinar/workshop with 66 participants from key stakeholder groups across Europe**. The workshop feedback was incorporated to finalize case study assessments and draft an initial list of policy options. Note that some of the selected case studies are relatively new and/or innovative and therefore, these lacked data on impact and effectiveness.

Most of the case studies cover more than one type of policy instrument. Most cover all building types (i.e. all public and private, residential and commercial buildings) and almost half cover all stages of the building life cycle. Half are voluntary measures, whilst the other half are split between mandatory initiatives (30%) and initiatives that are both voluntary and mandatory (20%).

The different types of policy instruments covered by the initiatives assessed in the case studies have been broadly categorised as follows:

- **Regulation:** a broad variety of laws and legislation that set binding requirements, which in cases of noncompliance are followed by sanctions. Examples include for example amendments to existing building regulations, new legislation on extended producer responsibility, pre-demolition audit requirements, etc.
- **Green public procurement (GPP):** process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.
- **Strategy:** documents such as roadmaps outlining vision, aims and objectives for resource management, building design, etc.
- **Voluntary agreements:** agreements between government and industry to facilitate voluntary action with shared goals, objectives and outcomes.
- **Financial:** economic or market based instruments that influence market mechanisms e.g. subsidies, loans, taxes, credits, levies, etc.
- **Standards/methodology:** established rules or methodologies on common approaches to measure, calculate, define, and monitor, report, etc. specific aspects.
- **Local/regional planning:** requirements in local and regional planning, including urban planning and infrastructure on resource efficiency, circular economy, sustainable building design, etc.
- **Business support:** provision of technical support, funded support programmes, etc. to businesses, the private sector, etc.
- **Information provision:** provision and use of information such as awareness raising campaigns, product labels, handbooks, etc. that enable decision makers, consumers, etc. to make informed decisions.
- **Guidelines:** Recommendations and advice on how something should be done or understood.

The majority of the case studies, with very few exceptions, cover more than one type of policy instrument. When looking solely at the primary type of policy instrument covered by the initiatives, which was identified based on their main objectives and characteristics, regulation (7), voluntary agreements (7) and GPP (6) together represent 66% (20 out of the 30 case studies), followed by strategy (2), local/regional planning (2), business support (2), standards/methodology (2) and financial measures (2).

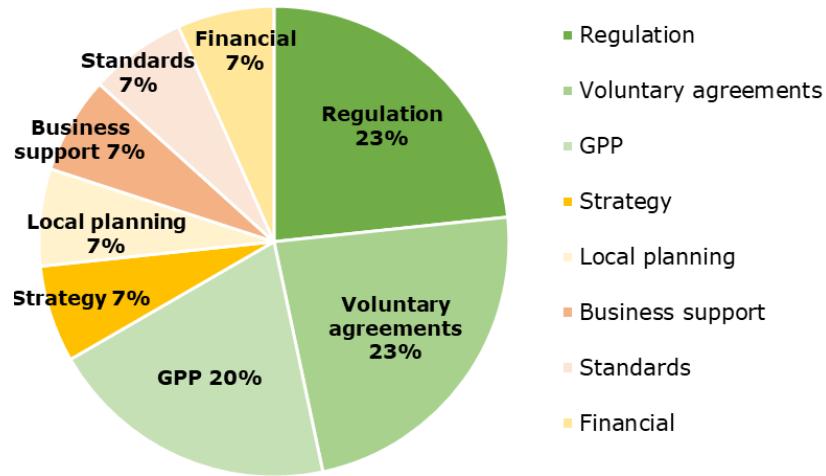
Half of the initiatives are voluntary measures, while the other half are split between mandatory (30%) and initiatives that are both voluntary and mandatory in nature (20%). In terms of geographic scope, of the 15 voluntary initiatives, the scope of implementation is almost equally split with (8) carried out at national level, (6) at regional level and (1) at EU level. Of the 8 mandatory initiatives assessed, 75% (6) are carried out at national level with the remaining 25% (2) applied at regional / city level.

Regarding the main categories of buildings covered, the majority of case studies cover all buildings (i.e. all public and private, residential and commercial buildings). In order of magnitude, this is followed by public buildings only (both residential and commercial),

private buildings only (both residential and commercial), residential buildings only, and commercial buildings only.

Figure 1, shows the case study distribution based on the primary type of policy instrument and the complete list with summarized descriptions can be found in Annex 2.

Figure 1: Distribution of initiatives per primary policy instrument applied (%)



In addition, Table 2 provides a distribution of the initiatives together with type of implementation, scope and all policy instruments applied.

Table 2: Distribution of initiatives per policy instrument applied

No.	Country	Name of initiative	Year launched	Implementation		Scope		Policy instrument(s) applied	
				Mandatory	Voluntary	National	Regional	Predominant	Secondary
1	Belgium	Circular Flanders – Green Deal on Circular Construction	2017		X		X	Business Support	Financial
2	Belgium	Be Circular (PREC)	2017		X		X	Voluntary agreement	Information Provision Regulatory Business Support
3	Denmark	Sustainability in Construction & Civil Works	2016	X			X	Local / regional planning	Standards / methodology
4	Denmark	Architecture policy for Copenhagen 2017-2025	2017	X	X		X	Local / regional planning	Information provision Guidelines Strategy
5	EU	Levels(s) Framework for reporting on CE in buildings	2015		X	EU wide		Voluntary agreement	Standards / methodology
6	Finland	Low-carbon road map for buildings and building materials	2017	X		X		Regulation	Strategy
7	Finland	Procurement criteria for low carbon building	2017		X	X		Green Public Procurement	Voluntary agreement
8	Finland	Green Deal Agreement on sustainable dismantling	2020		X	X		Voluntary agreement	-
9	France	EPR scheme for construction materials	2020	X		X		Financial	Regulation

No.	Country	Name of initiative	Year launched	Implementation		Scope		Policy instrument(s) applied	
				Mandatory	Voluntary	National	Regional	Predominant	Secondary
10	France	E+C- standard trial scheme	2016		X	X		Voluntary agreement	Standards/ methodology Financial
11	France	Bâtiment bas carbone Label	2015		X	X		Voluntary agreement	Information Provision
12	Italy	ITACA Protocol	2004	X	X	X	X	Standards / methodology	-
13	Italy	GPP compulsory Minimum Environmental Criteria for Buildings	2015	X		X		Green Public Procurement	Regulation
14	Luxembourg	Product Circularity Dataset Initiative	2018		X	X		Standards / methodology	Voluntary agreement
15	Netherlands	Green Deal 159: Circular Procurement	2013		X	X		Green Public Procurement	Voluntary agreement Business Support Guidelines
16	Netherlands	Dutch Building Decree	2012	X		X		Regulation	Standards / methodology
17	Netherlands	Roadmap for Circular Land Tendering, Amsterdam	2017		X		X	Green Public Procurement	Strategy
18	Netherlands	Circular Construction Economy Transition Agenda	2018	X		X		Strategy	Guidelines
19	Portugal	National System for Public Procurement	2017	X		X		Green Public Procurement	-

No.	Country	Name of initiative	Year launched	Implementation		Scope		Policy instrument(s) applied	
				Mandatory	Voluntary	National	Regional	Predominant	Secondary
20	Portugal	National waste management legal framework - Decree-Law no. 73/2011	2011	X	X	X		Green Public Procurement	Regulation
21	Slovenia	Strategy for the Transition to Circular Economy in the Municipality of Maribor	2018		X		X	Strategy	-
22	Sweden	Roadmap for future regulation on Climate declarations	2020	X		X		Regulation	Standards / methodology
23	Sweden	Fossil Free Sweden initiative	2018		X	X		Voluntary agreement	Strategy
24	UK	New London Plan	2020	X			X	Regulation	Local / regional planning
25	UK	Zero Waste Scotland	2012		X		X	Business support	Information provision Guidelines Financial
26	UK	Welsh Government Innovative Housing Programme	2017		X		X	Financial	Voluntary agreement
27	Japan	The Act for the Promotion of Long-Life Quality Housing (LQH)	2009		X	X		Voluntary agreement	Financial Guidelines Standards / methodology
28	Canada	Zero Emissions Building Plan, Vancouver	2016	X	X		X	Regulation	Standards / methodology

No.	Country	Name of initiative	Year launched	Implementation		Scope		Policy instrument(s) applied	
				Mandatory	Voluntary	National	Regional	Predominant	Secondary
29	Israel	Israel Green Building Standard	2016	X	X	X		Regulation	Standards / methodology
30	US	Minnesota Sustainable Building Guidelines	2001	X	X		X	Regulation	Guidelines

These are now considered in more detail in relation to the case studies that were evaluated within each of these categories:

Legislative initiatives

Almost one quarter of the case studies were primarily legislative initiatives that set legally binding requirements with sanctions for non-compliance at either national or regional level. More than half of these also incorporate technical standards. Standards and methodologies establish common approaches to define, measure, calculate, monitor and report. For example, the Dutch Building Decree in the Netherlands requires a lifecycle environmental performance assessment to obtain a planning permit (all-in-one permit). The regulation is applicable for the construction, use, and demolition of all new residential and commercial buildings above 100m². The methods developed follow a harmonised approach as the same assessment method is prescribed by BREEAM-NL and Green Public Procurements for office buildings and civil engineering works. The method also follows common standards on the methodological requirements on LCA (EN 15804:2019) and calculation rules on environmental performance of buildings and civil engineering works (EN-15978). A key challenge with implementing the LCA requirements in the Dutch Building Decree was assuring this coherence with other regulations related to environment. Flexibility was also important so that the legislation did not act as a barrier to the construction of new buildings and it was critical to involve relevant stakeholders during policy development to enable wide implementation.

Similarly, Finland's Low-Carbon Road Map for Buildings and Building Materials, Sweden's Roadmap for Future Regulation on Climate Declarations and the UK's New London Plan will require developers to report LCA data on new buildings. The respective policies have integrated widely used standards and supporting tools such as BIM. A key challenge for Finland and Sweden is a lack of national data and to overcome this in the short term, data from other Member States (e.g. France and the Netherlands) has been referred to. In the UK, public consultation led to tightening requirements on metrics, incorporating language used by developers and having better alignment with existing relevant metrics, performance tools and good practices. In general, there are concerns about the potential high costs of implementation, particularly for SMEs (e.g. for data collection and reporting processes) and this has so far mainly been addressed through economic and technical support for companies. Due to the lack of embodied carbon knowledge in the construction sector, more training schemes are also required.

In Israel, the national Green Building Standard (SI 5281) established requirements for new and existing buildings using a point rating system similar to BREEAM. There were similar key learnings such as the importance of stakeholder engagement and business support. It was also important to learn from other countries and increase sourcing opportunities for eco-materials. In the U.S.A., the Minnesota Sustainable Building Guidelines (B3) is a mandatory sustainability programme for state funded buildings from pre-design to construction and for ten years of operation. It was developed between the State's government and the Centre for Sustainable Building Research (CSBR) at the University of Minnesota. A publicly accessible case study database provides information on each building's achievement. B3 is continually updated and improved in collaboration with state agencies and industry stakeholders and serves as a model for localized green building programmes. Though it is voluntary for the private sector, some local (sub-state) units of government require portions of the programme for their projects. There have been funding challenges, especially regarding support for smaller projects, and difficulty in achieving stakeholder agreement but overall, the programme has received positive feedback.

Italy's Institute for transparency, updating and certification of contracts and the environmental compatibility (ITACA) established a voluntary national assessment system, the ITACA Protocol, with the technical support of the International Initiative for a Sustainable Built Environment (iiSBE Italia). The Protocol is for assessing the level of energy and environmental sustainability of buildings and is integrated in various regional

policies such as funding programmes, housing plans, laws and regulations on land consumption and urban regeneration, GPP, and authorization processes. In some cases, the use of the Protocol is made mandatory by regional legislation for access to funding or to obtain building permits.

In addition to LCA requirements, there are emerging requirements for construction product data that incorporates reuse and disassembly considerations. For certain planning applications (e.g. for more than 150 residential units), the New London Plan requires a circular economy statement, which includes recycled content requirements for building materials, design considerations for the building's lifecycle (longevity, adaptability, flexibility), future reuse potential, and other circularity aspects. Similarly, the Zero Emissions Building Plan in Vancouver helps create demand in the deconstruction and reuse market by directly requiring a small percentage of material reuse or incentives and Portugal's national waste management Decree-Law no. 73/2011 includes an obligation to use at least 5% recycled materials, as long as technically feasible, in public construction and infrastructure maintenance contracts.

The French Ministry for Ecological and Inclusive Transition aims to expand Extended Producer Responsibility (EPR) to include building materials by 2022. The French Anti-Waste Law for the Circular Economy (AGEC) was established under the French Environmental Code and within this new law, the proposed EPR scheme will establish: a free return scheme for sorted waste; requirements related to transparency and traceability on environmental & health impacts of the materials concerned; new waste prevention and eco-design action plans to be updated every 5 years to improve recyclability and inclusion of recycled materials; and new professional waste collection centres. There are industry concerns that the scheme will lead to additional costs, even to the extent of bankruptcy, and also positive feedback that it would facilitate the redirection of waste flows from disposal to recycling. Municipalities and environmental NGOs have welcomed the law as a potential solution to the problem of uncontrolled waste disposal.

Voluntary agreements

Voluntary agreements are typically between government and industry to facilitate voluntary action with shared goals, objectives and outcomes. Almost one quarter of the case studies were primarily strategy-induced co-regulatory actions (public-private arrangements) or self-regulation at national level (except for regional programmes in Belgium). These voluntary agreements also incorporate **standards, technical and financial support to businesses, and information provision and guidelines**.

Sweden's Fossil Free Roadmaps encourage business sectors to draw up their own roadmaps towards becoming fossil free, while also increasing their competitiveness. Industry must describe how and when they will be fossil free, what technological solutions need to be developed, what investments need to be made and what obstacles need to be overcome. To date, 22 roadmaps have been submitted to the Government. These 22 roadmaps represent about 70% of Sweden's carbon emissions. Within the framework of the Fossil Free Sweden initiative, and under Skanska's project management, the construction sector has united around a common roadmap to achieve a carbon-neutral value chain in the construction and civil engineering sector. The Swedish Construction Federation is responsible for implementation.

Finland's Green Deal Agreement on Sustainable Dismantling is a 5-year voluntary programme that commenced in 2020 between the Finnish Association of Building Owners and Construction Clients (RAKLI ry). The aim is to stimulate the market for materials arising from renovation and demolition towards the increase the reuse and recycling of demolition materials. Due to the lack of baseline quantitative data, this voluntary approach is also being used to improve the quality and quantity of data on materials arising (critical for setting and monitoring quantifiable targets). The Finnish government is administering a free to use, web-based material exchange platform (marketplace) to facilitate data

collection and sharing. Implementation activities also include public awareness raising and RAKLI is hosting regular industry training workshops.

This lack of national data has been a consistent theme within the case studies. In Luxembourg, the Circularity Dataset Initiative aims to develop an accessible cross-sector open and easily accessible circularity data framework, the Product Circularity Datasheet (PCDS), towards a future ISO standard. It was launched after discussions with companies involved in Horizon 2020 projects such as BAMB (Buildings as Material Banks)⁸⁰ and Healthy Printing and it will provide a structured framework for circular economy data on products throughout the entire value chain from raw materials to finished products, to use phase to reuse/recycling. In 2020, 50 stakeholders were working on the project from 12 countries across Europe and North America. There are concerns that implementation could require significant additional effort, especially regarding education on how to effectively use the framework, and managing confidentiality within information exchange; however, there is overall interest and support at the EU level for this type of solution.

Belgium's Be Circular Construction Monitoring Dashboard is considered a first step towards gathering data and measuring the state of circular economy for the construction sector in the Brussels region and its potential for improvement. The Dashboard is a subset of a government led voluntary initiative, the Be Circular programme, which promotes circular economy in the Brussels region across many sectors. The programme also includes a Roadmap for the construction sector in Brussels that aims to have comprehensive regulation for circular public buildings by 2030 and for all buildings by 2040. Rotor Deconstruction, a company that is active in the salvage of building materials has so far received funding through Be Circular for two research and demonstrator projects; however, more business support is needed such as subsidies and training.

France's data enhancement approach includes the Energy-plus & Carbon Reduction Buildings (E+C-) trial scheme that aimed to reduce the overall carbon footprint of buildings by using low carbon and energy efficient materials. The scheme also involved the development of the E+C- label which indicates that a building meets precise performance targets based on a lifecycle approach. The label can be obtained following a self-assessment or via a certification body (approved by the French government). Calculation software (Elodie) was developed for participants and it used data from the national database on the environmental and health assessment of buildings in France or generic data from the software. The national observatory gathered the data on buildings' technical and economic characteristics, as well as feedback and best practices to help draft future legislation. Stringent performance threshold levels led to low participation in the trial and while there was overall encouragement for manufacturers to produce better data on their products, some of the submitted data was of very low quality and not useable. The requirements were considered burdensome for smaller manufacturers and the use of generic data was also problematic, emphasizing the need to establish comprehensive national databases. France's Association for the Development of Low Carbon Buildings (Association BBCA) also administers a low carbon building label that certifies a building based on carbon emissions over its entire lifecycle and includes a label dedicated to renovation projects (BBCA renovation). A BBCA point corresponds to the equivalent of 10kg of CO₂ not emitted or stored. The label took about a year to be effectively implemented and was set up with the scientific support of the French Scientific and Technical Centre for Building (CSTB). Labelling can be an effective consumer information scheme such as with the energy labelling of home appliances; however, there has also been low uptake with the BBCA scheme. This is largely due to a lack of local (municipal) promotion and in some cases opposing recommendations such as encouraging the use of concrete over wood. The Association is seeking additional funding for further outreach activities.

⁸⁰ Buildings as Material Banks: Integrating Materials Passports with Reversible Building Design to Optimise Circular Industrial Value Chains, <https://cordis.europa.eu/project/id/642384>

Japan's Act for the Promotion of Long-Life Quality Housing similarly aims to improve housing quality and performance through a voluntary certification scheme, but it also includes financial incentives such as mortgage rate and income tax reductions. The main challenges encountered are a lack of certainty around increased property value after certification, split incentives dilemma and in some cases, higher costs for certification. Additionally, homeowners may not maintain certification after the included 10-year period. To reduce procedural burden, especially with recertifications, the aim is to nationally standardize processes for each local agency by using a centralized database that is easy to understand. There are also plans to increase government-led promotional activities.

Green public procurement (GPP)

GPP involves public authorities reviewing alternative options such that goods, services and works can be procured with a reduced environmental impact throughout their life cycle.

All of the GPP initiatives are carried out at national level with the exception of the Roadmap for Circular Land Tendering in the Netherlands for the Amsterdam region. The initiatives are both mandatory and voluntary in nature.

The Italian procurement code (Codice degli Appalti) requires compulsory environmental criteria (Criteri Ambientali Minimi-CAM) to enhance the sustainability process of construction products, of new public and refurbished buildings and of public construction sites management. CAM's criteria are based on: the sustainable site analysis, in which the considered building is located; the building's technical specifications, which include the material technical specifications; and the recycled content value for specific material categories. The mandatory nature of CAM has accelerated change and brought more attention to environmental aspects. Some GPP requirements have already been extended to private building projects such as detailed requirements for recycled content in insulation materials to access incentives (tax credits and discounts). An overall key learning was that effectiveness requires detailed criteria with specific thresholds.

As part of the Dutch government strategy to reduce the emission of CO₂ by 20% in 2020, Rijkswaterstaat (Directorate-General for Public Works and Water Management) developed a methodology for sustainable procurement targeting infrastructure projects. Tendering is based on a certification system with which the tenderer can show the measures taken to limit CO₂e emissions within the company and in projects as well as elsewhere in the supply chain. It is also based on DuboCalc, an LCA-based tool that calculates the sustainability value of a specific design based on the materials to be used. Amsterdam's Roadmap for Circular Land Tendering also proposes criteria for the city to use in its tendering procedure to assess the extent to which buildings and the construction process comply with the principles of circular building. The roadmap is initially for tenders for land allocation, primarily for new-build projects, but the aim is to use the Roadmap for all transformation, renovation and demolition projects. Amsterdam has already made some criteria mandatory by obligating potential contractors to add the criteria in the specifications of their project. For example, applicants must submit an Environmental Performance of Buildings calculation, demonstrate that it was carried out by an expert and explain how the design and material choices (made in the National Environmental Database) link to the calculation assumptions.

The Netherlands Green Deal for Circular Procurement uses a practice-based and collaborative learning networks approach to initiate the incorporation of circularity guidelines in procurement. The view is that practice can often move much faster than policy and provides an excellent source of knowledge for policy makers to address larger challenges and scaling of the changes in the market. The first phase (2013-2018) resulted in 80 pilot projects with 38 factsheets available online. Green Deal 2.0 (2018-2021) had around 100 projects up to the end of 2020 with 40% in the construction sector. The Belgian Green Deal for Circular Procurement (2017-2019) was inspired by the Netherlands's Green Deal and ended with 100 procuring organizations and 50 facilitators.

The Finnish procurement criteria guidance for low carbon building is a voluntary initiative (being revised and transitioned to mandatory) that aims to enhance lifecycle thinking in construction by using calculations of buildings' lifecycle carbon footprint. The guide provides GPP suitability requirements for tenderers and cost estimates. It includes considerations for energy, materials and innovation. Recommended criteria include categories for: designing a low-carbon new building; designing low-carbon renovations; contracts/ material and equipment procurement; and Design, Build & Operate model in low-carbon building. The comparison and calculation methods for applying criteria are based on standards and widely used assessment and calculation methods. This enables comparable calculations across projects. It covers all publicly owned and operated buildings such as schools and clinics, also new build and renovations.

Portugal's National Strategy for Ecological Public Procurement (ENCPE 2020) is a complementary tool for environmental policies to reduce the environmental impact of public works projects throughout their life cycle and help promote resource efficiency. It defines environmental criteria for a set of priority goods and services in alignment with the EU's GPP criteria. Portugal's national waste management Decree-Law no. 73/2011 further includes an obligation to use at least 5% recycled materials, as long as technically feasible, in construction and infrastructure maintenance contracts under the Public Contracts Code.

Local and regional planning initiatives

There are various requirements within local and regional planning such as urban planning on resource efficiency, circular economy, sustainable building design, etc. Along with the previously mentioned local/regional initiatives (New London Plan, Minnesota Sustainable Building Guidelines (B3), Vancouver Zero Emissions Building Plan, Amsterdam Circular Land Tendering, etc.), two initiatives from Denmark primarily demonstrate city level planning for various circular economy requirements (i.e. adaptability, durability, material reuse, etc.). Denmark and Copenhagen City architectural policies have been in place since 2007 and 2010 respectively. They include typical architectural aspects of character, cultural heritage and liveability. Copenhagen's new Architecture Policy 2017-2025 now includes specific reference to circular economy and embeds circular economy principles to be considered during design. The policy encourages lifecycle assessment (LCA) and lifecycle cost analysis and aims to facilitate dialogue with building clients, architects, planners and landscape architects about construction projects.

Copenhagen's Sustainability in Construction & Civil Works is not formal regulation but is a mandatory client standard for construction and civil works commissioned or supported (funded, or on land being sold) by the city to ensure that substantial city works are managed in an environmentally responsible way. The fifth version includes a number of elements that contribute to circular economy, such as requiring LCA and choosing a design with the least possible environmental impact, ensuring key building materials have an Environmental Label, the assessment of reusable building components, sorting and source-cleaning of materials suitable for recycling during demolition/ renovation, and the requirement of a plan for sorting and managing building waste. The aim is to inspire private developers to also use the criteria. A challenge when the new circular economy aspects were introduced was a lack of examples for the industry to follow and lack of knowledge on LCA methodologies and tools. Revisions take place every 4 years or so to ensure updates are made in line with developing policies. In 2020, municipal projects over DKK 20M (approx. €2.5M) must instead achieve DGNB certification (Gold standard for public projects, Silver standard for public housing) in place of this standard. The transfer to DGNB provides a more standardized and well-defined approach and reduces overlap existing approaches.

Strategies

Two initiatives have been primarily categorized as strategy but all of the initiatives are directly linked to EU, national, or regional level strategies and roadmaps that define

circular economy visions and include specific targets, objectives and actions for key sectors such as construction. For example, Copenhagen's initiatives are driven by Copenhagen's 2025 Climate Plan and Amsterdam's Circular Land Tendering is driven by Amsterdam Circular Strategy 2020-2025 and ultimately the Netherlands Circular Economy by 2050 strategy. Israel's Green Building Standard is directly linked to Israel's national policies on reduction of construction waste, reduction of CO₂ emissions, energy and water efficiency. Sweden's Fossil Free Roadmap for the Construction and Civil Engineering Sector is based on the decision of the parliament to make Sweden climate neutral by 2045.

The Netherlands Circular Construction Transition Agenda describes the national strategy for achieving a circular construction economy in 2050 and contains the Agenda for the 2018-2021 period. The output is a series of proposed mandatory and non-mandatory actions for the government such as: make all public tenders fully circular from 2023 onward; embed circularity in construction laws; use material passports; integrate circular construction in education; create a knowledge institute; execute circular construction awareness campaign; pilot projects for EPR; and subsidize circular businesses and revenue models.

Slovenia is working on a strategic project with European institutions to implement systemic change for circular economy. The municipality of Maribor in Slovenia has defined a strategy using strategic project areas as the pillars of circular efficient resource management in the circular transition of the city. The use of processed construction and demolition waste and soil in urban construction is a key strategic project area. It is mandatory for the 5 public utility companies to implement the strategy through projects that reflect the action plan. WCYCLE Institute was created to increase implementation capacity and has identified 18 joint projects for the City and public utility companies aligned with these focus areas: material waste – construction, organic waste and soil; lost energy; waste water; unused space; and improvement of social collaborative and the sharing economy.

Although certain strategies can be replicable, a key lesson learned is that it is essential for national and local conditions to be considered. Each city is different (e.g. local infrastructure, demographics, etc.) and it therefore may not be feasible or relevant to replicate strategies across cities in the exact same way. Overall, the encountered and potential challenges are those already highlighted throughout the various case studies.

Business support and other financial measures

The initiatives that are primarily focused on **business support provide both technical and financial support to businesses in the construction sector such as guidelines, best practice, knowledge exchange platforms, training and funding opportunities for research and development**. Others are primarily focussed on **financial instruments to influence the market such as directly funding the sector to promote circular economy practices and making industry financially responsible for their products at end of life** (e.g. France's proposed EPR scheme for building materials).

Along with the previously mentioned financial and technical support within regulations, voluntary agreements and GPP, Circular Flanders is a regional multi-sector initiative in Belgium, predominantly funded and supported by the Flemish Public Waste Agency (OVAM), to transition to a more circular economy. Flanders has been a pioneer in the management of resources for better recycling and reuse. Construction specific actions include the Green Deal on Circular Construction (2019-2022) that has created a multi-stakeholder (public and private) knowledge sharing and learning network of over 300 organizations via online platforms, conferences and business/project experimentation. Research activities include Living Labs on urban mining and circular building design and project funding calls. Some key challenges have been with reducing stakeholder's perceived risk associated with new building techniques and circular design approaches, clearly defining business and societal opportunities and the lack of trust between actors in the sector.

Similarly, the Zero Waste Scotland (ZWS) initiative is regarded by the Scottish Government as a vital part of its success in accelerating progress and delivering results from policies on the circular economy, business resource efficiency and low-carbon heating. In 2017/18, the Scottish Government funded the programme with £17.1 million. There is also funding from the ERDF of £73 million over 4 years. ZWS provides support to business, especially SMEs, and individuals on resource efficiency through programmes such as Resource Efficient Scotland, Accelerator Programme, Waste Prevention Fund, Circular Glasgow and Circular Economy Investment Fund. ZWS also provides advice to the Scottish Government on policy development such as the planning framework and green recovery programme. Specialist consultants are available to the construction sector, at no cost, to help improve resource efficiency and embed circular economy principles and thinking. ZWS has project monitoring indicators such as realised CO₂e savings from partners, progression of transformative ideas for the circular economy, societal benefits, contribution to new policy, and recycling infrastructure capacity. Overall stakeholder feedback from ZWS has been positive. The main challenge is resource constraints, which limits the extent of activities. In addition to the challenges highlighted in Circular Flanders, ZWS has experienced challenges with engaging SMEs and policies/standards that have not evolved in line with technological developments.

The Welsh Government Innovative Housing Programme (IHP) provided funding to test innovative approaches for increasing the scale and pace of high quality social and affordable housing delivery in Wales. From 2017-2020, £90 million was provided and a further £25 million has been added for a 4th year. Potential innovations include construction techniques, delivery pathways and housing models to reduce the impact of house building on the environment, reduce fuel poverty, and reduce health and wellbeing inequalities that are exacerbated by poor quality housing. Key considerations included: ensuring that projects continue to be innovative year on year; ensuring value for money by gradually reducing the grant level from 100%; circular economy aspects since the scoring and selection process does not favour any particular types of innovation; and identifying adequate funding for monitoring and evaluation.

Summary of case studies

The case study results showed that the main policy approaches to enhancing circularity in building design are **a combination of mandatory and voluntary initiatives** that focus on:

- Improving the quality, quantity and consistency of building and material data collection
- Incorporating lifecycle carbon emission calculations in: land, building and infrastructure planning approval and public procurement processes; and, building performance standards and certifications
- Promoting deconstruction processes, reuse and higher value recycling
- Incorporating considerations for future building, product and material reuse (durability, adaptability)
- Providing technical support and training on embodied carbon, deconstruction processes and reuse/recycling potential
- Providing economic support for research and demonstrations

The most common challenges and concerns include:

- Ensuring coherence with other relevant policy initiatives, minimizing duplication and conflicts;
- Lack of existing data to assess current scenarios, create national databases and set targets;
- Lack of embodied carbon knowledge in construction and procurement;

- Potential high costs of implementation regarding LCA requirements, particularly for SMEs (e.g. for data collection and reporting processes);
- Difficulty in achieving stakeholder agreement on targets/standards;
- Lack of detail within requirements and uncommon language (not specific enough and terms unfamiliar to local sector).

These were mostly overcome using similar approaches such as **short-term voluntary initiatives to prepare the market and gather data, the provision of technical and economic support, and awareness raising/training activities**. However, some voluntary initiatives had very low uptake and others are in early stages with minimal to no impact data available (and will be impacted by the pandemic). The voluntary initiatives that require **lifecycle carbon calculations all include plans for mandatory transitions**. Overall, all case studies emphasized the importance of involving key stakeholders during policy development to get useful feedback and enable wider implementation.

3.2 Online survey of construction stakeholders

An online survey comprising of multiple choice and open-ended questions was circulated to key stakeholder groups:

- Building users, facility managers and owners
- Design teams (engineering & architecture of buildings)
- Contractors and builders
- Manufacturers (of construction products)
- Deconstruction/demolition teams
- Investors, developers and insurance providers
- Government/regulators (including national, regional and local (municipal) authorities responsible for land use/urban planning and building regulations/permits).

The multiple-choice questions required respondents to provide their views on the importance of pre-defined drivers, barriers and opportunities as well as aspects related to stakeholder involvement and the policy landscape. Open-ended questions gave the respondents the opportunity to provide additional quantitative and/or qualitative information. **There were 95 responses and the respondents had a good geographical distribution.**

The survey results showed that the main **drivers and opportunities** to enhance circularity in building design are the following:

- Enhanced commitment to reduce GHG emissions and/or other environmental impacts
- Include circularity criteria in Green Public Procurement (GPP)
- Increase interest and awareness from the end user on the benefits of sustainable design (across building life)
- Establish legislative requirements and increase compliance with regulations
- Deliver better-quality products and buildings for the end users
- Establish long-term sustainable business models
- Promote construction techniques that facilitate easier maintenance, replacement and repairs at product, system and building levels

Particularly in relation to GPP it was highlighted that it is important to include the overall building costs (i.e. design, raw-material generation, construction, use-phase, deconstruction, waste management) that are visible and part of the (public) procurement. In addition, it was highlighted that specified design criteria for the use of recycled material

are required together with the establishment of harmonised standards and assessment methods based on LCA methods. The promotion of disassembly and reuse of materials in existing buildings was also mentioned as a key driver.

In relation to the regulatory aspects, it was highlighted that focus should be directed towards policies and investments derived by the Renovation Wave by underlining the reuse of the existing built environment. The expansion of the requirements on the Energy Performance of Buildings Directive with the inclusion of sustainability indicators was also mentioned as key driver of circularity in buildings.

3.3 ***Selected policy options***

The identification of policy options that would be most effective in promoting circular economy principles for building design considered the following aspects:

- **Existing national and regional policies and approaches** (based mainly on the case studies)
- **Ability to tackle key challenges and barriers** in relation to implementing whole life circular design in the built environment.
- **Priority areas across the value chain** of buildings' design where further action at EU level presents potential for increased uptake and effectiveness (based mainly on the outputs of the online survey)
- **Potential synergies** with existing EU policies and initiatives that impact construction and buildings, including: European Green Deal⁸¹; Renovation Wave⁸²; Circular Economy Action Plan⁸³; Level(s)⁸⁴; Construction Products Regulation⁸⁵; Energy Performance of Buildings Directive⁸⁶; EU Construction & Demolition Waste Protocol⁸⁷; New European Bauhaus⁸⁸; EU Commission action plan on financing sustainable growth⁸⁹; Sustainable Product Policy and Standards⁹⁰; Ecodesign and Energy Labelling Directives and Standards⁹¹; Environmental Performance of Buildings (EPB) Standards⁹²; EU Green Bond Standards⁹³; Digital building Logbooks⁹⁴; EU criteria for Green Public Procurement (GPP Criteria)⁹⁵; EU framework programmes for Research and Innovation⁹⁶.

⁸¹ COM/2019/640 final, The European Green Deal, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>

⁸² COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

⁸³ COM(2020) 662 final, A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662>

⁸⁴ European Commission (2019), LEVEL(S), Taking action on the total impact of the construction sector

⁸⁵ Regulation (EU) No 305/2011 laying down harmonised conditions for the marketing of construction products, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0305>

⁸⁶ Directive 2010/31/EU on the energy performance of buildings, https://eur-lex.europa.eu/legal-content/EN/ALL;/ELX_SESSIONID=FZMjThLLzfxmmMCQGp2Y1s2d3TjwtD8QS3pqdkhXZbwqGwlqY9KN!2064651424?uri=CELEX:32010L0031

⁸⁷ European Commission (2016), EU Construction & Demolition Waste Management Protocol, <https://ecocircular.com/wp-content/uploads/2017/05/Protocol-Ares20165840668-101016-3.pdf>

⁸⁸ https://europa.eu/new-european-bauhaus/index_en

⁸⁹ European Commission (2018), Renewed sustainable finance strategy and implementation of the action plan on financing sustainable growth, https://ec.europa.eu/info/publications/sustainable-finance-renewed-strategy_en

⁹⁰ https://ec.europa.eu/growth/industry/sustainability/product-policy-and-ecodesign_en

⁹¹ https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/ecodesign_en

⁹² <https://epb.center/>

⁹³ https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-green-bond-standard_en

⁹⁴ European Commission (2020), Study on the development of an EU framework for Digital Building Logbooks, https://ec.europa.eu/growth/content/study-developing-eu-framework-digital-logbook-buildings_en

⁹⁵ https://ec.europa.eu/environment/gpp/index_en.htm

⁹⁶ <https://ec.europa.eu/programmes/horizon2020/>

This led to the identification of 8 broad policy foci primarily based on their scalability and impact: Construction Products Regulation; Energy Performance of Buildings Directive (EPBD); Energy Efficiency Directive (EED); GPP criteria; Guidance for local and regional authorities; Extender Producer Responsibility (EPR); waste audit and selective demolition requirements; and fiscal instruments (business support).

EPR was discarded as currently there are no legislative developments that could require Member States to establish EPR schemes on construction products. In addition, potential revisions to the CPR and the EPBD would have greater potential to establish declaration of performance and minimum performance requirements in a uniform manner. In relation to fiscal instruments (provision of direct and indirect funding), GPP criteria, local planning guidance and EPBD establish the necessary basis for criteria required to direct EU funding towards the integration of circular economy in building design. The EPBD was found to have more relevant areas for intervention that could possibly be linked to the EED, as necessary, through cross-referencing. Therefore, after assessing interlinkages between the options and taking into account issues of feasibility and appropriateness for EU action beyond the Member State level, these options have been further refined to a final shortlist of 4 policy options:

- Potential revision of the Construction Products Regulation
- Potential revision of the Energy Performance of Buildings Directive
- Potential revision and expansion of the GPP criteria
- Development of guidance for local and regional authorities and requirements in planning and funding mechanisms

The table below provides the relevance of these policy options with the corresponding most relevant drivers and barriers that were identified in the context of this study and particularly the online survey.

Table 3: Selected policy options and their relevance to the main drivers and barriers

Policy options	Drivers	Barriers
1) Revision of the Construction Products Regulation	- Establishment of legislative requirements and increase compliance with regulations - Delivery of a better-quality products and buildings for the end users - Promotion of disassembly and reuse of products & materials	- Lack of regulatory drivers - Lack of standards for secondary materials - Lack of technical characteristics of new products made with circular materials
2) Revision of the Energy Performance of Buildings Directive.	- Promotion of construction techniques that facilitate easier maintenance, replacement and repairs at product, system and building levels - Promotion of design for deconstruction and disassembly	- Unclear costs and benefits that can be generated through circular economy across the value chain - Lack of well-established standards and indicators to measure circularity in buildings
3) Revision and expansion of the GPP criteria	- Establishment of specified design criteria for the use of recycled material are required together with the establishment of harmonised standards and assessment methods based on LCA methods. - Inclusion of the overall building costs	- Unfavourable market conditions such as higher costs in the short term compared to conventional buildings
4) Development of guidance for local and regional authorities and	- Increase interest and awareness from the end user on the benefits of sustainable design (across building life)	- Lack of financial incentives such as environmental taxes and subsidies - Lack of awareness and skills across the value chain

Policy options	Drivers	Barriers
requirements in planning and funding mechanisms		

Table 4 provides an overview of the case studies summarising the year the initiative was launched, type of implementation (mandatory or voluntary), as well as the relevance to the selected policy options.

Table 4: List of case studies and their relevance to the policy options

No.	Country	Name of initiative	Year launched	Relevance to selected policy options			
				CPR	EPBD	GPP	Local regional planning
1	Belgium	Circular Flanders – Green Deal on Circular Construction	2017		X	X	
2	Belgium	Be Circular (PREC)	2017		X		
3	Denmark	Sustainability in Construction & Civil Works	2016	X			X
4	Denmark	Architecture policy for Copenhagen 2017-2025	2017				X
5	EU	Levels(s) Framework for reporting on CE in buildings	2015	X			
6	Finland	Low-carbon road map for buildings and building materials	2017		X		
7	Finland	Procurement criteria for low carbon building	2017			X	
8	Finland	Green Deal Agreement on sustainable dismantling	2020				X
9	France	EPR scheme for construction materials	2020				
10	France	E+C- standard trial scheme	2016	X	X		

No.	Country	Name of initiative	Year launched	Relevance to selected policy options			
				CPR	EPBD	GPP	Local regional planning
11	France	Bâtiment bas carbone Label	2015	X	X		X
12	Italy	ITACA Protocol	2004	X			X
13	Italy	GPP compulsory Minimum Environmental Criteria for Buildings	2015			X	
14	Luxembourg	Product Circularity Dataset Initiative	2018	X			
15	Netherlands	Green Deal 159: Circular Procurement	2013			X	
16	Netherlands	Dutch Building Decree	2012	X			
17	Netherlands	Roadmap for Circular Land Tendering, Amsterdam	2017			X	
18	Netherlands	Circular Construction Economy Transition Agenda	2018		X		
19	Portugal	National System for Public Procurement	2017			X	
20	Portugal	National waste management legal framework - Decree-Law no. 73/2011	2011			X	
21	Slovenia	Strategy for the Transition to Circular Economy in the Municipality of Maribor	2018				X

No.	Country	Name of initiative	Year launched	Relevance to selected policy options			
				CPR	EPBD	GPP	Local regional planning
22	Sweden	Roadmap for future regulation on Climate declarations	2020	X			
23	Sweden	Fossil Free Sweden initiative	2018	X			
24	UK	New London Plan	2020				X
25	UK	Zero Waste Scotland	2012		X		
26	UK	Welsh Government Innovative Housing Programme	2017	X			X
27	Japan	The Act for the Promotion of Long-Life Quality Housing (LQH)	2009		X		X
28	Canada	Zero Emissions Building Plan, Vancouver	2016		X		X
29	Israel	Israel Green Building Standard	2016		X		X
30	US	Minnesota Sustainable Building Guidelines	2001		X		X

4. DESCRIPTION OF POLICY OPTIONS

This section provides a detailed description on each of the four policy options proposed to promote circular design in construction across the EU. These are:

- 4.1 Potential revision of the Construction Product Regulation (CPR) to integrate Circularity aspects
- 4.2 Potential revision of the Energy Performance of Buildings Directive (EPBD) to integrate circularity principles throughout the lifecycle of buildings
- 4.3 Development and potential revision of Green Public Procurement (GPP) requirements to include circularity criteria for products and services
- 4.4 Provision of guidance on local and regional planning (and funding) to mandate circularity

The description of the policy options includes the objectives, the policy context, their relevance and rationale, the targeted barriers and opportunities, their replicability, relevant initiatives as well as an assessment of their impacts.

In relation to the assessment of the impacts, a list of the main impacts and relevant indicators to be used in the assessment of policy options are summarised in the following Table 5.

Table 5: List of economic, social and environmental impacts and indicators for assessment of selected policy options

Category of impacts	Relevant indicators
Economic impacts	<ul style="list-style-type: none"> • Functioning of the internal market and competition; • Operating costs and conduct of business/Small and Medium Enterprises; • Administrative burdens on businesses; • Costs to public authorities; • Innovation and research; • Costs to consumers and households; • Costs and benefits to specific regions or sectors; • Effects on the macroeconomic environment, including impacts on international trade and competition
Social impacts	<ul style="list-style-type: none"> • Employment and labour markets; • Standards and rights related to job quality; • Governance, participation, good administration, access to justice, media and ethics; • Public health and safety
Environmental impacts	<ul style="list-style-type: none"> • Climate change; • Transport and the use of energy; • Biodiversity, flora, fauna and landscapes; • Water quality and resources; • Soil quality or resources; • Land use; • Renewable or non-renewable resources; • The likelihood or scale of environmental risks; • International environmental impacts

Within the data compiled and assessed, several information gaps were expected and identified in the case studies, related to different indicators. For certain indicators, these gaps were filled via consultation of experts through the delivery of the second workshop. Data gaps were mainly linked to the low maturity of most of the initiatives assessed in case studies and the consequent lack of evidence on the wider impacts. Depending on the data availability a semi-quantitative assessment was performed within the study to show the scale of the impacts using the following scoring system:

- '+' : Positive environmental impact;
- '-' : Negative environmental impact;
- '-/+': Positive or negative environmental impact (depending on certain conditions);
- '0': no effect;
- '?': unknown effect

The information on the different areas of the assessment was collected through a review of the case studies and an expert judgement by the project team. The aim of the assessment is to provide clear information on the likely impacts of the policy option of the potential direct and indirect environmental, social, and economic impacts of the policy option, also to act as a basis for comparing them against one another and the current situation and related trends (see Annex 1).

4.1 Potential revision of the Construction Product Regulation

Objectives	Revision of CPR (Construction Product Regulation) to integrate circularity aspects
Implementation approach	Mandatory (minimum level) & Voluntary (aspirational level)
Scope	Construction materials and products
Delivery mechanisms	Inclusion of harmonised & digitised, circularity information, aligned to Level(s) on construction products and materials traded
Relevance to other EU policies and initiatives	Level(s); The Waste Framework Directive; Circular Economy Action Plan; Digital Building Logbooks; CEN/TC 350 Sustainability of Construction Works (harmonization)
Relevant national policies and initiatives	Finland: Low-carbon road map for buildings and building materials; Netherlands : Dutch Building Decree; Sweden: Roadmap for future regulation on Climate declarations; UK : New London Plan; Canada: Zero Emissions Building Plan, Vancouver; Israel: Green Building Standard; US: Minnesota Sustainable Building Guidelines; Luxembourg: Product Circularity Dataset Initiative
Timeframe:	Beyond 2021

Objectives

This policy option entails a revision of CPR (Construction Product Regulation) to integrate circularity aspects.

It should be emphasised that the CPR revision is a separate process and this study in no way anticipates which form a revision might take, or indeed if a decision is taken to revise the Regulation at all.

Relevance & Rationale

CPR and BWR 7, or future alternative, provides a framework for potentially mandating the production of **harmonised information relating to circular design attributes relevant at construction product & material level**. In doing so, it could ensure the right information and data is readily accessible to understand and compare performance of products and enable more consistent and informed decision making at other levels, such as the whole building over its life cycle.

However, this needs to be considered alongside **other strategies and communications** to promote synergy and alignment of objectives and stated actions, which will reduce administrative burden and potential confusion for the sector in the medium to long term. These include:

- *The Waste Framework Directive⁹⁷* (2008) sets out the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It also defines when a product or material becomes a waste and when waste ceases to be waste (end-of-waste criteria). The *2018 amendment⁹⁸* to the Directive also introduced "extended producer responsibility" and a key target of 70% (by 2020) preparing for re-use, recycling and other recovery of construction and demolition waste. All of these aspects can be aligned or supported through additional and/or harmonised information relating to construction products and materials. For example, **a revised CPR might better enable products to be reused or remanufactured**, prevent products and materials being classed as waste. Also, by allowing such products to obtain CE marking gain access to the European market, support the aims and objectives of both the WFD and Member States' *Waste Prevention Programmes⁹⁹*.
- Construction focussed strategies such as the *Strategy for the sustainable competitiveness of the construction sector and its enterprises¹⁰⁰* ('2012) which states that the Commission 'will develop harmonised rules on the declaration of the performance characteristics of construction products in relation to a sustainable use of natural resources in the context of the Construction Products Regulation' (Time horizon 2013-2018).
- A recently published report on the *Study on the development of an EU framework for Digital Building Logbooks¹⁰¹* could be relevant in the context of harmonising and digitising circularity data for products & materials. Though it should be noted that **the main focus of the study was at building level**, rather than extracting the lessons learnt for product/material level information.
- The recent work in Luxembourg to create a *Product Circularity Data sheet¹⁰²* covers all products but has partners involved which have a built environment focus. The programme is currently piloting an industry standard that considers **5 core aspects of circularity data**: 1) General Information 2) Composition 3) Designed for Better Use 4) Designed for Disassembly 5) Designed for Re-use.

⁹⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098>

⁹⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018L0851>

⁹⁹ <https://ec.europa.eu/environment/waste/prevention/legislation.htm>

¹⁰⁰ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0433:FIN:EN:PDF>

¹⁰¹ <https://op.europa.eu/en/publication-detail/-/publication/40f40235-509e-11eb-b59f-01aa75ed71a1/language-en/format-PDF/source-search>

¹⁰² <https://pcds.lu/>

- Important to note also is the recently revised standard *EN 15804:2012+A2:2019 Environmental product declarations - Core rules for the product category of construction products*. It defines the environmental indicators that have to be declared for Type III **environmental product declarations (EPDs)** and describes which stages of the product's life cycle are considered in the EPD and which processes are to be included. Additionally, it provides **rules for the Life Cycle Inventory and the Life Cycle Impact Assessment, as well as for reporting environmental and health information** that is not covered by LCA for a construction product, process or service. As a follow up, the technical committee CEN/TC 350 is currently revising EN 15978¹⁰³ 'Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method' to align it with EN 15804:2012+A2:2019. However, **not all data requirements to support circular design are captured within EN 15804 compliant EPDs**, so additional information is needed to supplement the product environmental indicators required by this standard; to enable better circularity outcomes across the product/ building life cycle and beyond.
- The indicators and objectives of Level(s)¹⁰⁴ include numerous aspects of data capture and circularity aspects at the product & material level. These include: **1.2 Life cycle GWP; 2.1 Bill of quantities, materials and lifespans; 2.2 Design for adaptability & deconstruction; 2.3 Waste creation and material use (per m²); 2.4 Cradle to Grave LCA (7 impact categories); 6.1 Life cycle costs**. Within the Level(s) framework, the product and material level data is mostly required to calculate relative (e.g. per m²) building impacts such as waste production, embodied carbon and whole life costs.

Targeted barriers and opportunities

At this point in time, **it is difficult to compare performance on construction products and materials across various circular design related aspects**, such as ease of disassembly, future reuse potential, maximum technical service life, whole life cost/ carbon, material intensity/ waste, repairability etc. Often such data is required to support building level assessments and optioneering for circular design. This lack of clarity in declaring related construction product performance causes lack of incentive for suppliers to make changes that lead to a more circular built environment (e.g. ecodesign measures to enable future reuse). Additionally, **like for like comparison of 'end-of-life' impacts and residual value is not feasible** to undertake due to lack of data and harmonisation of data requirements which hampers development of alternative business models and procurement approaches. **Rectifying this situation is fundamental to moving forward with multiple circular design objectives**, such as implementation of detailed whole life costing and carbon calculations set within Level(s).

The second stakeholder workshop¹⁰⁵ developed further the opportunities surrounding minimising the whole life cycle costs, including the promotion of renewable materials based and/or more durable products; whilst recognising challenges such as tracking information throughout the life cycle, and ensuring that the financial burdens and gains are in

¹⁰³https://standards.cen.eu/dyn/www/f?p=204:110:0:::::FSP_PROJECT,FSP_LANG_ID:67043,25&cs=1015B528FE8A6D870B1E885C36089B9BE

¹⁰⁴https://ec.europa.eu/environment/topics/circular-economy/levels_en

¹⁰⁵ The half day webinar/workshop took place on 10th of March 2020, with 66 participants from key stakeholder groups across Europe

equilibrium for all stakeholders (see Annex 1 for a summary of the discussions). Other opportunities identified included the integration of wider Sustainable Development goals and green financing by using renewable materials versus the challenge around **accessing reliable data and having transparency over the value chain**. It was also thought important to understand and communicate more effectively the **rationale for any additional data requirements for construction products** since this should improve uptake and more robust data and information being provided.

Key success factors

Based on the analysis of existing initiatives, the following have been identified as key success factors:

- A consensus should be sought across various strands of activity where circularity data at product level is required, and with industry, academia and other public sector activities (such as Green Public Procurement criteria – see 4.3) as to **what construction product level data and information should be made readily available**, in a harmonised form, to support circular design and subsequent implementation of those design intentions across the product and building lifetime.
- **Minimise the collective administrative burden** for national authorities and the industry through ensuring requirements are clearly linked and aligned with other relevant accreditations or policies.
- **Align with existing methods and standards for data harmonisation**, as appropriate to achieving Circular Design outcomes. For example, Global Warming Potential data utilised from Environmental Product Declarations in line with EN 15804:2012+A2:2019 (Environmental product declarations - Core rules for the product category of construction products)¹⁰⁶.

A definition of product data to support circular design should also allow for varying levels of requirements and ambitions, beyond mandatory EU level compliance, across the EU Member States, thus promoting innovation and aspirational performance that is still set within an accessible and harmonizable framework. In doing so, this can then provide a test bed for mandating additional EU wide requirements in the longer term.

The second stakeholder workshop focussed on improving circularity data for products concluded that aspects such as: using standards and **harmonized method / format for data at the European scale (EN 15804; CENTC350; Level(s))**; establishing clear objectives on the use of data and ensure its understanding by all stakeholders; using an integrated approach, from the resource level to the construction and operation of buildings; defining a clear framework for data collection; ensuring transparency and secure access to data to protect confidentiality; and **developing taxonomy criteria based on circularity principle** were all key to achieving success in this context.

Possible Delivery mechanisms

In terms of integrating circularity into harmonized technical specifications of the CPR for methods and criteria to assess and declare the performance of construction products, the following actions could be useful:

- **Mapping of existing tools and initiatives:** Map the various commitments, regulations, actions, initiatives, tools, standards, procurement criteria and voluntary agreements that require product level data linked to circularity to be effectively implemented. Involve the various stakeholders and policy makers in

¹⁰⁶https://standards.cen.eu/dyn/www/f?p=204:110:0:::::FSP_PROJECT:70014&cs=1CFE7BDC38149F238F05C4C13E0E3B4C2

defining 'core/mandatory' and 'additional/aspirational' data fields that should be filled by construction product & material suppliers in a harmonised way. This could also consider further requirements on other parts of the supply chain to add or update information on these products; for example, in the context of building design, construction, maintenance, refurbishment/adaptation and eventual deconstruction. A new CEN TC/350 sub-committee 1 for Circular Economy has been established that could assist with this exercise and subsequent harmonisation work.

- Build consensus on the required data and information: Define the 'core' & 'aspirational' data and information (fields/attributes) that should be available for all construction products and materials to support circular design and implementation. This should build upon and align, where appropriate, with the harmonisation work of CEN/TC 350 – EN15804 in particular to avoid duplication of effort. It should also consider aspects of digitisation and ease of collation and updating throughout the asset/building life cycle. For example, linked to BIM (Building Information Modelling) data acquisition and integration. This could also be built upon the emerging EN ISO 22057 Data templates for the use of EPDs for construction products in BIM¹⁰⁷.
- Define implementation mechanisms: Develop further also the optimal mechanisms for reporting, transferring and updating such information by suppliers to their customers and tools that support more informed decision making, such as BIM uploads to provide instant LCA. This should also consider the scope to add or amend data requirements into the future to avoid new systems needing to be created and, hence, duplication of effort.

Ideally, the required data would be made available in the same format throughout the EU, rather than have a patchwork of data driven systems, to enable streamlined analysis and decision making; which supports a recommendation to have a more accessible, harmonised and digitised approach to relevant construction product data. It should also be noted that optimising circular design and implementation goes beyond embodied carbon at design stage using a predetermined asset life span of 60 to 80 years. Otherwise, it should only be necessary to require all products to produce an EPD (Environmental Product Declaration) to achieve the objective. The building context linked and additional, often more qualitative, circularity attributes are also necessary to create a standardised system that can capture, transfer and retain all the relevant data over long periods of time.

Some additional thoughts linked to the delivery mechanism, as expressed by stakeholders during the second workshop, included: Focus is also needed on a harmonised digital format to enable better exchange of information; interview frontrunner stakeholders who would use the information to provide feedback on the initiatives analysis and provide input on requirements to support circularity; information on the circularity of products linked to building permit legislation and procurement; and to ensure that circularity indicators on building level and product level are linked.

Replicability

There is high potential for scalability given that regulations would be applied simultaneously and uniformly in all Member States. There is scope to have core requirements across the EU, with additional requirements operating at Member States level which should be encouraged to promote further innovation and better performance.

¹⁰⁷ <https://www.iso.org/standard/72463.html>

Expected impacts

The impact of successful implementation will be largely driven by any aspects of circular design that are subsequently enabled or made more effective.

The highest potential impact would be linked to **reducing embodied carbon of built assets over their life cycle**. This is linked to creating a more reversible, reusable and adaptable system whereby products and materials can be more readily recirculated and retained at their highest value, which in turns tends towards reuse, and hence reduction of embodied carbon. The other Cradle to Gate LCA impacts will equally benefit from a move from recycling to repair & reuse, including the extraction and processing of primary materials.

Should there be significant scope to retain products & materials already in the building stock, e.g. through improved marketing and confidence of demolition products, this could add a significant impact reduction in the built environment in the more immediate sense of displacing new products and materials today. This would have a similar impact in terms of reduction of demolition waste generated.

It is widely recognised that **deconstruction and reuse can support greater job creation** compared to low level recycling or disposal. However, with the development of alternative business models and repair/remanufacturing capability comes further opportunities for new business start ups and higher skilled/ paid job creation. Without further evidence, it is difficult to judge whether this could be a high or medium impact, and it would undoubtedly depend upon the nature and scale of new business models evolution and take up by the sector.

Lastly, the inclusion of information on material composition could be helpful in a number of ways, including **flagging up the location of potentially problematic products & materials in buildings and infrastructure**, that could thus be dealt with more effectively. Conversely, those resources that become more valuable, perhaps due to global scarcity, would also be easier to locate in the future, at individual asset and building stock levels.

Actors involved

A large number of actors would be involved in the revision of CPR in any event, so this would be another facet of data definition and consensus to consider. The proposed mapping activity would need to be **cross cutting in terms of Member States and product life cycle stage representation**. In addition, those actors currently engaged in developing, trialling and enabling circularity data standards (such as Product Circularity Data Sheet), building level circularity standards (such as Level(s)) and circularity assessment methods & tools would also be important to involve.

Existing initiatives to learn from

The case studies developed in the context of the present study provide some lessons that could be considered in the prospective revision of CPR. These are summarised in Table 6 below:

Table 6: Lessons learnt from the case study on a potential revision of CPR

Case study	Key points
Low-carbon Road Map in Finland	Developed to build upon related initiatives in other Member States (e.g. France, Netherlands and Belgium), whilst integrating current European Standards and supporting tools such as BIM. The Finnish Ministry of the Environment also

Case study	Key points
	investigated how well the method promoted by the Road Map was applicable to ordinary planning and construction projects to improve it before its roll out. One barrier identified relates to the lack of data on EPDs, but efforts have since been made to fill that gap again based on data developed in other Member States (e.g. France and the Netherlands).
Building Decree in the Netherlands	This follows a harmonised approach as the same assessment method is prescribed by BREEAM-NL and Green Public Procurements for office buildings and civil engineering works. The method also follows common standards on the methodological requirements on LCA (EN 15804:2019) and calculation rules environmental performance of buildings and civil engineering works (EN-15978). Similar concerns also appear in the context of the implementation of a Roadmap on Climate declarations in Sweden particularly in relation to potential high costs of implementation, particularly for SMEs (e.g. for data collection and reporting processes). Again, these are addressed through the development of databases at a national level.
Circular Economy Statement London Plan	Has emerging requirements for consistent product data, such as ability to disassemble and reuse to produce a circular economy statement as part of planning process, including design considerations for the building's lifecycle and future reuse potential.
Zero Emissions Building Plan in Vancouver	Minimum requirements may be established by either directly requiring a small percentage of material reuse or incentives that create demand that will help encourage the deconstruction and reuse market

Evidence of impact from existing initiatives

It is difficult to extract much evidence of impact from these initiatives, mainly due to the narrow focus and often, evolving nature of implementation. The evidence for 'data need' is more apparent, especially in relation to the reduction of whole life carbon, such as the **Finland Low Carbon Roadmap**. What is interesting in that case study is recognition that more robust and accessible product & material **life cycle data, specifically relating to embodied carbon, is necessary to enable regulation to cap whole life carbon**. This is currently being undertaken at a generic level for commonly used products and materials, with the proposal that this generic data can be replaced by proprietary product data once the design detail has reached the point of product specification. As mentioned in the previous subsection, other case studies with a similar focus on creating product & material level databases to support regulatory action include the **Building Decree in the Netherlands and the Roadmap on Climate declarations in Sweden**.

Relevant/ supporting survey findings

Some of the high scoring aspects that resonate with this recommendation include circularity drivers of reducing whole life costs and carbon; developing longer term business models (such as **being able to retain ownership/take back products**; and having data available upon which to make more informed decisions.

Lack of suitable data was also referenced several times by way of barriers to circular economy and a key opportunity, which was highlighted by stakeholders, was 'Optimizing the whole life cost and value of buildings (e.g. by making use of building passports, Building Information Modelling)'. However, they gave less importance to policy measures to improve availability and quality of data.

Under the section on 'tools to enhance stakeholder engagement', a key conclusion was to support the **promotion of clear data templates for transfer and the integration of safety aspects, via BIM**. The development and sharing of reliable data on circularity of product and materials was also put forward as an important aspect by one respondent.

4.2 Potential revision of the Energy Performance of Buildings Directive (EPBD)

Objectives	Potential revision of the EPBD to include circularity principles throughout the lifecycle of buildings
Implementation approach	Mandatory
Scope	Public and private, residential and non-residential buildings
Delivery mechanisms	Revision of the EPBD to integrate the whole lifecycle carbon approach and circularity performance requirements for new and existing buildings
Relevance to other EU policies and initiatives	EED Renovation Wave Level(s)
Relevant national policies and initiatives	Netherlands: Dutch Building Decree; Israel: Green Building Standard; Japan: Act for the Promotion of Long-Life Quality Housing; Finland: Low-carbon road map for buildings and building materials; Sweden: Roadmap for future regulation on Climate declarations; UK: New London Plan; Canada: Zero Emissions Building Plan, Vancouver
Timeframe:	Beyond 2021

Objectives

This policy option would entail a revision of the Energy Performance of Buildings Directive 2010/31/EU (EPBD) to include circularity principles throughout the lifecycle of buildings.

The measures contained in the EPBD enable the reduction of energy consumption and associated greenhouse gas emissions that arise during the operation of buildings. However, emissions also occur during other parts of the building life cycle. There could be an opportunity for the EPBD to address some of these by taking into account the wider resource efficiency of construction materials from extraction and production to construction and end of life. There are operational impacts from energy generated for heating, cooling and lighting of buildings, and embodied impacts from the processes to manufacture, supply, construct and deconstruct building materials and products. The two are interlinked, since decisions to reduce operational impacts (e.g. to renovate an existing building) can influence embodied impacts.

The included recommendations are interconnected with other policies such as the Energy Efficiency Directive 2012/27/EU (EED), Renovation Wave and Level(s) and therefore these initiatives have been cross-referenced for uniformity.

Relevance & Rationale

The **Renovation Wave**¹⁰⁸ initiative integrates circular principles in the renovation of buildings and mentions a series of actions including revisions of the EPBD and EED. The Renovation Wave aims to at least double the annual energy renovation rate by 2030. One of the key principles outlined in the renovation wave is '**lifecycle thinking and circularity**'. To deliver faster and deeper renovation for better buildings, the Commission proposes to promote the development of standardised sustainable industrial solutions and the reuse of waste material.

- **By 2022, green public procurement criteria related to lifecycle and climate resilience for public buildings will be developed based on Level(s)**¹⁰⁹. Level(s) is the European reporting framework for sustainable buildings (common language for communicating on environmental performance) that includes indicators linked to both resource use and the quality and value of buildings throughout their lifecycle.
- **By 2023, a roadmap to 2050 will be developed for reducing whole life-cycle carbon emissions in buildings** (and advancing national benchmarking in Member States).
- **By 2024, construction and demolition waste (CDW) material recovery targets will be reviewed to increase reuse and recycling platforms and support a market for secondary raw materials.** The new Circular Economy Action Plan (CEAP)¹¹⁰ has already highlighted that the Commission will pay special attention to insulation materials when revising CDW recovery targets.

Overall, the renovation wave recommends that Level(s), 'circular economy principles for building design'¹¹¹ and the EU CDW management protocol¹¹² should be used as guides for renovation projects. **There is potential for the EPBD to work more closely with these initiatives.**

Digitalisation is also an important approach to accelerate and maximise decarbonisation. An EU framework for **a digital unification tool, Digital Building Logbooks (DBL)**¹¹³, **is proposed for 2023** and aims to cover the entire lifecycle and all relevant building information. DBL could serve as a repository for construction and building material data such as: type; quantity/amount; origin; carbon footprint; recycled content; end of life dismantling guidance; reuse and recycling possibilities. The EPBD sets out the framework for EPCs that could interact with DBLs alongside other data. Using DBLs, decision makers considering renovation of existing buildings could make more informed choices that integrate both operational and embodied emissions in a circular approach. Design decisions for optimal energy performance also have an impact on embodied emissions. Such decisions can include: selection of low embodied emission construction products; reuse of existing elements; design for future disassembly; efficient use of materials in design of structure and building fabric; decisions to lengthen the service life of buildings including by renovating rather than demolishing them; maximizing the efficient use of space. There is potential for the EPBD to address some of these issues.

¹⁰⁸ COM 2020 662 : https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

¹⁰⁹ https://ec.europa.eu/environment/topics/circular-economy/levels_en

¹¹⁰ https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

¹¹¹ <https://ec.europa.eu/docsroom/documents/39984>

¹¹² https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

¹¹³ Definition of the digital building logbook <https://op.europa.eu/en/publication-detail/-/publication/cacf9ee6-06ba-11eb-a511-01aa75ed71a1>

Targeted barriers and opportunities

The Commission's second assessment of national Long Term Renovation Strategies showed that data collection and descriptions of national building stocks improved between the 2014 and 2017 strategies. Improvements were also made in evaluating the cost-effectiveness of different interventions to determine the most appropriate. A key challenge found has been the evaluation and monitoring of implemented policies. This will make it challenging to assess the incorporation and impact of circular economy principles for building design. Moving forward, specific monitoring indicators (quantitative and qualitative progress indicators) will be developed and it is recommended to have "*a single document including all the legislative requirements that now are sometimes dispersed in several different documents or to always make explicit references to information contained in other sources in order to make any building renovation strategy update a self-standing document*"¹¹⁴. **The development of monitoring indicators addressing the whole life cycle may present an opportunity to further incorporate lifecycle thinking and circularity.** The CEN/TC350 is working on the incorporation of circularity principles in the construction sector¹¹⁵ and results could potentially be incorporated.

Financial measures in the EPBD are linked to energy performance such as the level of certification or improvement achieved. This is typically assessed by comparing EPC ratings before and after renovation but other standardised and transparent methods might also be added. For example, Level(s) includes the following 'resource efficient and circular material life cycles' indicators: bill of quantities, materials and lifespans; CDW; design for adaptability and renovation; and design for deconstruction.

Another key energy **efficiency challenge is the difficulty for end-users in understanding and measuring energy savings from renovations** (identified in EU policy reviews and also in this study's survey results). Given the interrelationship between energy performance and life cycle emissions, **a more holistic approach could lead to increased interest/awareness from the end user regarding the benefits of sustainable design across building life.** Results of the Commission's 2019 study on building energy renovation activities and the uptake of NZEBs¹¹⁶ showed that recommendations and rating instruments contained in EPCs, energy bills and energy labels on components are highly influential once the decision has been made to renovate. Along with justifying the decision, they help with selecting or recommending the right solutions and increasing the ambition level. The conclusion was that more promotion of EPCs is required, especially amongst architects, main contractors and installers.

Possible Delivery mechanisms

The EPBD Inception Impact Assessment Report (issued February 2021)¹¹⁷ highlighted measures that will be considered within the current EPBD review to increase building decarbonisation ambitions such as: mandatory minimum energy performance standards; updates to the EPC framework to increase quality and availability; the introduction of Building Renovation Passports (BRPs); and, the introduction of a deep renovation

¹¹⁴ European Commission (2019). Assessment of second long-term renovation strategies under the Energy Efficiency Directive. <https://op.europa.eu/en/publication-detail/-/publication/e04473ed-2daf-11e9-8d04-01aa75ed71a1/language-en/format-PDF/source-86607487>

¹¹⁵https://standards.cen.eu/dyn/www/f?p=204:7:0:::::FSP_ORG_ID:481830&cs=181BD0E0E925FA84EC4B8BC_CC284577F8

¹¹⁶ European Commission (2019). Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU. https://ec.europa.eu/energy/studies_main/final_studies/comprehensive-study-building-energy-renovation-activities-and-uptake-nearly-zero-energy_en

¹¹⁷ European Commission (2021). Inception Impact Assessment for the 'Revision of the Energy Performance of Buildings Directive 2010/31/EU'. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12910-Energy-efficiency-Revision-of-the-Energy-Performance-of-Buildings-Directive_en

standard. The EPBD revision also seeks to address resource efficiency and circularity principles. **Specific aspects have been highlighted in this section that have the potential to embed the whole lifecycle carbon approach and circularity performance requirements for new and existing buildings, in alignment with other EU initiatives** such as Level(s) and CEN/TC350.

Calculation of circularity performance of buildings

There may be potential to incorporate **circularity performance considerations such as potential for reuse and higher value recycling**. The Dutch Building Decree has environmental performance requirements that adopt a whole lifecycle carbon approach. Eleven impact categories (widening to 19 in 2021) are aggregated to obtain a single score as an output. Another example is the Israel Green Building Standard (SI 5281) covering design, construction materials, heating and cooling systems, health and safety, and innovation. The standard was initially voluntary and became mandatory in phases from cities and in-town planning appraisals (2013-15) and public and government buildings (2014) to nationwide (2021) for most types of new and existing buildings and local town plans. It is based on a point rating system (similar to LEED, BREEAM and Green Star) and due to its assessment and verification qualities, it is directly linked to Israel's energy and CO₂ emissions reductions objectives. Potentially, the EPBD could explore incorporation of a metric for GHG emissions produced in kgCO₂eq/(m².y) over the whole life cycle as well as other aspects of circularity performance.

Circularity considerations for NZEBs and beyond

There may be an opportunity to **establish more ambitious definitions of buildings such as net-zero emission and plus energy buildings, incorporating circularity principles**. Such an approach could be inspired by the Zero Emissions Building Plan in Vancouver, that requires new constructions' operational energy to be reduced to zero by 2030, and for new constructions' embodied emissions to be reduced by 40% by 2030, compared to a 2018 baseline.

Financial measures linked to circularity performance

There may be opportunities in future for **more sustainable financing through incorporating circularity considerations**. For example, the Welsh Government Innovative Housing Programme, funds housing infrastructure, based on certain criteria, including the embodied and whole life carbon, the use of recycled and recyclable materials and construction that facilitates future internal reconfiguration.

Information provision and awareness raising

Owners or tenants of buildings or building units should be informed of practices that enhance energy performance. There could be an opportunity here to also **provide guidance on the importance of circular economy principles for building design**. For example, the Belgian initiative, Circular Flanders, embodies 6 information sharing activities: networking; knowledge spreading and sharing (including policy-relevant research on CE and materials management); stimulation and acceleration of CE innovation and entrepreneurship; a laboratory function to support new ideas; provision of policy guidance and support and coordination between public authorities (to create a robust framework on policy); and working to ensure CE principles and good practices become embedded and are scaled-up. In addition, the European public web portal for energy efficiency in buildings (Build UP)¹¹⁸ includes some circular economy content and this aspect could be strengthened.

¹¹⁸ <https://www.buildup.eu/en/search/circular%20economy>

Exemplary construction and renovation projects, such as the proposed 'New European Bauhaus' demonstrators, could also be beneficial to the entire value chain, **raising awareness** amongst the suppliers and contractors on technological approaches and processes and amongst the end users on benefits and outcomes.

Complementary considerations

Energy Efficiency Directive

Since 2014, progress to achieving the 2020 energy efficiency targets have slowed, partially due to insufficient measures by Member States. There was a decrease in energy consumption in 2020 due to the COVID-19 pandemic, but recovery efforts could lead to increased consumption that further hinders target achievements. Collective contributions from draft NECPs (submitted in 2019) also showed a gap in achieving energy efficiency targets¹¹⁹. The EED is therefore still being reviewed¹²⁰ on how the revision could achieve a higher level of GHG reduction by 2030 and contribute to other European Green Deal initiatives. **There may be an opportunity to introduce circularity requirements in the EED, notably in relation to the procurement of buildings.**

Pre-demolition audits and selective demolition processes

Pre-renovation/demolition guidance helps prepare for arising products and materials, which should be treated in accordance with the Waste Framework Directive's waste hierarchy¹²¹. In 2018, the Commission published 'Guidelines for waste audits before demolition and renovation works of buildings'¹²², which was a key action from the first CEAP¹²³. The guidance aims to "*facilitate and maximize recovery of materials and components from demolition or renovation of buildings and infrastructures for beneficial reuse and recycling, without compromising the safety measures and practices outlined in the European Demolition Protocol*". **Establishing requirements for pre-demolition audits and selective demolition processes could facilitate reuse and higher value recycling** of materials and thus contribute to decarbonisation targets. Guidelines are flexible and can be updated with technological developments and scientific evidence.

As an example, Finland's Green Deal Agreement on Sustainable Dismantling¹²⁴ is a 5 year programme that started in 2020. The main objectives are: development of guidelines for material-efficient decommissioning; improved collection and quality of data on materials arising along with their re-use and recycling potential; digital tools that enable reuse and recycling such as the government administered, free to use, online material exchange platform. The approach is very new for the sector so effort must be placed on explaining roles and responsibilities. The lack of baseline quantitative data made it challenging to determine and agree quantifiable targets.

Ecodesign and energy labelling

The **EU Sustainable Product Policy, Ecodesign Directive and Energy Labelling Regulation are also tools for improving the energy efficiency and sustainability of products**. As a key action from the first CEAP, mandatory product requirements on durability, recyclability, reusability, and reparability were explored and incorporated. The

¹¹⁹https://ec.europa.eu/energy/sites/ener/files/report_of_the_work_of_task_force_mobilising_efforts_to_reach_eu_ee_targets_for_2020.pdf

¹²⁰<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12552-Review-of-Directive-2012-27-EU-on-energy-efficiency>

¹²¹<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098>

¹²²https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

¹²³https://ec.europa.eu/environment/circular-economy/first_circular_economy_action_plan.html

¹²⁴<https://ym.fi/green-deal-sopimukset>

Ecodesign working plan (2016-2019) also explored new product groups beyond the usual electronics and household appliances¹²⁵.

Key success factors

A common EU framework can reduce costs, increase benefits from the internal market and allow national policy-makers to learn from each other. The second EU review of national LTRS also showed that data collection and descriptions of national building stocks has been improving along with evaluating the cost-effectiveness of different interventions. It is expected that such improvements will continue. Based on the analysis of existing initiatives the following have been identified as key success factors:

- Minimise the administrative burden and inconsistencies for national authorities and the industry through **ensuring requirements are clearly linked and aligned** with other relevant accreditations or policies.
- **Create synergies between the stakeholders** by encouraging collaboration, interaction and debate; allowing lessons and success stories to be shared in order to inspire; developing a shared language and shared understanding of the issues; and stimulating data collection through a common tool.
- **Raise awareness for stakeholders and end-users** on the initiative's benefits. Explain and highlight the importance of GHG emissions embodied in buildings, support and encourage SMEs to engage and convince them to commit to change, explain the importance and positive impacts of data collection and reporting through a common tool.
- Provide **economic support** to enhance implementation of the policy, such as public subsidies for LCA assessments, financial assistance, etc.
- Provide **technical support** by standardizing calculation methodologies and tools, linking calculation methodologies with BIM systems and providing dedicated training schemes.

Replicability

Common frameworks can effectively complement and catalyse national measures, while leaving discretion for Member States to set concrete policies and actions¹²⁶. There is, therefore, potential for high scalability given that regulations would be applied simultaneously and consistently in all Member States. However, regulatory changes could also create administrative burden. Implementation of the EPBD is highly dependent on country-specific climate conditions, primary energy factors, calculation methodologies and building traditions. There are therefore limitations within setting numeric thresholds.

Expected impacts

There is potential for high impact when considering that legislation is accompanied by specific targets and monitoring mechanisms; however, **monitoring and evaluation** has been highlighted as an area of **improvement**.

Economic and social impacts

The construction sector provides 18 million direct jobs and contributes to about 9% of the EU's GDP but the sector has been hit particularly hard by the financial and economic crisis. Efficiency renovations have the highest potential to **stimulate demand**. SMEs in particular, benefit from a **boosted renovation market**, as they contribute more than

¹²⁵ https://ec.europa.eu/growth/industry/sustainability/product-policy-and-ecodesign_en

¹²⁶ EED Combined Evaluation Roadmap / Inception Impact Assessment
<https://eurovent.eu/sites/default/files/field/file/GEN%20-%20201155.01%20-%20EED%20Review%20Combined%20Evaluation%20Roadmap%20-%20Inception%20Impact%20Assessment.pdf>

70% of the value-added in EU's building sector¹²⁷. The renovation wave estimates suggest that around 35 million building units will be renovated over the next decade. '*Projections are for a 1% annual energy renovation rate for 2021-2022, an increase to 1.2% a year in 2023-2025 before stabilising to at least 2% per year in 2026-2029*'.

Environmental impacts

Given the focus on renovation activities, the highest environmental impact is likely to be linked to reducing operational and embodied carbon emissions over a building's lifecycle. There is potential to **increase reuse and higher value recycling** of building products and materials (increased resource efficiency/circularity) and **reduce CDW to landfill**; however, this is dependent on other factors such as a well-functioning market for secondary materials.

Actors involved

Primarily, the EU and national authorities establish directives and strategies. There is involvement of the **whole value chain** to establish effective and efficient solutions. Strong involvement is required by the European Committee for Standardization or European Committee for Electrotechnical Standardization for the development of harmonised standards.

Existing initiatives to learn from

The initiatives studied in the context of the present study (see Annex 2 : Summary of case studies) provide valuable lessons among which are: **the importance of checking existing policies for synergies**; involving **stakeholders**; streamlined **data collection**; investing in **training and workshops**; and **providing technical and economic business support**, especially for SMEs. The lessons learnt are listed in the following table.

Table 7: Lessons learnt from the relevant initiatives in the present study

Case study	Key points
Swedish Roadmap for Future Regulation on Climate Declarations ¹²⁸	The Swedish climate declarations will require developers to report LCA data on new buildings. To reduce administrative burden and high additional costs for companies, there was dialogue between government and industry on the best way to proceed before introducing mandatory LCA requirements. Economic and technical support is being offered to SMEs and a critical aspect is the development of a solid methodology and dedicated IT system.
Finland's Low-Carbon Road Map for Buildings and Building Materials ¹²⁹	Finland's Low-Carbon Road Map aims to make a carbon footprint/LCA of buildings part of Finland's building regulations by 2025. The main challenge is the lack of Environmental Product Declarations and common data sets. Financial assistance is available for companies to test the method and a support service website is for both public and private operators. Due to the lack of embodied carbon knowledge in the Finnish construction sector, more training schemes are required.
London Plan 2021 ¹³⁰	The new London Plan introduced the requirement for Whole Life-Cycle Carbon (WLC) assessments to be submitted with referable planning applications. A major hurdle was ensuring that there was no

¹²⁷ https://ec.europa.eu/growth/sectors/construction_en

¹²⁸ <https://www.boverket.se/sv/om-boverket/publicerat-av-boverket/publikationer/2020/utveckling-av-regler-om-klimatdeklaration-av-byggnader/>

¹²⁹ <https://www.oneclicklca.com/carbon-footprint-roadmap-finland/>

¹³⁰ <https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/london-plan-2021>

Case study	Key points
	duplication or inconsistency of requirements within sustainability and energy statements. It was also important to align with accreditations, such as BREEAM, and existing policies/protocols. Overall, the consultation process led to tightening requirements on metrics, incorporating language used by developers and having better alignment with existing performance tools and good practices.
Dutch Building Decree ¹³¹	The Dutch Building Decree incorporates an LCA evaluation of construction projects across 11 impact categories (widening to 19 in 2021) to obtain a single score as an output. Key challenges included ensuring coherence with other regulations related to the environment and providing flexibility so that requirements do not act as a barrier to the construction of new buildings. The involvement of relevant stakeholders during policy development was very important for facilitating wide implementation.
Israel Green Building Standard (SI 5281) ¹³²	The lessons learnt from developing Israel's Green Building Standard were that communication, deliberation and consensus are essential, as well as learning from other countries. The construction sector is still traditional and requires the development of a more collaborative culture. Some critical development aspects were business support and training and increased sourcing opportunities for eco-materials.
Japan's Act for the Promotion of Long-Life Quality Housing (LQH) ¹³³	Japan's LQH Act aims to improve housing quality and performance through a voluntary certification scheme with financial incentives. Certification criteria includes energy efficiency and conservation measures and also durability and adaptability considerations. Highlighted challenges include: lack of certainty around increased property value after certification; significantly more uptake from new detached houses in comparison to apartments/condos, mainly due to deterioration countermeasures, earthquake resistance requirements and split incentives dilemma; lack of proper integration with other housing performance requirements/guidance; difficulty in regulating the maintenance planning requirement due to the effort required for follow up inspections and updating records for non-compliance, etc.; reliance on financial incentives (certification not maintained beyond the period when incentives are available). To reduce procedural burden, the aim is to standardize processes for each administrative agency with a centralized database that is easy to understand.

Evidence of impact from existing initiatives

The Dutch Buildings Decree found that the **costs** for the implementation of an LCA-based assessment method were **negligible** compared to other costs.

¹³¹ <https://business.gov.nl/regulation/building-regulations/>

¹³² https://www.gov.il/en/departments/quides/standards_in_israel

¹³³ https://elaws.e-gov.go.jp/search/elawsSearch/elaws_search/lsg0500/detail?lawId=420AC0000000087

Relevant/ supporting survey findings

Two of the main barriers to the implementation of circularity across the life cycle of buildings are a **lack of regulatory drivers and lack of incentive to design with the aim to reduce impacts at the end of life**.

The **key regulatory barriers** included: **legislative framework on the reuse** of building components; and **lack of requirements to sort C&D waste** in certain countries.

The **key market barriers** included: **lack of markets and producers of secondary materials**; lack of **alternative business models** for construction; lack of **knowledge** and experience of circular business models and their effects; and lack of **architects and developers** with the required knowledge and willingness to adapt. Communication, skills and general awareness barriers were also highlighted such as limited awareness on the financial benefits of circular economy and a general lack of technical skills.

The use of construction techniques that facilitate easier maintenance, replacement and repairs was given high importance by survey respondents in almost all geographical regions and stakeholder categories. Further promotion of the disassembly and reuse of materials in existing buildings is encouraged.

4.3 Development and potential revision of GPP criteria

Objectives	Further development of clear, verifiable, justifiable and ambitious circularity criteria for products and services, relevant to the built environment, based on a life-cycle approach.
Implementation approach	Voluntary (currently), but with a view to minimum mandatory green public procurement criteria and targets in sectoral legislation ¹³⁴
Scope	EU
Delivery mechanisms	Embedding circularity on publicly procured contracts relating to the built environment, through widespread implementation of Level (s) based criteria, with the potential development of further GPP requirements.
Relevance to other EU policies and initiatives	Green Public Procurement; Level(s); Green Deal; Sustainable Europe Investment Plan; EU Taxonomy; Circular Economy Action Plan; Renovation Wave; New European Bauhaus, Energy Efficiency Directive, Energy Performance of Buildings Directive
Relevant national policies and initiatives	Finland: Procurement criteria for low carbon buildings; Italy: GPP compulsory Minimum Environmental Criteria for Buildings; Netherlands: Green Deal 159: Circular Procurement; Netherlands: Roadmap for Circular Land Tendering (Amsterdam); Portugal: National System for Public Procurement and Decree-Law no. 73/2011; Canada Zero emissions plan
Timeframe:	Beyond 2021

Objectives

This policy option supports widespread implementation of Level(s), but also the potential to develop further GPP criteria to support circular design and circularity in the built environment.

¹³⁴ https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf

Relevance & Rationale

In the 2008 Communication "Public Procurement for a Better Environment", the European Commission set an indicative target that, by 2010, 50% of all public tendering procedures should be green in the EU, where "green" means compliant with endorsed common core EU GPP criteria for priority product/service groups, including construction. Although this target was not met, a study estimated that around 38% of the total value of the contracts included green criteria in the 2009-10 period¹³⁵.

Green public procurement is defined by the European Commission as: "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured". Therefore, given that **public procurement and purchase of products, services and works account for 14% of the European GDP**, greening public procurement can be an effective lever to stimulate the market demand for more sustainable goods and services in Europe.

Alongside the policies relating to GPP directly are a number of other policy strands that reference GPP as a means of delivering circularity related objectives. These include:

- *Level(s)*, the European framework for assessing and reporting on sustainability performance of buildings, was published in October 2020. It is the result of a great collaborative exercise between the sector and the European Commission over five years. It sets out the key areas to focus on when assessing performance over the life cycle, with core indicators and methodologies to back them up. In this way, Level(s) provides a common language and defines metrics and methods, also to be used for public procurement. This allows the focus to shift to targets and policy measures, as opposed to discussing the "best" calculation or assessment methods.
- *The European Green Deal*¹³⁶ provides an action plan to boost the efficient use of resources by moving to a clean, circular economy. It **encompasses and reinforces other strategies such as Circular Economy Action Plan** and the Renovation Wave Strategy, specifically referencing the development of further legislation and guidance on green public purchasing.
- *The Monitoring Framework for Circular Economy*¹³⁷, adopted in 2018 includes an indicator on Green Public Procurement. This communication states that work is ongoing to develop methodologies and data collections that can be used for the indicators on green public procurement.
- *The Circular Economy Action Plan*¹³⁸, published in 2015, which proposed that in the future development of GPP requirements, special emphasis is placed on aspects relevant to the circular economy, such as **durability and reparability**, when setting out or revising criteria. Also, there should be a greater uptake of these criteria by public authorities, in particular for products or markets that have high relevance for the circular economy. Finally, the Commission would lead by example, by making sure that Green Public Procurement is used as widely as possible in its own procurement, and by **reinforcing the use of GPP in EU funding**.
- *The New (2nd) Circular Economy Action Plan*¹³⁹, published in 2020, contains key actions in relation to **GPP - Mandatory Green Public Procurement (GPP) criteria and targets in sectoral legislation and phasing-in mandatory**

¹³⁵ https://ec.europa.eu/environment/gpp/studies_en.htm

¹³⁶ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

¹³⁷ <https://ec.europa.eu/environment/circular-economy/pdf/monitoring-framework.pdf>

¹³⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1453384154337&uri=CELEX:52015DC0614>

¹³⁹ https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

reporting on GPP. There will also be continuing support for capacity building with guidance, training and dissemination of good practices and encouraging public buyers to take part in a "Public Buyers for Climate and Environment" initiative.

- Public Buyers Initiative, called *Big Buyers for Climate and Environment*¹⁴⁰ has a number of strands relating to construction. Of particular interest are the lessons learnt¹⁴¹ from the Public Procurement of Circular Construction Materials task group, split into 1) Circular approach to deconstruction and demolition projects; 2) Procurement process for new construction and renovation works; 3) Further public levers for promotion of circular construction. This report also includes **example procurement criteria for circular construction materials and buildings** and case studies where they have been used which could be useful to review for any further development of this recommendation.
- *Sustainable Europe Investment Plan*¹⁴² (also referred to as The European Green Deal Investment Plan), which states that Public investors will profit from tailor-made support on how to implement their projects in practice. A newly introduced '**Sustainable Procurement Screening' instrument**' will contribute to enhancing the sustainability of big infrastructure projects and respecting high environmental standards throughout the supply chain. There are also potential links to *The EU Taxonomy*¹⁴³ which sets out to provide the private sector with a common understanding on what is green investment and sets the basis for establishing an EU-wide classification system for environmentally sustainable economic activities.
- *The Renovation Wave Strategy* was published in October 2020¹⁴⁴ with a focus on building renovation to improve energy and resource performance and modernise in the expectation of new ways of working and living. This integrated strategy involves a wide range of sectors and actors on the basis of key principles, including Life-cycle thinking and circularity. Of the three areas that are deemed to deserve specific attention, one relates to renovating public buildings, such as administrative, educational and healthcare facilities, and to increase their annual renovation rate. It is stated that by June 2022, the Commission will **develop green public procurement criteria for public buildings based on Level(s)**. The Commission will also issue indicative milestones for the renovation of public and private service buildings for 2030 and 2040. This provides a further drive to ensure GPP requirements to implement circularity during renovation, or something similar, are developed to meet the life cycle and circularity key principle.
- The *New European Bauhaus*¹⁴⁵ will act as an incubator for innovation and creativity to drive sustainable design across Europe. Focus is to create a design movement integrating three dimensions: **sustainability (including circularity)**, quality of experience (including aesthetics) and inclusion (including affordability). Starting in December 2020, the exact programme of work has yet to be detailed, however influencing public procurement is mentioned.

¹⁴⁰ <https://sustainable-procurement.org/big-buyers/>

¹⁴¹ https://sustainable-procurement.org/fileadmin/user_upload/Big_Buyers_Initiative/Circular_Construction/BBI-CCM-lessons-learned.pdf

¹⁴² https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24

¹⁴³ https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teq-final-report-taxonomy_en.pdf

¹⁴⁴ https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf

¹⁴⁵ https://europa.eu/new-european-bauhaus/index_en

- *The EU Construction and Demolition Waste management protocol¹⁴⁶* was published in 2018 as non-binding guidelines to increase confidence in the Construction and Demolition waste management process and the trust in the quality of Construction and Demolition recycled materials. Public authorities at local, regional, national and EU levels are key target groups. Although this is a very specific and waste focussed protocol, **it has practical guidelines to improving C&D waste management in all procurement**, including public, such as requirements for waste audits before demolition and renovation works of buildings.

Targeted barriers and opportunities

As previously described, Level(s) links to numerous EU level strategies and action plans that reference Green Public Procurement as a key mechanism to achieving various sustainability and competitiveness objectives. Level(s) is the first-ever European Commission framework for improving the sustainability of buildings, living by the values of flexibility, resource efficiency, and circularity. Therefore, the implementation of Level(s) through Green Public Procurement represents a significant opportunity to address many aspects of circularity in new building and refurbishment, especially in the sectors targeted –offices, education and residential (especially social housing).

Level (s) has been developed and tested in consultation with stakeholders, including public procurers over the last 5 years. For example, the Housing Agency of Catalonia in Spain states 'To be able to benchmark your building stock and the definition of processes, products, equipment and systems in existing buildings: this is the future, and this is what Level(s) can provide'.

Going forward, next stages of development relevant to Level (s) and GPP include¹⁴⁷:

- Beginning of 2023 – Green Public Procurement Criteria based upon Level (s) for offices, social housing and schools – both new built and renovation
- 2021 – Web-based support tool to work with Level (s) and web-based training materials.

Public authorities and decision-makers can also learn more about Level(s) through Level(s) Stakeholder Briefing Sessions, organised online.

However, there are also numerous challenges that generally impact on the ability for GPP to have the level of impact that is possible. These include:

- Apart from mandatory measures taken in sectorial legislation or at Member State level, the **voluntary nature of GPP across the EU**, thus Member States and contracting authorities tend to not effectively apply or select many of the criteria in their tenders.
- There is currently **no EU GPP database to provide guidance on the environmental impacts associated with all the stages of the life-cycle of buildings**, although such databases are being developed at a national level. The future integration of criteria related to lifecycle and climate resilience developed under Level(s) in GPP is a particular opportunity to develop such an underpinning resource.
- **Lack of resources/capacity** and limited awareness and knowledge of the contracting authorities in relation to environmental issues, particularly in relation to defining and implementing robust GPP requirements. For example, the life-

¹⁴⁶ https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

¹⁴⁷ https://ec.europa.eu/environment/topics/circular-economy/levels_en

cycle costing method of awarding a tender is a complex process that requires time and an appropriately skilled procurement team.

- Potential issues with the initial direct **costs of implementing the GPP requirements** as well as the complexity of assessing broader financial benefits for society as a whole, linked to improved environmental performance, innovation, market transformation etc...
- **Lack of a reliable marketplace for greener products** hindering the application of GPP criteria. For example, some Member States and contracting authorities set mandatory recycled content percentage value for different material categories and access to high quality recycled materials can be limited if this market is not well advanced or regulated.

The second workshop that was organised in the context of the study identified the development of clear metrics for the procurement teams at National and EU level as a key challenge in enabling transparent green procurement decisions as without this, decisions could be seen as arbitrary. The participants also supported the need to make circularity and life cycle a key part of public procurement in general. Level(s) and the new GPP criteria to be based on this framework will have an important role to play in this regard. It was further supported that there is a lack of a standardised tool to ease assessment of indicators (e.g. in the form of a bill of materials), in particular digitalisation is seen as a great opportunity.

The second workshop also revealed that several stakeholders consider the **development of a holistic approach to calculate the actual costs of the building and its operations** as a significant opportunity. This could be achieved with the development of life-costing methods and skills which as mentioned above are currently lacking. These methods should limit any uncertainties and variabilities in relation to life costing. This could drive investors to look beyond the initial costs and promote a long-term thinking integrating life-cycle thinking. To this end, the communication between the different stakeholders need to be reinforced to exchange information on technical and cost-related aspects in different stages of the value chain. Again, Level(s) with its indicators linked to optimised life cycle cost and value, can support this process.

Participants also supported the **development of demonstration projects** to link the data on materials with the operational phase of buildings which could also promote more solutions on the use of renewable and low-carbon materials in construction. New financing models based on higher end-of-life value (residual value) could also promote higher recycling rates and better-quality recycled products and materials.

Key success factors

As could be expected, some of the key success factors revolve around addressing the challenges outlined above. A key factor is having mandatory GPP criteria, as demonstrated by certain case studies, that tend to showcase how this has been achieved on a city, region or national basis. The route to mandatory GPP criteria at building level, such as those based upon Level(s), could be through future revision of EPBD (Energy Performance in Buildings Directive) and Energy Efficiency Directive (the most appropriate sectoral legislation) as described in Section 4.2. There is also a link to revision of CPR in terms of harmonising the approach to declaring performance at product level to feed into the relevant evaluation and indicators aspects of implemented Level(s) based criteria.

It seems clear that an integrated, detailed and comprehensive approach to GPP and circular construction will help deliver successful outcomes, as should be the case through adoption of Level (s) based criteria. For example, the city of **Amsterdam created a step-by-step guide on how to conduct circular construction procurements**, with example criteria for different aspects of a building or civil works project (criteria text, justification,

calculation and validation) and example tender text. The Roadmap to Circular Land Tendering covers four steps to a circular procurement: (1) framing the construction baseline, (2) formulating the ambitions for the site, (3) choosing an appropriate procurement procedure, and (4) drafting an integrated tender with circular construction criteria.

Easier and more consistent life cycle and whole life costing assessment procedures would be highly beneficial in streamlining the assessment process for procurement teams. For example, LCA benchmark values could support European GPP criteria required for the construction sector and verification process made by public administrations/contracting authorities. It is also important to create databases at national level, as each Member States has its specific requirements, construction practices, products and materials. The Commission could encourage Member States to develop national databases, such as for **France, Finland and Sweden, providing LCA data for building materials** to facilitate this action. Implementation of Level(s) based criteria could drive this development.

The further development of the European Commission's Life Cycle Costing (LCC) tools, (currently only for Computers and Monitors, Indoor Lighting, Outdoor Lighting, Vending Machines and Imaging Equipment) for buildings could also help procurers during tender selection. The existing Level(s) indicators in this area could support such a process.

Combined with **implementation of the Level(s) framework**, these actions would support more informed decision making and procurement, taking into account the whole lifecycle of a building, providing a basis for quantifying, analysing and understanding the lifecycle and addressing a number of aspects of circularity. Therefore, these actions will provide indicators that can help with understanding how to extend the utility of the building (building's service life and value, and future potential for recovery, reuse and recycling of its materials).

During the second workshop of the study, several stakeholders supported the idea of developing databases at the national and EU levels. Such databases shall be built under the same standards, to provide solid aggregators and to set a standardised approach in measuring circularity. The development of standardised approaches can be based on existing standards such as Level(s) and CEN TC350 standards such as EN 15804 (see also section 4 on the potential revision of CPR). To this end it was also supported by several participants that the EU regulatory requirements at the EU and Member States levels on **information on the characteristics, contents and environmental impacts of construction products needs to be strengthened**. GPP is seen as a potentially effective means to encourage and accelerate the implementation or uptake of circularity initiatives. Specifically, GPP can have a strong potential in mainstreaming minimum recycled content and in promoting more recyclable products and systems.

Possible Delivery mechanisms

As described previously, work is underway to develop GPP criteria for buildings based upon Level(s), and a programme of consultation is underway currently, to be implemented by 2023. As it stands this would focus on new building and refurbishment, especially in the sectors of offices, education and residential (social housing). The criteria and indicators would be based upon those already in the Level(s) framework with scope to add a limited number of additional areas, such as adaptability to climate change. Accordingly, it is important to focus on the following for the next two-three years:

- 1) Ensure a wide variety of stakeholders, especially in the public procurement area, are involved in the process underway to develop GPP criteria based upon Level(s), with feedback in relation to ease and likelihood of uptake and anticipated level of ambition (since there are three levels of attainment) being captured along the way.

This feedback could help inform and evolve the final criteria and/or the required level of performance for public procurers to target (albeit on a voluntary basis).

- 2) Supporting evaluation tools and databases, again that can be revised and updated regularly based upon user experience, that enable the implementation of Level(s) based criteria. This is likely to require supporting training and capacity building, and it could be helpful to provide the necessary resources (at an EU level) to facilitate this. Linking into existing networks that operate at a City level (See section 4.4.) could also be useful, alongside the continuing development of case studies that demonstrate benefits of circular thinking in publicly procured building projects. In terms of databases, EU level support to develop data at Member State level, in a consistent format, that is then readily accessible, directly or via evaluation tools, should be considered.
- 3) Lessons learnt and a review of minimum performance criteria at building level could be collated to feed into future revision of EPBD. Similarly, the data needed to support assessment of performance, such as whole life carbon indicators, can be cascaded to product level declaration of performance requirements via revision of CPR.

Subsequent to the implementation of Level(s) based criteria could be the identification of additional GPP requirements that further support circularity in the buildings sector, for example building sectors not covered by Level(s), such as healthcare, industrial, infrastructure etc.. Thus, a parallel strand of action could be as follows:

- a) Continue consulting with public procurers on the necessity (or not) for further criteria, and higher level of performance, potentially covering additional building sectors and/or aspects of performance, ie not addressed through widespread application of Level(s) based criteria
- b) If a need is identified, do national standards or GPP criteria exist that could be adapted or adopted? If so, what could be the scale of life cycle benefits. If the scale of impact could be high, consider the development of further EU GPP criteria.

Overall, the participants in the second workshop of the study agreed that the setting of minimum requirements across EU are required to keep level playing field. Further a step by step approach was suggested, starting from larger projects and gradually define mandatory thresholds and targets in all types of projects (i.e. regardless their size) and implementation levels (i.e. national, regional and local). The importance of pilot projects was also highlighted as an effective step of implementation. In this context, it was argued that small scale demonstration projects are also required to integrate any local specificities. A clear roadmap is required to prepare the industry for the implementation of any mandatory requirements.

Replicability

Some difficulties exist in setting targets and/or standards applicable to all types of buildings across the EU. While **most Member States have developed or are developing some GPP criteria for buildings and construction products**, they do not have the same scope of products and are not at the same level of implementation of GPP criteria for buildings (mandatory criteria/ recommendation for certain MS, and under development for others). It is expected that the new GPP criteria being developed by the EC, based on Level(s), can support both replicability and national policy development. It will however be important that future development or revision of sector specific legislation in the EU uses GPP at its full potential to transform the sector and bring it into the circular economy.

Expected impacts

The **Economic impacts, especially whole life costs, could be significant**. For instance, planning for repairability and durability can reduce cost per year of public assets, when taking all the life cycle costs into account. Public procurement accounts for approximately 14% of overall GDP in Europe (around €2 trillion per year). The construction sector represents 9.3% European Union GDP and employs 7% of the European workforce. The European commission has estimated that "improving public procurement can yield big savings, a 1% efficiency gain could save €20 billion per year"¹⁴⁸.

Implementing green procurement in construction projects can also save money and resources during the construction phase, such as lower hazardous material management and waste management fees, and the time and cost of reporting and follow-up¹⁴⁹. Introducing green tendering criteria in the construction projects can affect the marketplace and develop new entrances for the businessman to the environmental field. Therefore, it has the potential for driving supply chain efficiency and increasing the market competition, innovation and capacity. For example, £40.7 million (€47.2 million) could be saved in the UK if the proposed Government Buying Standards (GPP criteria) including for construction projects and buildings, are applied by all central government departments and executive agencies, according to a cost-benefit analysis which monetised the potential impacts¹⁵⁰.

Social and societal benefits can also be realised, such as **improved health & wellbeing, job and wealth creation, and reduced local environmental issues**. There are also benefits derived from developing a more skilled and environmentally aware EU construction workforce. For example, a healthier operational place for the workers can reduce sickness and boost productivity.

There have also been numerous studies that indicate the shift to circularity can create new jobs that are more skilled and better paid. For example, in the Dutch green deal case study, it is estimated that shifting to circularity will create 50k jobs.

Environmental benefits are anticipated across whole life cycle impacts, such as: reduced embodied carbon, primary resource extraction, impacts from EU & overseas extraction/production and risks to biodiversity; reduction of local environmental impacts (noise/dust/transport), air/water/ground pollution; local and responsible sourcing, using less materials, producing less waste, and reduction in hazardous waste.

For example, 3 million tonnes of CO₂ would be saved in the Netherlands if all public contracting applied the national Sustainable Public Procurement criteria. The Dutch green deal case study contributes to the Netherlands objectives of becoming circular by 2050, and mitigates risks in other areas, such as hazardous waste, by implementing some measures like material passports, which gives information on the products. It also has an impact on the city living qualities, the local biodiversity, as well as the energy and material management (if the criteria are followed).

Innovation is also supported through actively driving change through Green Public Procurement. Even if more expensive to begin with, GPP can test out new approaches/technologies/product development and support entrepreneurs within the EU. There should also be longer term rewards in terms of promoting and supporting sustainable economic growth within Europe as the ultimate benefit of catalysing such innovation.

¹⁴⁸ https://ec.europa.eu/defence-industry-space/funding-and-grants/public-procurement_fr

¹⁴⁹ Khan, M. W. A., Ting, N. H., Kuang, L. C., Darun, M. R., Mehfooz, U., & Khamidi, M. F. (2018). Green procurement in construction industry: A theoretical perspective of enablers and barriers. In MATEC Web of Conferences (Vol. 203, p. 02012). EDP Sciences.

¹⁵⁰ <https://www.switchtogreen.eu/?p=1527>

For example, the Italian CAM case study demonstrates that companies in the supply chains of products/components for construction are rapidly investing in research and innovation (e.g. Italcementi – Calcestruzzi S.p.A., one the largest concrete firms in Italy, has developed a specific line of GPP compliant materials and certification of their products according to CAM requirements).

Actors involved

The stakeholders involved should include representation from contracting authorities (perhaps in conjunction with the Big Buyers Initiative), those product and service suppliers impacted, and other parts of the supply chain as relevant. The JRC GPP Buildings team is currently undertaking a formal consultation process in the second half of 2021 through mid-2022. Anyone wishing to participate is encouraged to register as a stakeholder¹⁵¹.

Sustainable procurement encourages early stage market dialogue to inform suppliers of plans and requirements for future procurement. In particular, for product manufacturers, embedding GPP criteria may lead to increased market demand of environmental product declarations and their availability in digital format.

Existing initiatives to learn from

Generally speaking, the areas targeted by GPPs case studies analysed are **focused on the use of recycled content and materials reuse**, through setting some requirements on the proportion of recycled materials that have to be used in public construction and infrastructure maintenance contracts if technically possible. Some verification can be performed by the authorities in charge of the follow-up of tenders, and can apply some penalties in case the requirements are not effectively implemented. Some guidelines have also been developed at national level, but each municipality has the responsibility to implement the criteria on their own, making some measures mandatory or voluntary. Some case study stakeholders mentioned that for an effective embedding of circularity criteria in GPP, some priority criteria should be made mandatory at EU level with a monitoring system. This is where the coming revised GPP criteria based on Level(s) can play an important role.

Most of the GPP case studies analysed, are carried out at national level (apart from the Roadmap for Circular Land Tendering which is limited to Amsterdam) and are both mandatory and voluntary in nature. When evaluating the latest updates for Member States NAPs (National Action Plans), it is also evident that many of the EU Member States have developed or are developing GPP criteria for the construction sector and civil engineering and other relevant construction products in some way. **Some Member States have also developed LCC tools, guidelines and monitoring systems** to facilitate the application of the criteria by public procurers. A number of Member States are looking at Level(s) and how this can be used for coming policy initiatives.

Case studies that illustrate these points are summarised in the table below:

¹⁵¹ The registration form is available in the following link (by selecting the product group "buildings"):
<https://susproc.jrc.ec.europa.eu/product-bureau/contact/register>

Table 8: Lessons learnt from case studies relevant to a potential revision of GPP

Case study	Key points
Italian procurement code (Codice degli Appalti): compulsory environmental criteria (Criteri Ambientali Minimi–CAMs)	CAMs set mandatory recycled content percentage value for different material categories (i.e. the concrete must contain at least 5% of recycled content, as well as bricks and gypsum plasterboards). The mandatory nature of CAM has accelerated change, although to be effective, criteria must be very detailed and have specific thresholds. There is also Criteria regarding insulation materials (requiring various different percentages of recycled content for each type of product) which must be implemented by private clients in order to access to incentives (tax deductions/ tax credit). Through this, GPP requirements have been extended to private building projects, thus having a greater impact on driving change throughout the construction sector in Italy.
The Roadmap for Circular Land Tendering (part of the Circular Amsterdam initiative)	Partially based on existing initiatives: assessment frameworks (EPC , BREEAM and GPR Building). Initially used for tenders for land allocation, primarily for new-build projects, with ultimate aim to use for all transformation, renovation and demolition projects. Some criteria are mandatory, for example, the applicant must submit an Environmental Performance of Buildings (MPG) calculation and also provide a specification of the work, explicitly showing what materials will be used and in what quantities. Lessons learnt are to improve training and technical support for effective implementation.
The Finnish procurement criteria guidance for low carbon building	Voluntary initiative to enhance lifecycle thinking in construction by using calculations of buildings' lifecycle carbon footprint. The guide provides green public procurement (GPP) suitability requirements for tenderers and cost estimates. The comparison and calculation methods for applying criteria are based on standards and widely used assessment and calculation methods. This enables comparable calculations across projects.

Level(s) is inspiring GPP development in both Italy and Finland, where several of the indicators are seen as a useful basis for national requirements. Other examples to learn from include the following.

As part of the Dutch government strategy to reduce the emission of CO₂ by 20% in 2020 (compared to 1990), Rijkswaterstaat developed a methodology for sustainable procurement targeting infrastructure projects. The expected results of this methodology is to **reduce CO_{2e} emissions and other environmental impacts caused by materials used in infrastructure projects**. The tendering is based on functional specifications: a certification system with which tenderers can show the measures taken to limit CO_{2e} emissions within the company and in projects as well as elsewhere in the supply chain, and DuboCalc a LCA-based tool which calculates the sustainability value of a specific design based on the materials to be used. This methodology was then applied as part of a project on the construction of a new lock in the harbour of IJmuiden.

In 2012, Denmark's central procurement agency (SKI) established a **four-year framework for sustainable office furniture** for more than 60 municipalities. Technical specifications were based on environmental requirements of the Nordic Swan eco-label, and included requirements on the chemicals used in the manufacturing, treatment, coating or dyes used, and the possibility of separation and recovery of materials at end-of-life. Wood and wood-based materials were also required to come from legally harvested timber, and at least 70% of this had to be either recycled or verified as sustainable timber.

In regard to **LCC tools development in the EU**, Norway has developed LCC guides including for construction, building and property. Monitoring of GPP will be an important part of the upcoming national action plan and is planned to be done within prioritised sectors including construction and buildings. The French state has also established a Joint task force aiming at developing precise criteria for LCC (for now the focus on CO₂ emissions from timber-based building materials).

Evidence of impact from existing initiatives

Several case studies provide evidence of benefits through the application of GPP requirements, these are summarised in the table below:

Table 9: Evidence of impact from existing initiatives

Case study	Evidence of impact
Dutch Green Deal 159: Circular Procurement	States that shifting to circularity will create 50k jobs and at least € 7 billion will be earned. It also contributes to the Netherlands objectives of becoming circular by 2050 and contributes to mitigate risks in other areas (material hazard, social risks...) by implementing some measures such as material passports, which gives information on the products.
Italian procurement code (Codice degli Appalti): compulsory environmental criteria (Criteri Ambientali Minimi–CAMs)	An impact assessment was carried out as part of the monitoring of CAM GPP implementation. It has been reported that companies in the supply chains of products/components for construction are more rapidly investing in research and innovation.

Additional evidence from other examples is provided below:

The new procurement method developed (as described in the previous section) by Rijkswaterstaat and applied as part of the project on the construction of the harbour entrance in IJmuiden, yielded **88,639 t reduction in CO₂e over a period of 75 years** (including 61% assigned materials for construction, 13% for operating and maintenance, and 26% for end-of-life)¹⁵². The calculated emissions value for the reference design was 221,598t (63,155 toe energy), or 2,954.6t CO₂e/year (842.1 toe energy), for a design lifetime of 75 years. The winning tender proposed a CO₂e reduction of 132,959t (37,893 toe energy) or 1,772.8t CO₂e/year over the same lifetime period, which represents 40% lower than the reference model. CO₂e emissions were calculated based on all processes involved; including production, transport, construction, demolishing, and reuse of all the building materials.

¹⁵²https://gpp2020.eu/fileadmin/files/Tender_Models/GPP2020_Tender_Model_Construction_Sea_Entrance_IJmond_RWS_April_2016.pdf

In 2013, the City-State of Berlin launched a pilot project with the aim of encouraging greater reuse of recycled concrete in building construction. A total volume of around 5,400m³ of certified 'circular economy' recycled concrete was used in the construction of a slurry wall and building shell of the new life science laboratory building at the Humboldt University. In comparison with concrete made from primary aggregates, **the recycled concrete alternative saved 880m³ of virgin gravel** (for approx. a 45% displacement of primary aggregates with RC –concrete with recycled concrete aggregates), 66% of the energy required for production and transport (or 225 megajoule (MJ) per tonne of recycled concrete), and 7% of the associated CO₂ emissions (0.6kg CO₂e/t of recycled concrete)¹⁵³. As a result of the success of the pilot project and subsequent uses, the State of Berlin now requires that recycled concrete is used in all future public high-rise construction projects, which will result in the replacement of around 100,000m³ of standard concrete per year.

Relevant/ supporting survey findings

In terms of GPP, several stakeholders provided feedback as part of the survey, as summarised below:

- **GPP criteria for buildings must be very detailed and have specific thresholds.** There needs to be a consistent number of tenders in order to effectively drive the market to adapt to the requirements. Large contracting authorities can play an important role in driving the adaptation process by providing exemplary practical cases. All stakeholders should be involved as much as possible due to the diversity of projects, products and materials concerned.
- Adopt at the EU level, mandatory GPP toolkits, which can be adapted according to country specific conditions and needs.
- GPP is a good first step towards implementing circularity through procurement processes as well as support future regulations. This can help promote policies and regulations that **support and drive the market for reused building materials and products**, rather than act as a barrier.
- Public procurement criteria and standards should include the following: Conduct waste audits before the launch of public procurements; include overall building costs (design, raw-material generation, construction, use-phase, deconstruction, waste management) that are also visible and part of the (public) procurement.

¹⁵³ https://ec.europa.eu/environment/qpp/pdf/news_alert/Issue75_Case_Study_149_Berlin.pdf

4.4 ***Provision of guidance on local and regional planning and requirements in planning and funding mechanisms***

Objectives	Mandating of circularity through EU funding policies; provision of guidance to regional and local planning authorities; influencing through various EU initiatives in the urban context.
Implementation approach	Mandatory and Voluntary
Scope	EU and Member States
Delivery mechanisms	Embedding circularity in building design, through the mandating within EU funding schemes and the provision of guidance and tools for national, regional and local planning. There are also some opportunities to leverage current EU initiatives regarding the Urban Agenda to include more requirements for circularity
Relevance to other EU policies and initiatives	Urban Agenda; Level(s); Green Deal; Renovation Wave; New European Urban Initiative; European Bauhaus; Cohesion Fund; EIA Directive; Taxonomy Regulation
Relevant national policies and initiatives	Netherlands: Dutch Building Decree (Bouwbesluit 2012; UK: London Plan; Israel: Green Building Standard; Denmark: Sustainability in Construction Works; US: Minnesota Sustainable Building Guidelines; Denmark: Architecture Policy, City of Copenhagen; France: Bâtiment bas carbone; Finland: Green Deal on Sustainable Dismantling; Canada: Zero Emissions Building Plan, Vancouver; Italy: ITACA Protocol; Japan: The Act for the Promotion of Long-Life Quality Housing (LQH); UK: Welsh Innovative Housing Fund Programme
Timeframe:	Could commence in 2021.

Objectives

This policy option proposes the setting of various requirements within local and regional planning which could be mandated through EU funding decisions as well as supported through the development of EC level guidance and related tools aimed at various Government levels. There is a close relationship with this policy option and the one presented for GPP, whereby national, regional and local authorities are key players, which the EC can influence through a variety of mechanisms.

Relevance & Rationale

Circular economy could be woven into a different array of EU policies that focus on the urban environment, related initiatives and funding. This could be from mandating requirements through funding, providing guidelines for circularity regional and local planning, utilising some of the policies and initiatives already identified; and, also influencing some of these policies and initiatives by making clear the linkages of circular economy in building design and other policy areas. Embedded within these is the importance of **knowledge and information exchange**.

Ellen MacArthur Foundation has recognised that 'City governments can engage, incentivise, manage, and set a regulatory framework to set the enabling conditions for cities fit for the 21st century to emerge. They can set a direction of travel. By **embedding circular economy principles into urban policy levers**, cities can bring about changes to the use and management of materials in cities'¹⁵⁴. From an urban perspective, the European Commission has, in recent years, been increasing its focus on urban issues, as

¹⁵⁴ Ellen MacArthur Foundation, City Governments and their role in enabling a circular economy transition, 2019

a response to the fact that by 2020 it is estimated that almost 80% of EU citizens will be living in cities. The political importance of the issue is demonstrated by its inclusion in the 7th Environmental Action Programme (7EAP)¹⁵⁵ under Priority Objective 8, entitled, Sustainable Cities: "Working together for Common Solutions". The overall objective of this policy drive is to enhance the sustainability of EU cities to achieve by 2050 that all Europeans are "living well, within the limits of the planet". Specifically, the Action Programme states that by 2020: "...a majority of cities in the Union are implementing policies for **sustainable urban planning and design**. The role of cities is critical in achieving Europe's objectives for a low carbon, resource-efficient and ecosystems resilient society. The cities of tomorrow have the potential to be healthier, denser, greener and smarter through better urban planning and governance"¹⁵⁶. Within the Urban Agenda, there is a clear commitment to circular economy with the development of the Circular Economy Partnership which aims to **stimulate the re-use, repair, refurbishment and recycling of existing materials and products to promote new growth and job opportunities**. The focus is on waste management (turning waste into resources), the sharing economy, and resource efficiency.

Included within the Urban Agenda is the respect for urban heritage; the Lisbon Treaty specifies that **safeguarding and enhancing Europe's cultural heritage** is a priority for the EU, which has a clear link to circular economy. The URBACT programme (see above) supports several projects in this area: for example, the REPAIR¹⁵⁷ project promotes the **re-use of abandoned military heritage for urban regeneration** by recognising the buildings' potential for economic action and employment. Another example is FORTIMED, supported by EU research funds, a project for the **restoration of medieval fortifications** in the Eastern Mediterranean¹⁵⁸. Under the new Leipzig Charter, there is a reference for circular economy which '*redefines and ensures a sustainable use of resources, while significantly reducing waste and carbon emissions*' for cities. The Territorial Agenda for 2030 specifically mentions circularity within the context of buildings '*Circularity means managing material, water and energy flows. It includes reusing and recycling products including buildings, building materials and wastewater based on life-cycle assessment and energy renovation for buildings*'. There is also a commitment '*to concentrate on strengthening awareness and empowering local and regional communities to protect, rehabilitate, utilise and reutilise their (built) environments, landscapes, material and immaterial cultural assets and other unique values sector organisations and facilitate public access to spatial information across Europe*'.

There is also relevance of funding to circularity and urban policy, albeit related to the landfill of waste, within the Circular Economy Action Plan¹⁵⁹, published in 2015, whereby, Cohesion Policy has been used; '*the Commission will assist Member States and regions to ensure that Cohesion Policy investments in the waste sector contribute to supporting the objectives of the EU waste legislation and are guided by the EU waste hierarchy*'. It is also recognised that Cohesion funds have been directed towards circular economy, with the acknowledgement that the EC will assist Member States, regions and local authorities in strengthening their circular economy approach in this context through targeted outreach. Private finance needs to be directed towards new opportunities created by the circular economy. There is also the recognition that the European Fund for Strategic Investments (EFSI) and the European Investment Bank (EIB), and the European Investment Advisory Hub are all relevant in pushing circular economy forward.

¹⁵⁵ <https://ec.europa.eu/environment/action-programme/>

¹⁵⁶ <https://www.eea.europa.eu/soer/2015/europe/urban-systems>

¹⁵⁷ <https://urbact.eu/repair>

¹⁵⁸ https://ec.europa.eu/environment/pubs/pdf/urban/cities_of_the_future.pdf

¹⁵⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1453384154337&uri=CELEX:52015DC0614>

The New (2nd) Circular Economy Action Plan¹⁶⁰, published in 2020, has a number of commitments with regard regions and cities including the use of Cohesion Policy funds will help **regions to implement circular economy strategies** and reinforce their industrial fabric and value chains. The Just Transition Mechanism¹⁶¹ proposed as part of the European Green Deal Investment Plan and InvestEU¹⁶² will be able to support projects focusing on the circular economy. Reference is made for circular economy to be one of the priority areas of the Green Accord as well as the new proposed European Urban Initiative and the Intelligent Cities Challenge Initiative¹⁶³, and the Circular Cities and Regions Initiative¹⁶⁴.

The EU has committed to spending €275 billion per year over the period 2021-2030 to reach climate and energy objectives. The Smart Finance for Smart Buildings initiative (2016)¹⁶⁵ outlines how projects funded should contribute to climate energy objectives and different funding mechanisms; to the use of Level(s) is referenced to promote **circular economy in the built environment**, including by being used as a reference in large scale application projects, in European Structural and Investment Funds and in national policy and legislation. The Renovation Wave Strategy was published in October 2020¹⁶⁶ with a focus on building renovation to improve energy performance and modernise in the expectation of new ways of working and living. This integrated strategy involves a wide range of sectors and actors on the basis of key principles, including **life-cycle thinking and circularity**. For funding, it is recognised that Cohesion policy has historically represented a main source of EU public funding for direct investment in improving buildings' energy efficiency and will maintain this role over the 2021-2027 period. Member States will need to ensure that their co-funded energy and resource efficiency programmes are well targeted on delivering high energy performance, the monitoring of which will be improved through a more detailed and robust indicator system. Member States should also complement the deployment of EU co-funded programmes with additional support schemes, in particular to mobilise private financing. As such, InvestEU will act as a single EU-level investment support programme to provide technical assistance and financing backed by an EU budget guarantee to unlock private investments. Simplified rules will mean that loans can be combined with grants and reward best-performing projects with a higher grant rate. The European Investment Bank (EIB) will step up its support for the aggregation into portfolios of building renovation projects and the provision of tailored financial support, ranging from traditional long-term loans to guarantees, equity or receivables financing. The EU Taxonomy Regulatory is also being developed with technical screening criteria for the building sector, to direct private capital towards sustainable investments in energy renovation, relying on Energy Performance Certificates and nearly zero-energy building standards. There is also a link to financing for regions and local authorities through the various structural funds as well as the at the local level, the Covenant of Mayors to support a new coalition of willing cities ready to commit to ambitious pledges on building renovation.

The New European Bauhaus¹⁶⁷ will act as an incubator for innovation and creativity to drive sustainable design across Europe. The focus is to create a design movement integrating three dimensions: **sustainability (including circularity)**, quality of experience

¹⁶⁰ https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

¹⁶¹ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/just-transition-mechanism_en

¹⁶² https://europa.eu/investeu/home_en

¹⁶³ <https://www.intelligentcitieschallenge.eu/>

¹⁶⁴ https://ec.europa.eu/info/research-and-innovation/research-area/environment/circular-economy/circular-cities-and-regions-initiative_en

¹⁶⁵ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1575045684774&uri=CELEX:52016DC0860#document2>

¹⁶⁶ https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf

¹⁶⁷ https://europa.eu/new-european-bauhaus/index_en

(including aesthetics) and inclusion (including affordability). Showing that creativity is in finding affordable, inclusive and attractive solutions for our climate challenges. It is interdisciplinary and cross cutting to include art, culture, beauty with technological and fiscal solutions and being delivered in three phases: Design (December 2020 to Summer 2021); Deliver (Spring 2021 to 2024); and Disseminate (2022)

From a guidelines perspective, there are a number of non-binding guidance documents/protocols for circular economy in buildings and for construction and demolition waste. The EU Construction and Demolition Waste management protocol¹⁶⁸ was published in 2018 as non-binding guidelines to increase confidence in the use of recycled materials from construction and demolition waste. There are also the Guidelines for waste audits before demolition and renovation works which outline a process for data collection and reporting¹⁶⁹ and the more recent Circular Economy in Building Design guidance¹⁷⁰ which includes a target audience of local authorities and action such as '**recognise relevant impact indicators for adaptability, deconstruction, reuse and recycling that can be integrated into building policies**' and '**'promote the multiple-use design of buildings – aim for reuse and/or renovation of buildings**' (repurposing and promoting the multi-functionality of buildings over time'.

Targeted barriers and opportunities

As detailed above, and in later sections there are multiple opportunities to enhance and embed circularity in funding mechanisms, the provision of guidance to local and regional authorities and influencing various European initiatives. However, there are a number of barriers, that will need to be addressed:

A report identified that construction was of the most common sector represented in circular economy strategies and roadmaps in Europe; however, there is a mismatch at a local level, as the report identified that there was only one locally for the the construction sector.. There is clearly **a gap between national and local level policy and implementation**¹⁷¹.

There are many different types of planning requirements and guidance at regional and local level and often what can be undertaken is dictated at the national level. As such it may be difficult to ask for mandatory requirements for circularity in planning, if the **national enablers are missing**. It may also be difficult to integrate any new guidance into existing guidance; it will also need to **align to local needs and priorities** and be **flexible** in its implementation.

There is a **lack of knowledge within local authorities** with regard to circular economy in buildings, as such it is difficult for them to know what represents a 'good' approach. Moreover, local authorities may be concentrating their efforts on circularity with regard to municipal waste, food, mobility etc, and the **connection may still need to be made (along with evidence) on why to also focus on buildings** and the link with the Urban Agenda.

A wide educational effort will be needed both for the construction value chain and for citizens to **ensure local buy-in and support**, which is largely missing.

¹⁶⁸ https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

¹⁶⁹ https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

¹⁷⁰ https://ec.europa.eu/docsroom/documents/3998_4

¹⁷¹ http://fissacproject.eu/wp-content/uploads/2020/04/2019_ACR_Sustainable-construction-guidelines-for-public-authorities.pdf

Setting strict requirements related to circularity in a) new design and b) renovation is likely to be difficult as the **opportunities will depend on the local context**, the value chain and if renovation, the existing buildings. There is also a lack of evidence on what the level of requirements should be and their cost implications (e.g. levels of recycled content). There is also the issue as to **what the penalties would be if the requirements were not met** and how they would be enforced.

The European Commission providing guidance to local and regional authorities, is voluntary in its nature, as such is likely to affect their uptake. Other activities are likely to be needed to support uptake of guidance including **capacity building, case studies and influencing** many of the aforementioned institutions and initiatives.

There will be **increased costs in requiring circularity** within funding or at a local and regional level; both through the authority implementing it and the actors undertaking the requirements. These will need to be properly assessed together with the cost benefits of addressing circularity.

There needs to be considerable thought given to how the requirement for circular economy **impacts on other sustainability requirements** e.g. BREEAM and DGNB. This is to ensure that that they are aligned appropriately and do not duplicate effort and resources.

Requirements for circularity within funding requirements, will need to be aligned to other funding requirements, taking a **system perspective approach**; as to ensure one element does not adversely affect another. Moreover, it is likely that **targeted support is required** for these requirements to be realised.

Key challenges that were identified by participants in the second workshop included allowing **flexibility and diversity** through local planning and how any EU guidance would need to take this into account; the need for appropriate **training and capacity building** for authorities especially in the context of setting planning requirements and evaluating applications which consider circular economy (what does good look like?). There was also thought to be a **lack of digital circularity data** to support implementation.

For funding, the key challenges were to align the funding mechanisms across the value chain to ensure leverage and to have **common funding rules for circularity**, which may differ locally and nationally. Consideration of opportunities included the need to reuse existing assets as much as possible (which links to zoning requirements), promotion of low carbon materials and the use of modular methods of construction for renovation. Integration to the digital economy and integrating social aspects were seen to be important aspects.

Key success factors

Some of the key success factors relate to the key challenges identified such as capacity building, the need to address local concerns, the interconnectedness of requirements, the ability to be able to set strict requirements and the need for greater awareness and education. In terms of setting requirements or interventions, these may differ such as those that are regulative in nature where requirements can be set in the development permitting process or as part of funding requirements. For example, these could relate to **setting requirements for reuse/recycled content or the measurement of it**, or the requirement for a **circular economy statement**, such as those required in London which encompasses various aspects across the whole building lifecycle; there is also a separate requirement for a whole life carbon assessment. This relies on **clear guidance throughout the planning process** to ensure a good understanding by the applicant; it also applies to **larger developments**, where there are more likely to be resources in place to prepare a circular economy statement; lessons are being learnt and can be subsequently taken forward for smaller developments. A key part of the development of

these requirements was to **develop them as much as possible jointly with industry**, to provide them with a sense of ownership, and pilot through case studies, guidance and consultation. Much of the circular economy statement **relates to processes** (i.e. collection of data, development of an end of life plan, consideration of circular economy principles), **providing flexibility for the applicant** in terms of applying circular economy for the project's particular context. Similarly, the requirements for a whole life carbon assessment, does not require particular performance (as yet); though this could change when more data to develop benchmarks is available.

Fiscal incentives could include using **a permit 'deposit'** where monies can be refunded when the requirement has been achieved. These tend to work where there is something that is measurable and achievable and case studies of these largely relate to the use of reused/recycled materials and the recycling of waste. These maybe more difficult to implement for circular economy design principles; though could for example be used for the **incorporation of reused and/or recycled content**.

At a regional and local level, requirements could include the **prioritisation of the reuse of asset**, ensuring zoning regulations do not restrict refurbishment; and indeed, encourage it where possible. This could be through a financial incentive or the ability to be able to build more (e.g. more floor space) than is what is normally permitted; an example of this is the Adaptive Reuse Incentive Program in the City of Long Beach, California. This needs to link to whole life carbon assessment (to ensure no perverse outcomes) and ensure that there are higher level regional and national policies to lever this. Capacity building, in **understanding the link between strategic policy, zoning (refurb v demolition and new build) and the generation of waste and use of resources** is needed for this to be fully adopted. For shorter lifespan buildings, disassembly requirements could be set, through a mechanism such as an end of life plan. Incentive wise, larger developments could be allowed where certain environmental criteria are met, faster permitting or a reduction in permitting fees, if legislation allows.

Some planning authorities already require the use of sustainability assessment certification and gaining certain thresholds/targets, for example the use of BREEAM in the UK. These need to be communicated effectively and recognised both economically and environmentally for them to be successfully implemented. Again, capacity building is needed, to establish the benefits of them across the value chain.

An important aspect, similar to GPP, is to streamline any requirements where possible and ensuring that any requirements are complementary to each other. For example, requiring the use of Level(s) and a Circular Economy/ Circularity Assessment. Any circular economy funding requirements need to be clear in their criteria and the outcomes expected. Support to implement the requirements is likely to be needed, through potentially **individual technical advisors**. **Monitoring of outcomes** including lessons learnt needs to be embedded within funding programmes.

During the second workshop, participants agreed that to encourage and accelerate the uptake of circular economy, **mandating through planning** was an option; as was green public procurement and to empower local and regional authorities through the provision of clear guidance. **Education at all levels** was viewed as important, as was the need to **allow room for innovation, learning from failures and the need for 'lighthouse' projects**. Support for the scaling up of proven solutions and clearer guidance on what is already achievable and 'good' is needed. Some sort of fiscal instruments were thought to be useful.

Possible Delivery mechanisms

Depending on the focus there are a number of delivery mechanisms:

Funding

The setting of circularity requirements in the form of requiring circularity statements and/or Level(s) could be within the new Cohesion Funds which are part of the Renovation Wave funding. This would be a condition of funding; this could also extend to some of the private financing mechanisms and the structural funds at the local level. This is important to encompass under the new European Urban Initiative and the Taxonomy Regulation. There are many different types of funding mechanisms and it is suggested that these are reviewed for a) the ability to be able to require circular economy requirements; b) what form would most suit the funding mechanism; c) how they could be implemented and monitored; d) how could lessons be learnt. It maybe that a mix is required; for example, the use of grants to fund implementation and monitoring and an incentive grants/loans to fund those that are applying higher levels of circularity. This will require the involvement of relevant stakeholders such as the EIB. It is also recommended that learning is taken for applying energy efficiency measures through funding; including how any risk (perceived/real) has been addressed.

Guidance

It is recommended that guidance is developed for national, and regional planning for circularity in buildings. This guidance should be process oriented, providing a flexible framework which can be taken forward by regional planning authorities and amended as appropriate for local areas. This could also involve providing guidance on how Level(s) could be required. This should cover the opportunities through zoning (and the retention of buildings); deposit permit systems and planning application requirements. Together with the guidance, there may also be a need to show the steps an authority should undertake to adopt such requirements, such as a) define the need through a national/regional/local circular economy strategy; b) define the business case and environmental impacts; c) undertake pilots; d) draft guidance and consult; e) finalise guidance. Guidance could also be partly aligned with the requirements under the EIA Directive for identifying impacts related to resources and waste and how they can be mitigated.

There are many ways of influencing how some of this guidance could be adopted and also for the EC to communicate and exchange knowledge and undertake capacity building with cities. This will provide a better understanding of why this type of guidance is needed within their urban planning processes. This includes working with CoP-CITIES; EuroCites, The European Green Capital, The Green City Accord and the EU Covenant of Mayors for Climate & Energy. Also, through the various mechanisms of the Urban Agenda and the new European Urban Initiative and Bauhaus.

With regard to delivery mechanisms, the feedback from the participants in the second workshop expressed the need for **technical assistance** which was thought to have been very useful for energy efficiency funding; the ability of national authorities to bring together different municipalities together through guidance and tools; funding could be sought for the adoption of the EU guidance within projects. Guidance was thought to be preferable due to planning being a national/local competence. EC guidance was felt to be needed to guide the national authorities who in turn could then guide the regional authorities. There was a mention of learning from some of the processes required for industry installations such as BREF and BAT documents. It was noted that funding linked to circular economy objectives could be difficult as local authorities have many objectives to consider. Whilst for this report, production of guidance for planning and financing have been considered together; it was noted that these could be separated out in the future; though there are some interlinkages e.g. similar guidance may be needed for both. Due to the need for public consultation in relation to planning requirements, the ability to

engage with the value chain which was seen as a positive aspect. The Urban Agenda Initiative was thought to be working well and it was felt important to work within that framework.

Replicability

It will be difficult to set targets/requirements that are applicable to all types of buildings and to suit the local context; however, if requiring a process, such as a circular economy statement/assessment or environmental assessment standards (e.g. Level(s)) this should be replicable. Any local and regional planning guidelines would have to be flexible enough to consider local conditions and obligations. Setting requirements through funding mechanisms may differ depending on the type of funding arrangement (e.g. loan, grants, direct investment) and the body that is providing the funding.

Expected impacts

The impacts will be dependent upon how much the guidance is adopted at the national and regional levels and how many requirements are put through funding mechanism. As the recommendations are looking at early-stage planning decisions, then there could be greatest impacts through either the reuse of buildings, through zoning requirements and therefore a reduction in the number of materials used and the related embodied carbon. From requiring a circular economy assessment/Level(s) via planning, then there could be impacts from a number of areas such as extending lifetimes through adaptability and flexibility strategies (and therefore the reduction of materials); better reuse and recycling (through designing for end of life and/or requiring pre-demolition audit); and encouraging the use of secondary materials from reused and recycled content. All of these would result in the reduction of embodied carbon.

From a social impact perspective, for local and regional planning there could be an impact from the engagement of more citizens in the urban circular economy agenda area; for example, refurbishment v demolition. There is also some impact from job creation; with an estimated 160,000 additional green jobs in the construction sector from the Renovation Wave. Economically, then there is a key impact through setting requirements through some of the cohesion funding of €330 billion for regional and local projects in 2021-2027, some of which will be spent on urban development projects. Having local requirements is also likely to stimulate the local value chain, which could involve innovators, SMEs and community-based organisations.

Actors involved

The number of actors involved is quite wide ranging. From a national and regional planning perspective, then national Governments and regional authorities need to be involved. There are a number of initiatives that have been highlighted which include municipalities and their Mayors. As well as DG Grow and DG Environment; DG Regional and Urban policy are key stakeholders. DG Economic and Financial Affairs may also be involved from an investment point of view. Also, all of the value chain actors, could be considered important especially developers in the content of planning guidance and funding.

Existing initiatives to learn from

Existing initiatives from across the EU and wider can be grouped into permitting, mandatory requirement of standards, voluntary requirements through planning, development requirements and financial incentives. Where there are mandatory requirements set through the planning/building control process, some of these have set targets for reuse and recycling which is then linked to a deposit, which is returned when the target is met (these are related to waste diversion). There are also requirements for whole life carbon and life cycle assessments as part of planning permission and the

generation of a circular economy statement. Some local authorities require the use of environmental building standards such as BREEAM in the UK, DGNB in Denmark, the Green Building Standard in Israel and the Minnesota Sustainable Building Guidelines. These standards contain elements of circularity, however requirements for this within the standard may be voluntary and it will be up to the developer to decide how to apply the assessment. There may also be voluntary requirements within planning, especially when the national legislation limits what can be mandated at the local level. There are also a few examples of where requirements are in place related to zoning requirements; such as allowing larger buildings via adaptive reuse rather than demolishing and the use of a whole building LCA; and, sharing of materials. Lastly, there are some examples of financial incentives either through relating good practice to tax reduction to the provision of business support and innovative funding programs.

Permitting

The case studies that relate to permitting are summarised in the table below (see also Annex 2 for detailed summaries of the case studies):

Table 10: Lessons learnt from case studies that relate to permitting

Case study	Key points
Dutch Building Decree (Bouwbesluit 2012) ¹⁷²	Technical regulations for the construction, use, and demolition of structures requiring new houses and offices above 100m ² to have an environmental performance calculation report, looking at life cycle emission and resources indicators, in order to obtain a planning permit (all-in-one permit). The objective of this obligation is, in the long term, to regulate the minimal environmental performance of materials. There is a new approach in the Decree: BENG, 'almost energy neutral building' that will be legally in force in 2021. Key learning included the need to work and involve all the stakeholders, which takes more time, but it is important and participates to the success of the policy.
London Plan	Policy S17 encourages waste reduction and increased reuse and recycling. It requires for referable applications (>150 residential units; development over 30m high (outside the City of London), development on Green Belt or Metropolitan Open Land) to produce a Circular Economy Statement on how building / construction / demolition waste will be reused and recycled, design considerations for the building throughout its lifecycle and how much waste will be generated. There is also a requirement for referable applications to undertake a Whole Life-Cycle Carbon (WLC) assessment in line with Policy SI2 of the London Plan. All planning applications referred to the Mayor must include a WLC assessment prepared in accordance with a guidance document. Planning applications are not accepted if they do not provide these requirements under the two policies above. When developing these requirements, it was a challenge to ensure there was no duplication of requirements with sustainability statements and it was important to make the requirements link to other

¹⁷² <https://business.gov.nl/regulation/all-in-one-permit-building/> and https://www.bregroup.com/wp-content/uploads/sites/3/2019/03/1.-BREEAM_Practitioner-Guidance-for-Planning-Professionals_v1-March-2019.pdf

Case study	Key points
	accreditations (e.g. BREEAM) or policy. Another challenge was around deciding what the metrics should be. In addition, the GLA sought to bring in developers early in the development process, meaning that these developers broadly support and accept the requirements.

Other initiatives include:

- City of Seattle, Washington Residential Deconstruction Permit¹⁷³ - A residential deconstruction permit allows for deconstruction of existing buildings before the new construction permit has been issued. To qualify for a residential deconstruction permit, there is a requirement to: reuse a minimum of 20% of the building materials, by weight and excluding asphalt, brick, and concrete; recycle or reuse a minimum of 50% of the building materials, by weight and excluding asphalt, brick, and concrete; recycle or reuse 100% of asphalt, brick, and concrete; submit a Waste Diversion Plan with the permit application and plans; submit a Waste Diversion Report that identifies the actual rates of salvaged and recycled materials when deconstruction is complete.
- Cook County, Illinois Demolition Debris Diversion Ordinance¹⁷⁴ - new applications for a demolition permit are subject to requirements. Any new buildings are subject to a minimum total 70% by weight diversion requirement and residential buildings are also subject to a 5% by weight reuse requirement and a minimum. These requirements must be incorporated into a Demolition Debris Diversion Plan, which estimates the required diversion goals, the transport means and destinations of demolition debris. Violation is subject to up to \$5,000 fine.
- Green Demolition Bylaw, Vancouver¹⁷⁵ - this Bylaw is to encourage the preservation and renewal of character homes, increase the reuse of demolition materials, and generally reduce construction and demolition waste disposed to landfill and incineration. The system is enforced through the requirement for a \$14,650 deposit, paid when applying for a demolition permit. There is a sliding scale for return of the deposit depending on the recycling rate achieved. For houses not designated by the city as 'Character houses', 75% of the waste (measured by weight) must be reused or recycled for full return of the deposit. Guidance on salvaging and reusing materials is provided by the city authorities. From January 2019, this law covers all homes pre-1950 – which account for around 70% of demolition. In addition, pre-1910 homes will have to reuse at least 3 tonnes of timber.

Requirement of standards

The case studies that relate to requiring of standards are summarised in the table below:

¹⁷³ [http://www.seattle.gov/sdci/permits/permits-we-issue-\(a-z\)/demolition-permit---building](http://www.seattle.gov/sdci/permits/permits-we-issue-(a-z)/demolition-permit---building)

¹⁷⁴ <http://blog.cookcountylil.gov/sustainability/wp-content/uploads/2012/07/Substitute-Demolition-Debris-Diversion-Ordinance-July-23.pdf>

¹⁷⁵ <https://vancouver.ca/home-property-development/demolition-permit-with-recycling-requirements.aspx>

Table 11: Lessons learnt from case studies that relate to requiring of standards

Case study	Key points
Green Building Standard, Israel	- Establishes criteria and minimum requirements for a variety of elements of green building, including design, construction materials, heating and cooling systems, health and safety, innovation etc. The main objective of the standard is to promote the construction of green buildings. In terms of circularity in construction, the standard also rewards reuse of existing structures and recycled/reused materials. The standard has become mandatory in phases following several years of stakeholders' consultations, policy revisions and voluntary implementation a) 2013 - 15 cities and in town planning appraisals; b) 2014 - public and government buildings; c) 2021 - nationwide for most types of buildings and local town plans. There are basically three stages, each is enforced by a different agency: 1) building permit application – local planning committee; 2) validation by building inspectors and authorized labs, and, 3) on completion and post evaluation and third party validation. Trained and certified green building consultants accompany the process. Compliance is now becoming a prerequisite for receiving the building's occupancy permit. There were a few challenges in its development including the Government accepting a bottom-up initiative which was led by municipal and private stakeholders; communication between stakeholders, integrating standard into planning regulations and raising pubic awareness. These were overcome through a phased implementation, several revisions, a marketing campaign and high profile pilot projects.
Sustainability in Construction Works, Denmark	- This ensures that substantial city works are managed in an environmentally responsible way, by setting requirements that go beyond existing laws. It hopes to inspire private developers to use the criteria also. The fifth version in particular includes a number of elements that contribute to circularity, such as requiring LCA and choosing a design with the least possible environmental impact, ensuring key building materials have an Environmental Label, the assessment of reusable building components, sorting and source-cleaning of materials suitable for recycling during demolition/ renovation, and the requirement of a plan for sorting and managing building waste. In 2020, municipal projects over DKK 20M (approx. €2.5M) must instead achieve DGNB certification (Gold standard for public projects, Silver standard for public housing) in place of following the guidance. Projects below this value and infrastructure projects will continue to use the 2016 Sustainability standard. As new elements have led to additional costs for the developers, it has therefore been necessary for the City to pay more towards projects – typically 3-5%. Practitioners note that demonstrator projects (by the City) are particularly important to show real examples of how the circularity aspects can be done.

Case study	Key points
Minnesota Sustainable Building Guidelines, US	<p>This is a progressive sustainability program for state funded buildings which serves as a model for sustainability in Minnesota buildings. Unlike other green building programs, it focuses on measured performance improvements, using a list of required metrics instead of a menu of potential options. The program is structured to provide a feedback loop to the building design, construction, and operations industry in the state. Elements of the program are required to be used through all phases of the development of state-funded buildings in Minnesota from pre-design through design, and construction and for ten years of operations. It is continually updated and improved in collaboration with state agencies and industry stakeholders and could serve as a model for localized green building programs. The program is designed to target broad sustainability goals for state funded construction which includes roughly 35 projects of various type and size each year. It is mandatory for state funded construction and voluntary for private sector, and some local units of government require portions of the program for projects that they construct and/or fund. An important learning aspect is to have consistent funding to launch project guidelines, work with projects and then learn what worked and what failed to have a feedback loop to improve long term performance of the building environment. An identified barrier is that of small projects which include lack of budgets to afford some of the specialized consulting, that may be required.</p>

Other initiatives include:

- BREEAM in the UK¹⁷⁶ - The BREEAM Family is a suite of certification schemes which drive built environment performance across the entire sustainability spectrum including specifications for better public health, more resource efficient and responsible construction practices, protection and enhancements of our natural world, and radical actions against the adverse impacts of climate change including climate resilience. It is common practice in the UK to support Strategic/Local Plan policies with Supplementary Planning Documents (SPD) and other policy tools. While the BREEAM schemes could be highlighted in the SPDs they can also be required in the main strategic/local plan.

Voluntary

The case studies that relate to voluntary requirements within planning are summarised in the table below:

¹⁷⁶ <https://www.breeam.com/news/breeam-launches-local-planning-authority-guidance/>

Table 12: Lessons learnt from case studies that relate to voluntary requirements

Case study	Key points
Architecture Policy, City of Copenhagen	The most recent 2017 version of the Copenhagen Plan now makes specific reference to Circular Economy and embeds a number of CE principles to be considered during design, including the need for responsible design to meet environmental and climate challenges, to provide flexibility, durability and resource efficiency including design for deconstruction, and to adapt the city to the climate of the future. The policy also encourages lifecycle assessment (LCA) and lifecycle cost analysis. It is mandatory on city/ public projects (funded or on land owned by city), voluntary on private schemes as it is not currently possible to mandate additional requirements (e.g. CE, low CO ₂ impact) in national Planning laws, the Local Plans or in Building Permits. Hence it is only a voluntary guide for private developments, therefore it has been a challenge to encourage them to adopt the principles of the Architecture Policy. Another challenge to delivering the recycling/ recyclable aspects of materials availability and the Planning and Permitting process – projects can take a long time to go through the planning process and Planners generally want to know the detail of the proposals (i.e. proposed material finishes) to ensure design quality and that the proposals are (visually) appropriate to the local context. So far, pilot projects have been approved on more of a 'trust' basis to enable circular use of materials and products.
Bâtiment bas carbone, France ¹⁷⁷	To facilitate the promotion of all the initiatives that contribute to the development of good low-carbon practices, the association BBCA launched, in March 2016, the first label for measuring the footprint carbon of building over its entire life cycle, which is based on a single-criteria indicator with 4 pillars, including circular economy. A BBCA point corresponds to the equivalent of 10kg of CO ₂ not emitted or stored. The recent version of the BBCA New Building standards integrates significant methodological changes to advance the measurement of the carbon footprint in order to be as close as possible to the reality of the building, while remaining compatible with the E + C- Regulation (Positive Energy-Carbon Reduction). This labelling scheme is now starting to be required as part of the building permit process in some regions. The main challenge remains the unwillingness of stakeholders to participate in the voluntary initiative (not necessarily because of financial issues) and integrate new construction methods based on circular economy and low-carbon practices. A large part of actors in the construction sector, particularly investors are not sufficiently aware of the climate issue in the building sector. In addition, paradoxically, some mayors do not promote low-carbon practices in their municipalities. For large construction groups, there is no necessary need for assistance as they have the necessary tools to prepare for the certification. However, for SMEs, the approach requires a change in process and technical support (need for building modelling, LCA calculation, etc.). Financial incentives

¹⁷⁷ <https://www.batimentbascarbone.org/qui-sommes-nous/>

Case study	Key points
	(e.g. in the context of energy taxation) may also be a useful way of accelerating the deployment of the label.
Green Deal on Sustainable Dismantling, Finland	Green Deals are voluntary agreements between central government and other stakeholders to take joint action on promoting sustainable development. These agreements are used to improve or complement existing legislation such as achieving certain targets and implementing more ambitious targets without further regulation. The Green Deal Agreement on Sustainable Dismantling is a voluntary agreement between the Ministry of the Environment and RAKLI - Finnish Association of Building Owners and Construction Clients. The agreement states that by 2022, 50% of RAKLI property owners will complete demolition surveys before applying for a demolition permit (required for the demolition or large-scale renovation of buildings) and this will increase to 75% by 2025. Key learnings conclude the approach is very new for the sector so effort must be placed on awareness raising and training. There was an initial roadshow and there are regularly scheduled workshops. Demolition processes are being reviewed in parallel with construction processes to also improve design and construction that facilitates demolition. Additionally, the lack of baseline quantitative data made it challenging to determine and set quantifiable targets acceptable to all stakeholders. Targets and actions are therefore heavily reliant on sector feedback; however, the initiative will gather data towards improving this position.

Development

The case studies that relate to land use planning are summarised in the table below:

Table 13: Lessons learnt from case studies that relate to land use planning

Case study	Key points
Zero Emissions Building Plan, Vancouver	This positions Vancouver as the first city in North America with a roadmap for eliminating emissions from new homes and buildings by 2030. New construction operational energy is targeted to be reduced to zero by 2030 or sooner and for embodied emissions from new buildings and construction projects to be reduced by 40% by 2030, compared to a 2018 baseline. This is targeted at new construction and rezoning projects for public and private buildings including residential and most commercial building types. The initial focus was on operational energy but the focus will increasingly include all life cycle stages as embodied emissions gain in relative importance. The City currently uses voluntary commitments from developers applying for rezoning to gradually drive improved green building outcomes. A whole building LCA is currently required to be reported (declaration of impacts only) as part of planning for 'rezoning' projects as per the Green Buildings Policy for Rezoning. This reporting requirement has been in place for new rezoning applications received since May 2017. In the future, it is expected that whole building LCA may be resubmitted at stages beyond early design, for example, at the construction stage and later, to further advance and demonstrate impacts on reducing embodied carbon in practice. Lessons learned and success stories are shared across

Case study	Key points
	the community to generate awareness and inspire creative solutions. An important lesson is to have the market set up to incentivize recovery, reuse and recycling with a balanced supply and demand, or else recovered materials may not end up being used. Local relationships need to be established with different "partners" to enable this infrastructure and marketplace.

Initiatives that relate to land use polices include:

- Adaptive Reuse Incentive Program, City of Long Beach, California¹⁷⁸ - in order to encourage adaptive reuse in the centre city area in lieu of demolition and new construction, this local regulation provides incentives such as allowing addition of upper floors; additions that then may exceed current allowable maximum total building sizes; waivers of current minimum parking requirements, etc. The Site Plan Review (SPR) Committee determines qualification for adaptive reuse on an individual basis with the understanding that each project is unique and requires specific attention. To qualify, a project must involve a substantial change of use from both a building and zoning perspective.
- Land Mass Coordinator in Helsinki - in Helsinki, the position of Municipal Circular Land Mass Coordinator was created in 2014. The coordinator oversees master planning and construction projects to clean and repurpose up to 1.1m tonnes of soil and crushed concrete per year, saving the city €47m and avoiding 17,100 tonnes of CO₂e by 2020. In the city's process outline for construction and demolition works, coordination with this person is obligatory to incentivise resource-wise movement of mass materials around and between sites.

Financial incentives

The case studies that relate to financial planning are summarised in the table below:

Table 14: Lessons learnt from case studies that relate to financial planning

Case study	Key points
ITACA Protocol, Italy ¹⁷⁹	This assesses the level of energy and environmental sustainability of buildings. As regards the implementation of circular strategies, the Protocol provides the following requirements: reuse of existing structures (60-100% of structures and envelope); recycled materials (30-50% of the total of envelope and internal floors); reused materials/components (30-50% of the total of envelope and internal floors); durability, adaptability, deconstruction and reusability (application of strategies and solutions for disassembly in at least 1 and up to 6 classes of technical elements). The ITACA Protocol has been adopted by many Regions in Italy (Piedmont; Liguria; Tuscany; Marche; Lazio; Apulia; Basilicata; Campania; Veneto; Friuli Venezia Giulia; Valle d'Aosta; Umbria). Most of the regional protocols are applied in tenders, incentive programs and public housing. The

¹⁷⁸ http://www.longbeach.gov/globalassets/lbds/media-library/documents/publications/lbds-publications/350444_brochure_for-web

¹⁷⁹ https://www.itaca.org/valutazione_sostenibilita.asp

Case study	Key points
	<p>Apulia Region with Regional Law 13/2008 "Regulations for sustainable dwelling" introduces the voluntary adoption of the ITACA Protocol, makes it mandatory in case of interventions with at least 50% public funding. There are some interesting learnings from applying this at a regional level. One challenge is represented by the political willingness towards the adoption and promotion of the Protocol in the national/regional policies. There are also issues of the low level of promotion by Regions, who own it, which results in only partial levels of implementation and monitoring. It is important that it is promoted to all regions, to all the different stakeholders, highlighting its regional characteristics. Investments are needed to create financial/tax incentives to support the voluntary implementation of the Protocol. The main support activity, over time, has been the training of professionals in charge of developing and verifying the projects. The enforcement of the Protocol has proven to be fundamental in elevating the average quality of buildings.</p>
The Act for the Promotion of Long-Life Quality Housing (LQH), Japan ¹⁸⁰	<p>This Act promotes the longer life of housing in Japan. Technical guidelines outline the criteria for extending the life span of housing. Compliant properties can apply for tax reductions, subsidies/mortgage support. Approved since June 2009, it has applied to 696,516 houses, as of 2016. The Long-Life Housing Law provides a set of technical guidelines which promote a change in design culture. These include guidelines regarding ease of maintenance and renewal of services, particularly with respect to the disconnection of support and infill elements in a building with the requirement to be able to access service functions from outside the house. Adaptability is also considered important, with the fit-out giving great flexibility for individual residents and being configured to allow for refurbishment as required. However, there has been slow uptake of the scheme, for a number of reasons including the construction costs can be more and there is a lack of integration with other housing requirements. Feedback with users suggested that it needs to be simpler in its application and more promotion and integration is needed. More incentivisation is needed for the scheme for the rental housing market.</p>

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https://www.researchgate.net/publication/310662201_The_Efforts_to_Develop_Longer_Life_Housing_with_Adaptability_in_Japan

Case study	Key points
Innovative Housing Program (IHP) Fund, Wales	<p>The IHP provided £90 million of funding over 3 years between 2017-2020, with a further £25 million added in 2020 for a 4th year, to test new innovative approaches to increase the scale and pace of high quality social and affordable housing delivery in Wales. Potential innovations include construction techniques, delivery pathways and housing models to reduce the impact of house building on the environment, reduce fuel poverty, and reduce health and wellbeing inequalities that are exacerbated by poor quality housing. The scheme should also contribute to Welsh Government policy objectives around reducing waste and the circular economy, e.g. low embodied energy and future flexibility. Funding is provided to cover the innovative aspects of a scheme. Not all projects necessarily focus on circular economy issues; many adopt timber for low embodied carbon. There are around 10 projects with descriptions that touch on circularity issues, with 3-4 projects where aspects of CE are their main innovation focus. Survey findings have found that construction partners have learnt much from the IHP and that it provided them with the 'safety net' of the additional funding, would allow them to deliver similar schemes more quickly and cheaply in future. Direct feedback from Housing Associations receiving the funding is that it is very beneficial to have such funding to allow them to develop and trial things that they would otherwise not be able to afford to do, and use this to create a foundation to build on in future developments. However, it can be a long time from the funding being granted to completion of the actual construction (homes are still being constructed from the first round of funding). This time lag can make it difficult to establish the outcomes and integrate lessons learnt for future housing funding programmes. Key learnings included ensuring that projects continue to be innovative year on year, rather than developers submitting the same types of projects each time and ensuring value for money when 100% grant is being offered (for the innovations). This reduces the motivation for developers to seek best value.</p>

Other relevant initiatives identified include:

- Housing Funding, Finland - the Housing Finance and Development Centre of Finland (ARA) is responsible for the implementation of Finnish housing policy, issues subsidies, grants and guarantees for housing and construction, and supports the improvement of housing conditions for people with low or average incomes and special-needs groups. Demolition grants now require pre-demolition audits to qualify for aid.

Evidence of impact from existing initiatives

Several case studies, and other reviewed information, provide evidence of impacts (though not often quantified) through the application of circular economy requirements in planning and/or within funding mechanisms. These are summarised in the table below:

Table 15 : Evidence of impact from the case studies

Case study	Evidence of impact
Netherlands: Dutch Building Decree (Bouwbesluit 2012)	Moving to ask for a stricter circularity indicator from 1.0 to 0.8 does not lead to extra costs.
UK: London Plan	The GLA expects that the adoption of circular economy principles in referable applications (and promoted in local plans) will help London to achieve the CD&E waste and material recovery targets early in the Plan period. A case study has shown expected savings of 16,500 fewer HGV movements, 7,760 tCO ₂ e savings and 122,000 tonnes of virgin material use avoided.
Israel: Green Building Standard	Over the last decade some 30 million IS (7.5 million Euros) have been invested by the government for research, training, publicity, accessing information, standard revisions, and pilot projects.
France: Bâtiment bas carbone	The proposed outcomes of this initiative is to halve the carbon emissions of buildings. Currently, it is estimated that 1m ² of new buildings generates around 1.5 tonnes of CO ₂ over a 50-year lifespan. The BBCA label aims to lower these emissions to 750 kg of CO ₂ per m ² built, over the same lifetime.
Canada: Zero Emissions Building Plan, Vancouver	A recent study of the Zero Emission Building Plan undertaken showed that it creates a \$3.3 billion job opportunity in the lower mainland of British Columbia, in combination with the related provincial policies. A similar study will be conducted in future for the embodied carbon portion of the Plan. Another recent study on the deconstruction market estimated the regional deconstruction market is worth up to \$350 million CAD. Since other municipalities don't currently have any deconstruction requirements and BC's requirements are currently very limited there is a lot of potential for growth of that local economy if the market supply and demand can be created and balanced.

Relevant/ supporting survey findings

In terms of regional and local planning, several stakeholders provided feedback as part of the survey, as summarized below, together with relevant findings:

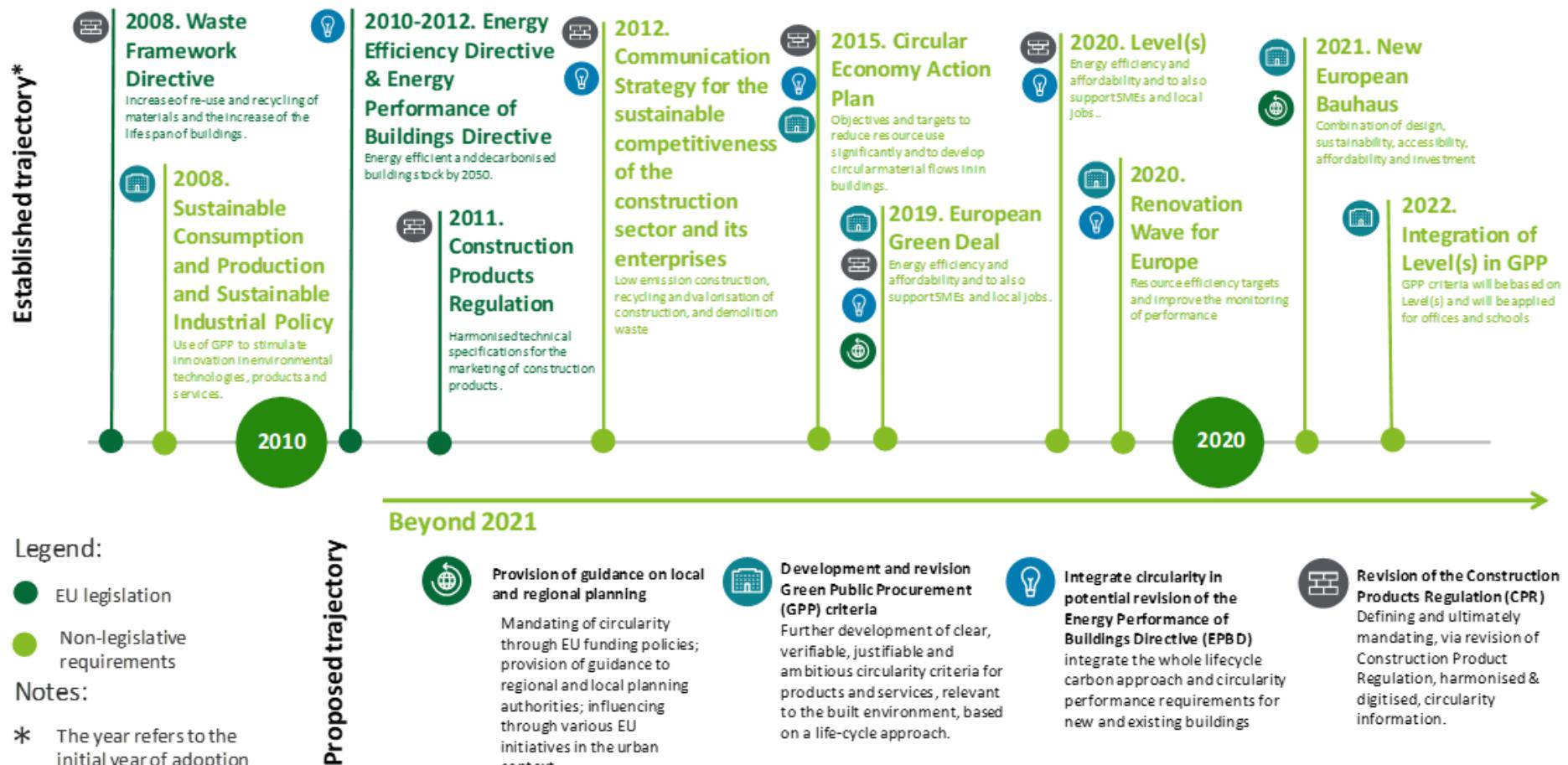
- As part of the drivers, social aspects could be considered with a focus on health, wellbeing & comfort such as through promotion of **Nature Based Solutions** (NBS) in urban planning strategies)
- Important barriers, such as regulatory drivers, lack of financial incentives, lack of incentives to design with the aim to reduce impacts at the end of life, can all be addressed through local and regional planning. Corresponding opportunities that ranked important included legislative requirements, integration of health and environmental considerations in the end of life management of buildings, promotion of design for deconstruction and disassembly and improvements in

collaboration of actors involved across the whole building value chain, which can also be addressed through planning. Increased interest/awareness from the end user on the benefits of sustainable design (across building life) was also thought to be at least partially covered by local and regional planning requirements.

- One respondent identified the opportunity of a more systematic consultation and co-design of solutions with concerned public at urban plans level (notably brownfield renovation) as well as at building level (notably public building)
- The tool of 'Promotion of a common understanding and interpretation through the use of existing standards, development of or update of existing guidelines' was ranked as important. The use of planning zone incentives was also considered important.
- For policy gaps, a **lack of coherence** between the approaches developed at EU and local level was raised.

5. ANALYSIS OF THE INTERLINKAGES AND CUMULATIVE IMPACTS

The roadmap illustration below outlines the suggested timeframe of implementation of the suggested policy options (proposed trajectory). It also includes the main existing and planned EU policy initiatives (established trajectory). The relevance of the suggested policy options to the adopted and planned EU policies is also illustrated with pictograms.



As indicated in the roadmap illustration, there are several interlinkages to consider between the proposed policy options and other EU activities that are completed, underway or proposed. These are signified by the addition of an icon (to signify a specific policy option) next to the items in the established trajectory. The table below summarises the linkages for each policy option:

Table 16: Identified interlinkages of the policy options

Policy option	Linkages identified
Revision of CPR	<p>Level(s) – circularity data and eco-design at product level could support aspects such as design for future disassembly & reuse</p> <p>Waste Framework Directive – CE marking and support for reuse & remanufacturing to divert from landfill and low value recycling</p> <p>Circular Economy Action Plan - addressing the sustainability performance of construction products in the context of the revision of the Construction Product Regulation</p> <p>The Sustainable Products Initiative¹⁸¹ (SPI) intends to widen the scope of the Ecodesign Directive beyond energy-related products so as to make it applicable to the broadest possible range of products (current consultation).</p> <p>Sustainable Competitiveness of the Construction Sector (and proposed Strategy for a Sustainable Built Environment) - develop harmonised rules on the declaration of the performance characteristics of construction products in relation to a sustainable use of natural resources.</p> <p>There are also linkages to EPBD (where product information enables building level assessment), GPP (where product specific criteria are developed), and Local & regional planning and funding (where improved resource outcomes linked to products and materials are being mandated).</p> <p>Energy Efficiency Directive - could also include some elements of circularity performance as recommended within this policy option.</p> <p>See also – Digital Building Logbooks; CEN/TC 350 New sub-committee on circular Economy and future developments of EN 15804 linked to EPDs.</p>
Revision of EPBD	<p>Level(s) – could become the basis for the introduction of circularity performance considerations such as recycled content of products and materials and potential for reuse and higher value recycling. It could also provide a strategic framework for the incorporation of a whole life carbon approach.</p> <p>New European Bauhaus – could be beneficial to the entire value chain, raising awareness amongst the suppliers and contractors on technological approaches and processes.</p>

¹⁸¹

https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative/public-consultation_en

Policy option	Linkages identified
	<p>Waste Framework Directive – The Guidelines for the waste audits could establish requirements for pre-demolition audits and selective demolition processes could facilitate reuse and higher value recycling.</p> <p>EU Sustainable Product Policy, Ecodesign Directive and Energy Labelling Regulation – further mandatory product requirements on durability, recyclability, reusability, and reparability could be explored and incorporated.</p> <p>See also - LEED, BREEAM and Green Star for the establishment of a point rating system.</p>
Development and revision of GPP	<p>Level(s) – will become the basis for developing green public procurement criteria for offices, schools and social housing, including newbuild and renovation, planned for implementation in 2022.</p> <p>New European Bauhaus - sustainable design movement including circularity that could be piloted potentially in public sector projects.</p> <p>European Green Deal - encompasses and reinforces other strategies such as <i>Circular Economy Action Plan</i>, which contains key actions in relation to mandatory criteria and targets in sectoral legislation and phasing-in mandatory reporting on GPP.</p> <p>Renovation Wave Strategy includes focus on renovating public buildings, it is stated that by June 2022, the Commission will look into the possibility to develop green public procurement criteria for public buildings based on Level(s).</p> <p>There are also links to Revision of CPR and EPBD – to make use of harmonised and established performance and assessment criteria/data. Also, the funding aspects of local & regional developments to support consistent and mutually reinforcing specifications and requirements.</p> <p>See also: <i>EU Taxonomy</i>¹⁸² performance thresholds (referred to as 'technical screening criteria') for economic activities which make a substantive contribution to one of six environmental objectives, including transition to circular economy. <i>Big Buyers for Climate and Environment</i> lessons learnt from the Public Procurement of Circular Construction Materials task group. <i>Monitoring Framework for Circular Economy</i>, adopted in 2018 includes an indicator on Green Public Procurement.</p>
Local and regional planning and funding	<p>Level(s) – used as a requirement for funding and provision of guidance for requiring as part of the planning process.</p>

¹⁸² https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf

Policy option	Linkages identified
	<p>New European Bauhaus - sustainable design movement including circularity that could be piloted, with the development of guidance at the local level and linked to funding obligations,</p> <p>Renovation Wave Strategy includes focus on renovating public buildings, with an emphasis in providing funding which could have circularity assessment attached.</p> <p>There are also links to the new Urban Agenda and the Circular Cities and Regions Initiative, where guidance and support could be given at a local level and funding requirements through cohesion policy. Also links to other financial initiatives e.g. Green Bonds, EU Taxonomy, EIB etc.</p> <p>Potential links to Waste Framework Directive, through regional and local planning authorities understanding the flow of their materials, including those from the construction, maintenance, refurbishment and end of life buildings and how they will be managed.</p> <p>More guidance provided for developments subject to EIAs and SEAs as part of policy assessments.</p> <p>Links to mandating GPP as part of local and regional planning and within funding mechanisms. Links to the Revision of CPR and EPBD – to make use of harmonised and established performance and assessment criteria/data if being utilised in funding and planning guidance.</p>

6. CUMULATIVE IMPACTS OF THE POLICY OPTIONS

This section provides a qualitative assessment of the socioeconomic and environmental impacts of the 4 policy options. The approach and the indicators used in the assessment are described in section 4. Table 17, Table 18 and Legend: '+': Positive social impact; '-': Negative social impact; '-/+': Positive or negative social impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 19 below provide a summary of the impacts respectively for the economic, social and environmental impacts including their rationale. The impact is based on evidence collected through the analysis of the case studies. This evidence is presented in Annex 3 of the report. In addition, the assessment was further refined based on the expert opinion of the project team as well as a stakeholder consultation conducted during the 2nd stakeholder workshop of the study.

Based on the assessed impacts for each policy options presented below, the following qualitative conclusions are drawn for the cumulative impacts (i.e. when all policy options are implemented simultaneously) for each of impact categories and indicators.

Table 17: Assessment of the cumulative economic impacts

Economic impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Functioning of the internal market and competition	+ A level playing field across the EU would be ensured as the legislation will be implemented in a harmonised manner across the EU. Cross-border market opportunities can be created from the harmonisation of data.	+ The development of harmonized circularity indicators at the EU level could promote cross-border market opportunities. A common EU framework along with these indicators could also allow national policymakers to learn from each other, creating synergies and increasing benefits for the internal market.	+ With GPP, authorities can create and escalate the market as the public sector take a role of lead consumer in green products and services. Public sector can drive an increased demand of low carbon building materials and the use of recovered or recycled material content, creating new markets and providing incentives to develop eligible products and services.	-/+ Strengthened implementation and spreading of knowledge will be ensured, as national and local levels will be supported and incentivized in the spatial planning of EU Directives and networks at the city-level will be created. However, these initiatives may also create gaps of implementation between certain regions.
Operating costs and conduct of business/Small and Medium Enterprises	+ Additional costs of implementation, particularly for SMEs (e.g. for data collection and reporting processes), unless product & material level databases are created. In addition, demand of circular products is expected to be stimulated, and other opportunities, e.g. circular service models) can be expected from a more effective implementation of aspects of circular design.	+ The boost in efficiency renovations has the potential to stimulate demand in the construction sectors. Businesses and SMEs would especially benefit from the boost of the efficiency renovation market.	+ Promoting green procurement gives important incentives for industry to develop 'green' technologies and products and promote them in the market place. In particular, small- and medium-sized companies may profit from environmental procurement, as it offers an opportunity to find markets for their innovative solutions and products.	-/+ SMEs may face higher costs in the implementation of circularity requirements, for example through upskilling. However, these costs may be eased by the local and regional initiatives and support. Digitisation is important to offset some costs (e.g. data input). Some of the innovative solutions could be provided by SMEs, that could then be targets for merger/acquisition

Economic impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning	
Administrative burdens on businesses	-	- Additional administrative burdens for adapting the current enforcement, monitoring and reporting mechanisms. Nevertheless, the costs are expected to be limited by the digitalised and harmonised provision of the circularity information. Certification costs considered to be included in the administrative burdens	- It may cause an initial additional burden on businesses, especially SMEs, to implement new harmonized standards and indicators. The collection and monitoring of data could also be a burden. Nevertheless, these limitations are expected to be short term as work continues to improve digitalisation and harmonisation of the whole process.	- It may cause an initial additional burden on businesses to implement the procurement processes but the development of more standardised approaches will gradually decrease the cost of administrative procedures.	- Provision of new guidance and tools at regional and local levels may cause additional burden on businesses to implement circularity, especially in the beginning. The collection and monitoring of data, but also the implementation of strengthened requirements may also be a burden.
Costs to public authorities	- Additional costs of implementation are expected for the public authorities in the short term for the development of databases and, potentially, the provision of financial incentives for the development of pilots.	+/- Additional costs for the implementation of new policies and for the monitoring of data could be expected in the short term. However, common EU frameworks eventually reduce costs on MS, increase benefits and allow national policymakers to learn from each other. Moreover, the boost of circular marketplaces could allow local authorities to save money by preventing waste.	-/+ In general the development and implementation of GPP criteria in tender procedure is expected to create additional costs, e.g. setting and enforcing specific GPP criteria, and to develop tools/methods to assess proposals as well as for reporting. Also, implementation requires suitable capacity/skills for monitoring and provision of assessment methods and guidance, that are regularly reviewed and updated. Nevertheless, GPP can support extended lifespans of public buildings with reduced operational and maintenance costs in the long run.	 Eased costs to public authorities through the development of European funds providing financial incentives. However, there remains a need to ensure alignment between Circular economy and other planning requirements and there will be cost in development, monitoring and enforcement.	

Economic impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Innovation and research	+ Innovation will be boosted, particularly on the eco-design of products and the overall efforts to reduce embodied carbon of built assets over their life cycle. Innovation is also expected to increase on the digitalisation of processes (e.g. in the form of product circularity data templates).	+ The emphasis on sustainable materials and products, on sustainable methods (renovation, demolition processes, etc.), as well as the increased collection of data would boost innovation and research in the sector	+ One of the main goals of GPP, which is the demand-side innovation policy, are the emergence of new products and the enhancement of quality of the products by innovation, and the improvement of competitiveness of green industry e.g. development of products with high recycled content and which are energy efficient and have less environmental impacts.	+ Promoting and funding partnerships between stakeholders, along with enhancements of knowledge spreading and sharing, would stimulate innovation. This would also allow research projects to benefit from synergies.
Costs to consumers and households	-/+ An increase of costs of housing, particularly at the initial stages of implementation. Nevertheless, construction products will gradually be recirculated and retained at their highest value and property value could increase.	+ Efficiency renovations have initial costs but allow buildings to have longer lifespans and lower operational costs. There are also various energy performance business models that reduce upfront costs.	+ The construction of energy efficient buildings with reduced use of toxic chemicals, in particular in the case of social housing can considerably reduce energy consumption for households saving money and also improve housing lifespans with reduced operational costs in the long run.	0 For funding, there would be no costs to consumers and households, since it would be provided by European subsidies.

Economic impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Costs and benefits to specific regions or sectors	+ Reduction of differences caused by national standards and certifications between Member States as well as uneven implementation and market surveillance of EU regulations	? It may be easier, and thus less costly, for more advanced regions on sustainability and circularity matters to implement lifecycle thinking approaches. They may also benefit from more dynamic secondary materials and products marketplaces.	+ It may cause an initial additional burden on businesses to implement the procurement processes but the development of more standardised approaches will gradually decrease the cost of administrative procedures.	+/- Some regions could receive economic gains, through promotion and financial subsidies of green constructions and green jobs. They would also benefit from capacity building on circularity subjects. Planning interventions could change the viability of developing certain sites. In the short term this could have a negative impact for land owners and investors (for long term gains). According to how it is implemented, some regions may benefit more than others, especially urban areas.
Effects on the macroeconomic environment, including impacts on international trade and competition	+ The establishment of a common technical language would promote a cross-border market opportunities, selling and sourcing construction products and services from other EU countries.	+ A common EU framework along with common indicators could allow national policymakers to learn from each other, creating synergies and increasing the influence of the EU market internationally.	+/- Introducing 'green' tendering criteria can influence the marketplace and result in new entrants in the field of environmental technologies and products - potentially resulting in increased competition and reduced prices.	0 No manifest effect

Legend: '+': Positive economic impact; '-': Negative economic impact; '+/-': Positive or negative economic impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 18: Assessment of the cumulative social impacts

Social impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Employment and labour markets	+ Deconstruction and reuse can support greater job creation compared to low level recycling or disposal. New job opportunities may also be offered by the integration of maintenance and disassembly in business models	+ Efficiency renovation as well as financial measures linked to sustainability performance criteria could support job creation and the development of new expertise (e.g. integration of simplified LCA approaches, requirement of indicators implementation and monitoring, data collection)	+ Introducing 'green' tendering criteria could support job creation and the development of new expertise (e.g. development of tools and calculation methods, integration of simplified LCA approaches, requirement of indicators implementation and monitoring, data collection). New job opportunities are also expected for less qualified workforce at the local level.	+ The embedding of circularity in building design through EU funding schemes and the provision of guidance and tools can support greater job creation by incentivising for more circular projects and green jobs. On housing, could potentially, provide a more affordable supply.
Standards and rights related to job quality	+ Alternative business models and reuse/repair/remanufacturing capability provides opportunities for new business start ups (e.g. through the improved marketing and confidence of reused products) and higher skilled/ paid job creation. However, some jobs related to reuse could be manual. Quality and skilled jobs are also expected to be created for the digitalisation and harmonisation of standards.	?	+ Greening procurement could lead to the development of a more skilled and environmentally aware EU construction workforce. For example, a healthier operational place for the workers can reduce sickness and boost productivity.	+/- Embedding circularity in building design will lead to the upskilling of workers, supported by national, regional and local training. However there could be a risk to the existing labour market through low to high skilled jobs

Social impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Governance, participation, good administration, access to justice, media and ethics	+	?	?	?
The revision of the CPR Directive, by default will increase participation of different actors – public and private sector, and transparency of data. The same applies for the participation of the industry that will be significantly involved in the development of harmonised standards.	The revision of the CPR Directive, by default will increase participation of different actors – public and private sector, and transparency of data. The same applies for the participation of the industry that will be significantly involved in the development of harmonised standards.	The implementation of indicators on the safe handling of hazardous substance (as proposed in the financial measures linked to sustainability performance criteria) would increase safety, as well as raise awareness on linked health hazards. Other types of health and safety indicators could also be implemented.	The implementation of some measures such as material passport and the reduction in potentially hazardous materials could enhance quality of life as well as improve health and safety both in the workplace and the living environment (low emitting products, less toxic materials use, etc.)	Some guidance document or requirements could ask for citizen participation, in particular when public buildings or infrastructures are involved.
Public health and safety	+	+	+	+
A positive impact is expected as the future impact of hazardous substances could be reduced, for example having better information on where problematic substances are located	A positive impact is expected as the future impact of hazardous substances could be reduced, for example having better information on where problematic substances are located	The implementation of indicators on the safe handling of hazardous substance (as proposed in the financial measures linked to sustainability performance criteria) would increase safety, as well as raise awareness on linked health hazards. Other types of health and safety indicators could also be implemented.	The implementation of some measures such as material passport and the reduction in potentially hazardous materials could enhance quality of life as well as improve health and safety both in the workplace and the living environment (low emitting products, less toxic materials use, etc.)	Promoting circularity at urban planning level leads to increased good practices in waste, air pollution, biodiversity and water management This promotes improved and healthier urban areas.

Legend: '+': Positive social impact; '-': Negative social impact; '-/+': Positive or negative social impact (depending on certain conditions); '0': no effect; '?' unknown effect

Table 19: Assessment of the cumulative environmental impacts

Environmental impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Climate change	+ Potential reduction of embodied carbon of products and materials, as installed in built assets, over their life cycle through supporting a more reversible, reusable and adaptable systems.	+ The integration of lifecycle carbon emissions in NCEP would decrease the impact of buildings on climate change by reducing GHG emissions.	+ Public authorities achieve targets, in particular related to climate change, by reducing GHG emissions through the purchase of products and services with a lower whole life CO ₂ footprint. More generally, awareness of how circularity contributes to attaining objectives of carbon neutrality (life cycle) will increase.	+ Reduction of carbon emissions through the investments in projects contributing to a shift to a low-carbon economy (ESI, ERDF and Cohesion fund) and the sustainable planning of cities.
Transport and the use of energy	+ The creation of a more reversible, reusable and adaptable buildings will allow products and materials to be more readily recirculated, thus reducing the need for transportation. Also potential to reduce transportation linked to the extraction of raw materials.	+ The focus on efficiency renovation activities would lower the transport and use of energy by decreasing operational energy needs and embodied carbon emission. It would also decrease the energy use linked to construction and product/material manufacturing by promoting reuse and recycling.	+ Introducing green tendering criteria in the construction projects could considerably reduce energy consumption in particular by choosing products which are more efficient and implementing environmentally conscious design principles, e.g. cradle-to-cradle. Contracting authorities can choose products and proposals with the lowest energy consumption.	+ Local initiatives are more likely to contribute to improvements in transport and the use of energy.

Environmental impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Biodiversity, flora, fauna and landscapes	+ The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	+ The focus on renovation could decrease the needs for new construction and prevent to denaturalized landscapes and erode linked biodiversity.	+ GPP could be used to address some environmental issues such as deforestation through the purchase of wood and wood products from legally harvested and sustainably managed forests, and help preserve biodiversity by reducing local impacts connected to raw material extraction and product manufacture.	+ Local implementation, and more specifically urban-scale implementation, will lead to strengthened consideration of biodiversity in urban areas and of local ecosystems. The provision of guidance and tools on the impact assessment process before project launching would also contribute to assess the potential effects on biodiversity and landscapes of the building sector.
Water quality and resources	+ The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	+ The integration of circularity thinking could decrease the pressure on water resources (this is dependent on other factors such as a well-functioning market for secondary materials). The increase of reuse and recycling would also reduce construction material and products being landfilled at end of life, and any associated leachate.	+ Primarily through criteria in such as rainwater harvesting, recycling and reuse of grey water, low-flow fixtures, sensors etc. The ban or reduction in the use of hazardous substances could also limit ground and surface water pollution	+ Overall a positive impact is expected through the promotion of use of sustainable materials in constructions and renovation

Environmental impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Soil quality or resources	+ The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	+ Encouraging renovations and deconstruction could significantly reduce excavation waste. The increase of reuse and recycling would reduce construction material and products being landfilled at end of life. Overall, the integration of circularity thinking would decrease waste, landfilling and pressure on soil resources.	+ GPP criteria generally promote the use of recycled materials and reuse which would reduce waste landfilling, decreasing soil pollution. Overall, the integration of circularity thinking would allow to improve resource efficiency, decrease waste production and pressure on soil resources.	+ Promotion of land use policies that promote the use of existing land and buildings, would reduce the requirement for new build and excavation.
Land use	+ The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	+ The focus on renovation would lead to a decrease of land needs.	+ Similarly to oil quality, the integration of circularity thinking would decrease land needs.	+ At regional level, a prioritisation of the reuse of asset could reduce land use.

Environmental impact indicator	Revision of CPR	Revision of EPBD	Revision of GPP criteria	Guidance on local and regional planning
Renewable or non-renewable resources	+ Products and materials can be more readily recirculated and retained at their highest value, which in turns tends towards reuse and reduction of demolition waste generated. This should reduce overall resource requirements, renewable and non-renewable through treating the existing built environment as a 'product/ material bank'.	+ The implementation of circularity thinking, for example the integration of Level(s) simplified LCA approach, would enable the increase of renewable resources usage and decrease raw material needs. This could overall boost the secondary materials and products markets, expanding benefits beyond the construction sector.	+ The implementation of circularity thinking, for example the integration of Level(s) simplified LCA approach, would enable the increase of renewable resources usage and decrease raw material needs.	+ It would promote use of sustainable materials in constructions and renovation, for example through requirements of reused/recycled content requirements in permit deposit, or through fiscal incentives (monies could be refunded if some requirements are achieved). Use of locally sourced bio-based materials.
The likelihood or scale of environmental risks	+ Improved information about the conditions for better hygiene, health and environment.	0 No significant impact is expected on the likelihood of environmental risks.	+ Supports products which are more efficient and implementing environmentally conscious design principles, e.g. cradle-to-cradle. Contracting authorities can choose products and proposals with the lowest whole life environmental impacts and risks.	0 No significant impact is expected on the likelihood of environmental risks.

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

7. CONCLUSIONS AND RECOMMENDATIONS

It is **clear from the evaluation of case studies and stakeholder feedback that no single policy on its own will create the perfect conditions for embedding circularity into the built environment.** This is due to the diverse nature of buildings and their composition, multiple performance requirements, lifespans, uses, asset management and maintenance, ownership, valuation and regulation across the EU. To a certain extent, Level(s) accommodates this variety of contexts by allowing for defined levels of attainment across multiple performance criteria. In the context of the policy options outlined, Level(s) is a tool to support implementation, alongside other measures working together to fully catalyse a sector traditionally resistant to change.

Much of this resistance is due to the risk (real or perceived) involved in deviating from business as usual. Thus, it is important to create a level playing field for a highly competitive sector; drive innovation and demonstrate benefits; incentivise and provide market pull; provide much needed data and evaluation methods/tools to assess multifaceted performance criteria; and make the transition as easy as possible. For example, obligatory and specific performance requirements in planning and other regulation; R&D funding, Green Deals and GPP; requirements in structural funds; financial incentives to renovate rather than demolish and rebuild; improved LCA data and whole life carbon assessment methods; and harmonised and digitalised data capture, transfer and utilisation in supporting tools/assessment.

In addition to the policy options outlined in this report, a number of other areas for intervention are relevant. These include:

- **Digitalisation of the construction industry ecosystem**, notably in the area of building information modelling (BIM) and data capture/transfer, but also in public services such as planning, and information sharing, such as construction product and supplier information. There is huge potential for advances in digitalisation to facilitate circularity in building design. Examples of this include Digital Building Logbooks, BIM, product data templates, planning, land and building registers, automated and connected asset management and service life planning, machine learning and data mining, for example to support investment or insurance decisions.
- There is a pressing **need for good data**, which fits the level of detail and accuracy needed. Yet, the acquisition of this data should be made as simple and easy as possible, especially bearing in mind that some data attributes are relevant to multiple policy and performance objectives. A useful example is the paucity of rich and reliable data on the current building stock. Such information is important for many areas including the harvesting of materials and products for reuse and recycling. Other use cases for such data include various priorities for renovation (energy, health, social cohesion, economic stimulus), and management of existing assets for better socio-economic outcomes at a city scale. Knowledge of the current building stock is a prerequisite for maximising its resource use.
- **Capacity building and training across the board** is a challenge to resolve in most of the policy options. Special focus should be placed on the design (private) and procurement (public) professions, working with recognised trade and professional associations.
- Relevant to both Construction Product information and Green Procurement is the **further development of Ecodesign and sustainable product policy**. The Ecodesign and labelling approach used to improve sustainability of energy-consuming products has been very effective at setting out performance thresholds and assessment methods, raising awareness and reducing operational energy

consumption. A similar approach with focusing more on circularity and on non-energy using products could be an effective policy option to also consider.

- **Standardisation work** relating to sustainability of construction works, (including environmental and social assessment), service life planning and other aspects of asset management and whole life costing, are relevant to achieving the goals of circular design. Such activities should encompass all aspects of circularity, including extending the scope of analysis, and hence acquiring the data needed to support additional circularity aspects of performance and impacts that may not be covered by current methods. For example, should the 'unutilised' impacts of a previous asset, demolished within its technical service life, be added to the life cycle impacts of a new asset replacing it?
- Continuing to support **Research and Development** related to the issues above and the policy options described previously. EU funded projects that span several MS and at different levels of ambition for circularity, with varying building typologies and national standards and methods of working can be particularly valuable. For example, to help establish common ground for harmonisation activities, such as core product data requirements, and assessment methods for measuring circularity. *Other examples could include:*
 - Resource mapping of existing buildings and assets using a range of emerging technologies and existing databases.
 - Tagging, tracking and tracing products and materials over the long term and multiple asset ownership.
 - Quality requirements, end-of-waste criteria and recertification of products and materials for further reuse.
 - Developing new tools and data and assessment methods to support more effective decision making across the whole life of buildings and components in particular in relation to planning and investment.
 - Understanding the future requirements for climate change adaptation and resilience in line with circular economy principles.
 - Support eco-design in line with circular economy principles, in particular in relation to disassembly, maintenance and repair.
 - Better understanding of sustainable business models that consider financial, social and environmental costs and benefits such as moving from products to services (servitisation, leasing).
 - Further development of digitalisation and alignment with building information modelling to enable easier data acquisition, scenario modelling and evaluation of whole life impacts.

The principal recommendations have been captured within the four final policy options and their potential delivery mechanisms. If these were to be pursued, **further evaluation and consultation, and further exploration of the interlinkages and potential synergies** with other activities and initiatives would be necessary.

A focus on circular design principles is important, but it is only part of the picture driving greater circularity in construction. For example, the full benefits of design for disassembly and future adaptability depend on the later stages of construction, use, maintenance, renovation and demolition continuing to support or implement those design intentions. For this reason, the scope of the policies and initiatives studied in this report also included other aspects beyond design. The whole life consequences of design decisions are obviously important to focus on too, and by combining these two levels of scope – whole life of the asset and whole value chain – it should be possible to consider

and address most of the challenges and opportunities relevant to transitioning to circularity on the built environment.

In addition, there are levels of value retention that add to this complex system, including product/material, buildings and urban area level that can be acted upon. In effect, they all need to be acted upon in different ways by various actors using a range of instruments to influence change. For example, the option relating to construction product information could provide much needed data and harmonisation linked to circularity performance at this component level, bearing in mind that the way in which they get installed, connected, maintained and removed in relation to the built asset will make a large difference to the potential to retain their resource value. Similarly, the potential to develop building level performance thresholds for circularity, such as policies addressing whole life cycle embodied carbon, will be impacted by supplier and product aspects and also the urban level facets, such as future planning and investment decisions.

Finally, the urban level aspects of planning, investment, trends and wider socioeconomic considerations has great potential to influence positively or negatively, such as whether existing assets are renovated or adaptively reused, versus demolition and new build (even if these existing assets had been designed for future adaptation). Ultimately, these strands need to be aligned and connected to drive in the same direction, make better decisions and support a value retention hierarchy.

A value retention hierarchy could act in a similar way to the waste hierarchy in promoting the best use for 'resources'. Examples of this include reuse & renovate existing assets in preference to demolish & rebuild; reuse (including remanufacture & recertify) systems and main building elements in preference to reuse at component/product level; reuse (including remanufacture & recertify) products and components in preference to material reuse; reuse materials in preference to recycling etc. This could then provide clearer direction of the cascading objectives linked to circularity, rather than all 'resource value retention' being considered of equal importance. Obviously, there will be cases in which this hierarchy will not necessarily lead to the best whole life outcomes, such as where operational energy impacts outweigh the embodied carbon savings, but this would be a key objective of assessment methods developed to underpin such an approach.

Further **consideration of carbon savings now** (e.g. by avoiding embodied carbon) **versus savings in the future** (e.g. by reducing operational carbon cumulatively by year x) are also relevant in the context of achieving carbon reductions as soon as possible. Hence some sort of weighting (carbon impact now versus carbon impact later) may be needed to add into this assessment of what constitutes the best decision given the information available. For example, is it possible for the decarbonisation of construction products and materials to follow a similar downward trajectory as energy production? Also, the wider impacts of biodiversity loss, local pollution and impacts are very important to consider with the 'embodied' side of the calculation, albeit difficult to quantify in the same way as carbon.

Finally, there is an **undoubted disparity across the EU in terms of accepted levels of challenge, local capability and supporting tools/data to enable effective implementation and enforcement**. One way to approach this is to have mandatory thresholds, targets and requirements that are achievable across the EU, such as the 70% CDW recovery (including low value recycling) target embedded in the WFD. However, this can have the effect of limiting progress in Member States that have already achieved stated objectives and act against higher levels of performance and innovation to test more transformative approaches. Therefore, a suggestion would be to have a tiered approach in which minimum performance thresholds are mandated (core requirements), with voluntary (more challenging/aspirational) targets recommended; whilst creating common and harmonised supporting data, standards and taxonomy that can evolve in line with a MS's capability and aspirations. This would not necessarily be restricted to a Member States level, e.g. public and private procurement may wish to adopt higher standards, or cities could enact at local planning level.

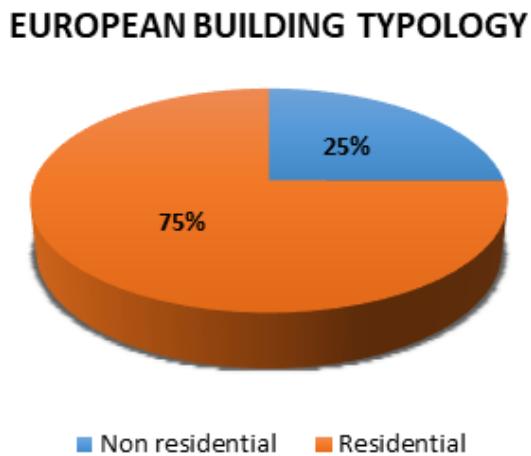
ANNEX 1: KEY CHARACTERISTICS AND TRENDS IN THE BUILDING SECTOR

This annex presents the key characteristics of the building sector with a focus on a description of the building stock (i.e. age and density) and the market of construction products. The description covers the **current situation and the future trends** as identified in the literature.

BUILDING TYPOLOGY

The European building stock is composed of approximately 131 million buildings, with a vast majority being residential buildings, accounting for around 75% (119 million) of the total with the remaining 25% being non-residential buildings (12 million)¹⁸³.

Figure 2: Member States building typology¹⁸⁴



Residential buildings

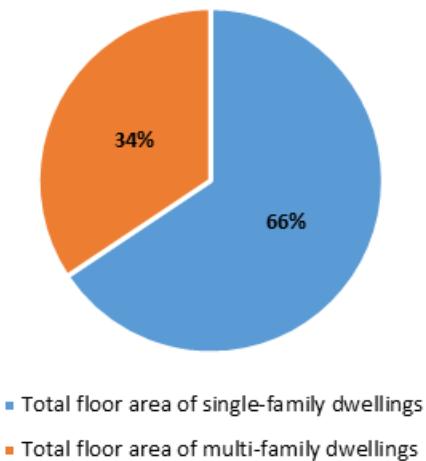
The breakdown by building type is composed as follows: 42% are flats, 34% are detached dwellings and 24% are semi-detached dwellings¹⁸⁵. Moreover, more than half of residential buildings are single-family buildings against a smaller but increasing part of multi-family buildings. Indeed, the most recent trends available have highlighted that, in the last decade, **more multi-family residential buildings were built in comparison with stagnating single-family** building construction: from 6 974 851.983 Mm² of multi-family buildings in 2012 to 7 163 631.488 Mm² in 2016¹⁸⁶.

¹⁸³ Retrieved from RICS (2020), "Energy efficiency of the building stock in the EU": [Energy efficiency of the building stock in the EU \(rics.org\)](https://www.rics.org/-/media/assets/advocacy/circular-economy-energy-efficiency/building-stock-energy-efficiency-report-2020.pdf)

¹⁸⁴ RICS (2020), "Energy efficiency of the building stock in the EU": [Energy efficiency of the building stock in the EU \(rics.org\)](https://www.rics.org/-/media/assets/advocacy/circular-economy-energy-efficiency/building-stock-energy-efficiency-report-2020.pdf)

¹⁸⁵ Ibid

¹⁸⁶ Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

Figure 3: European single-family and multi-family residential buildings¹⁸⁷**RESIDENTIAL BUILDING TYPES****Non-residential buildings**

Based on floor area, the breakdown by building type is composed as followed: largest portion is comprised by public and private offices (29%); then wholesale & retail (27%); educational buildings (16%); hotels & restaurants (15%); and health (6,5%)¹⁸⁸.

Figure 4: Share of non-residential building types according to floor area¹⁸⁹

	Source	Data quality	Unit	2012
Share of offices in non-residential	Estimation	%		29.234
Total floor area of offices	Estimation	Mm ²		2,032.100
Share of wholesale and trade in non-residential	Estimation	%		27.275
Total floor area of wholesale and retail trade	EC ENER/C3/2016-547/02/SI2.753931; EASME	Mm ²		1,517,910.171
Share of education in non-residential	Estimation	%		16.059
Total floor area of educational buildings	EC ENER/C3/2016-547/02/SI2.753931; EASME	Mm ²		1,225,570.251
Share of hotels and restaurants in non-residential	Estimation	%		15.013
Total floor area of hotels and restaurants	EC ENER/C3/2016-547/02/SI2.753931; EASME	Mm ²		603,551.786
Share of health in non-residential	Estimation	%		6.410
Total floor area of health care	EC ENER/C3/2016-547/02/SI2.753931; EASME	Mm ²		734,235.500

Age

A share of 42% of non-residential buildings and 38% of residential buildings were built pre-1970, before the adoption of energy efficiency measures¹⁹⁰. Many residential buildings were built between 1970 and 1990 but the **construction rate decreased after the**

¹⁸⁷ Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

¹⁸⁸ Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

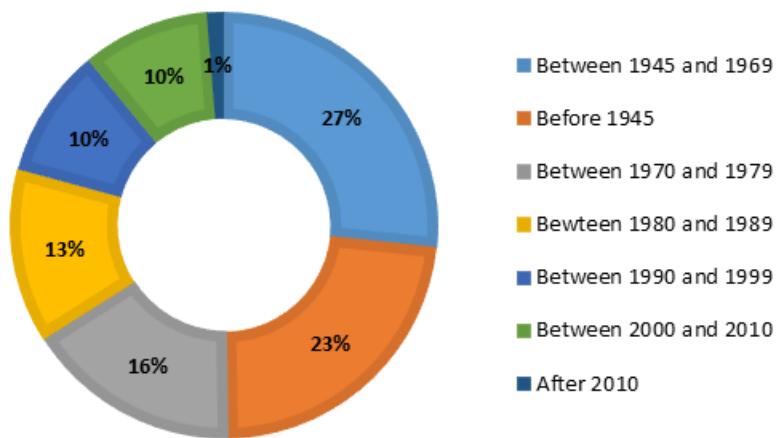
¹⁸⁹ Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

¹⁹⁰ Retrieved from RICS (2020), "Energy efficiency of the building stock in the EU

1990s¹⁹¹. Hence the necessity for a significant level of renovation to reach agreed energy efficiency targets in this ageing building stock.

Figure 5: Share of residential buildings according to the construction years

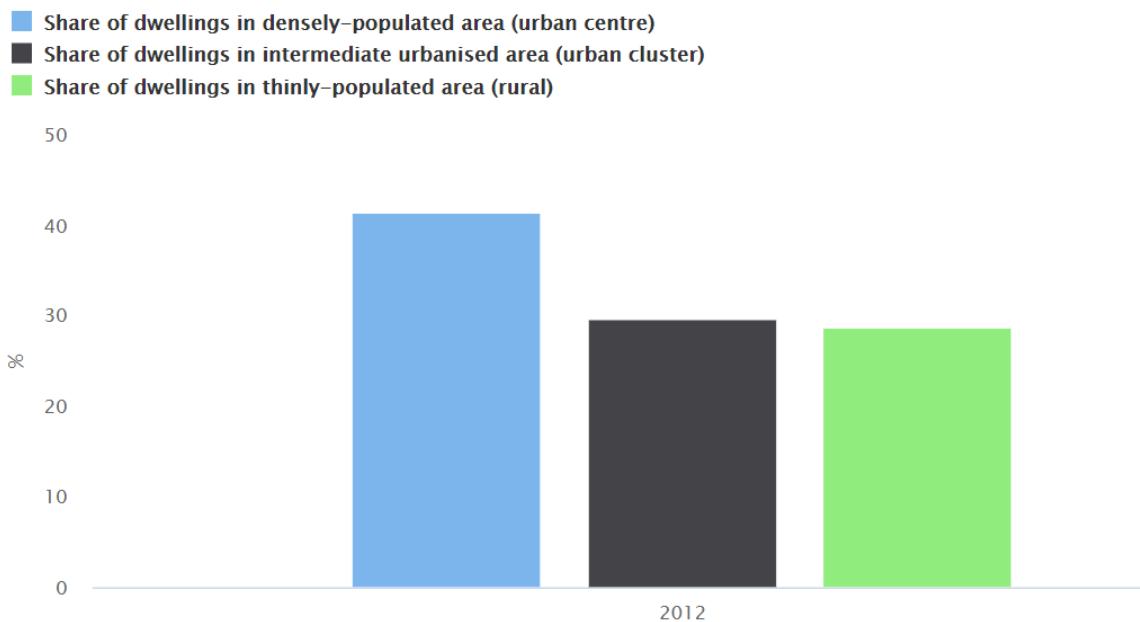
SHARE OF DWELLINGS: CONSTRUCTION AGE



Density

The largest proportion of the EU building stock is concentrated in densely populated urban centres (41,5%), and then almost equally in intermediate density urban clusters (29,6%) and rural areas (28,8%). However, the last decade has witnessed contrary trends, with **less residential buildings in urban centres, and increasing residential buildings in urban clusters or rural areas**¹⁹².

Figure 6: Share of residential buildings according to density



¹⁹¹ Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

¹⁹² Retrieved from the EU buildings database: https://ec.europa.eu/energy/eu-buildings-database_en

EUROPEAN CONSTRUCTION MARKET CHARACTERISTICS AND TRENDS

Growth

After a significant decline in March and April 2020 (-25.5%) due to the COVID 19 crisis, **construction production increased dynamically in May 2020** (21.8%) and continued to increase even though at a slower pace. It resulted that, in January 2021, 97.9% of the pre-crisis level of February 2020 has been regained¹⁹³. The recent trends of the construction production *in relation to 2015) are illustrated in the figure below.

Figure 7: EU development of construction production between January 2020 and January 2021



Employment

The construction sector provides 18¹⁹⁴ million direct jobs in the European market. The wider ecosystem of construction employees some 24.9 million people¹⁹⁵. Furthermore, the European construction market is characterized by its high fragmentation and preference for local markets due to local legal restrictions. This explains the limited mobility of workers and the entrepreneurial character of the construction industry. Indeed, 99.9% of the 5.3 million firms that make up the construction ecosystem are **micro-enterprises or small and medium-sized enterprise (SMEs)**.

Trade

The **intra-EU tradability of many construction products is limited**, given the lack of harmonization and common technical language for the performance of construction products but also given the low value-to-weight ratio¹⁹⁶.

Energy performance of buildings

Based on BPIE database¹⁹⁷, the average heating consumption levels in single-family homes in terms of final energy use (kwh/sqm/year), by construction year, did not vary

¹⁹³ Eurostat: Impacts of Covid-19 crisis on construction, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Impact_of_Covid-19_crisis_on_construction

¹⁹⁴ EC website: Construction | Internal Market, Industry, Entrepreneurship and SMEs (europa.eu)

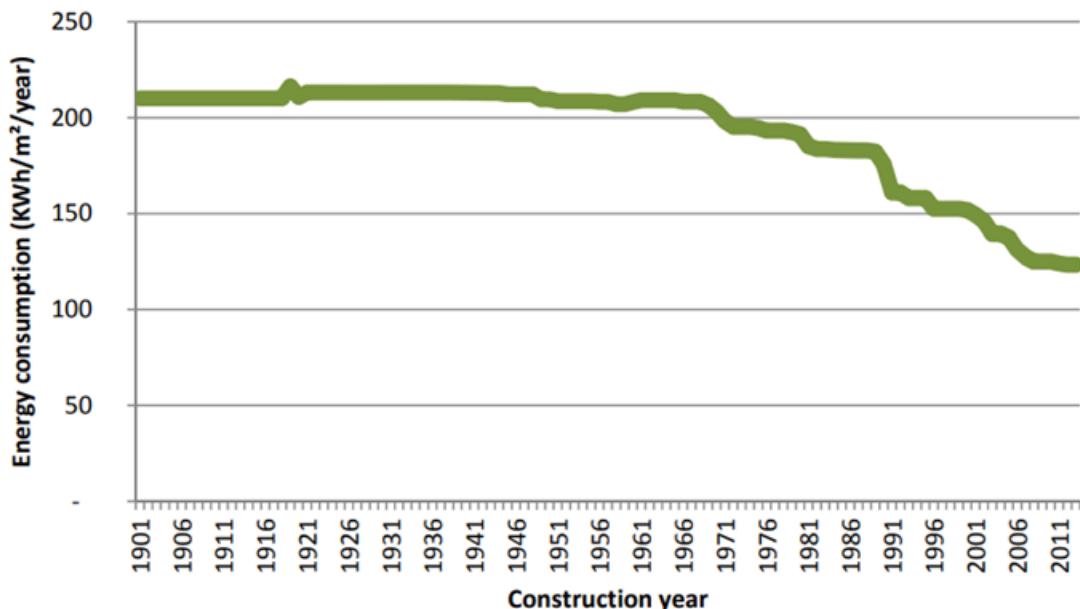
¹⁹⁵ European Commission : Annual Single Market Report 2021 https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

¹⁹⁶ Fitness Check, Chapter 3: <https://op.europa.eu/en/publication-detail/-/publication/d8474f57-9ac7-11e6-868c-01aa75ed71a1>

¹⁹⁷ BPIE (2015), Europe's buildings under the microscope – A country by country review of the energy performance of buildings, available at http://bpie.eu/wp-content/uploads/2015/10/HR_EU_B_under_microscope_study.pdf

significantly between 1901 and 1969, remaining close to 200 kWh/sqm/year. Nevertheless, between 1969 and 2011, there was a significant reduction, reaching 125 kWh/sqm/year. But still, energy remains a challenge as buildings account for the largest share of total EU final energy consumption (40%) and produce about 36% of all greenhouse emissions¹⁹⁸.

Figure 8: Average heating consumption levels in terms of final energy use of single-family homes in the EU



Market trends

More recently, several trends characterizing the construction market have been identified, highlighting current economic, social and environmental pressures¹⁹⁹:

Stagnating levels of productivity

Levels of productivity in the global construction industry have been stagnating over the past 50 years. Indeed, globally the building-materials industry is characterized by low profitability levels, with only 20% of companies in the industry experiencing growth²⁰⁰. Moreover, the typical industry's average economic profit is close to zero or captured by the highest-performing construction-materials companies – 90% of the industry's economic profit being generated by just 20% of companies. Shortages in workforce explain the growing difficulties to meet the demand of increasing investments in infrastructure.

Regional preferences

There is no or little variation in the selection of building materials within regions.

This is explained by stable regional preferences for the types of building material used in European markets at the regional levels. For instance, clay blocks is the primary construction material for walls in Germany and Belgium, but is barely used in the

¹⁹⁸ European Commission (2019), New rules for greener and smarter buildings will increase the quality of life for all Europeans.

¹⁹⁹ McKinsey (2019) report: <https://www.mckinsey.com/business-functions/operations/our-insights/value-creation-in-european-building-materials-where-do-the-opportunities-lie#>

²⁰⁰ McKinsey (2019) report: <https://www.mckinsey.com/business-functions/operations/our-insights/value-creation-in-european-building-materials-where-do-the-opportunities-lie#>

Netherlands or the UK. These regional market preferences limit innovation and construction-materials companies in balancing regional demand variations with exports²⁰¹.

Increasing big players

Recent high numbers of M&A (merger and acquisition) deals in the EU28 sector have led players to increase both in size and complexity. In 2017, France based Vinci SA was the largest construction company with 40,25 billion euros of sales²⁰².

Increasing pressure to reduce energy consumption

Materials companies are increasingly pressured by tighter environmental regulations to reduce their energy consumption and carbon emissions. Indeed, the typical cost of energy for a building-materials company represents a major cost component on the balance sheet. Moreover, there is a significant need for recycling practices as construction and demolition generate much material waste.

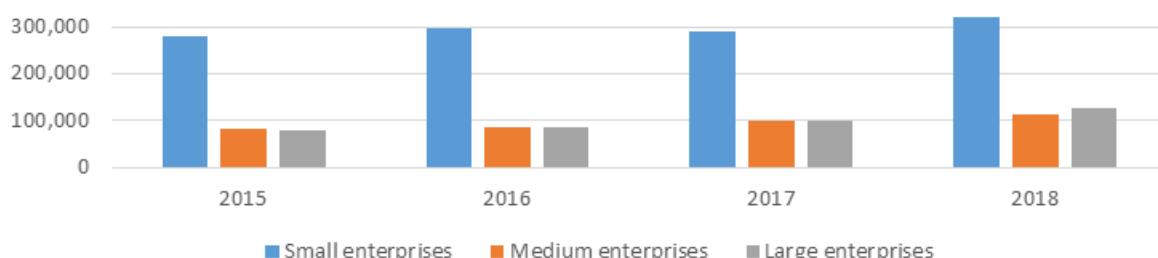
A progressive shift to digital innovation

The construction industry's value chain progressively **shifts towards digital solutions**: digital tools, automation, Building Information Modelling (BIM) etc.

ECONOMIC TRENDS

The building sector has a very important economic contribution in Europe, and it is important to note that **small and medium enterprises are currently the main contributors with almost 80% of the total turnover**.

Figure 9: Turnover (in M€) by company size in the building construction sector in Europe 27²⁰³



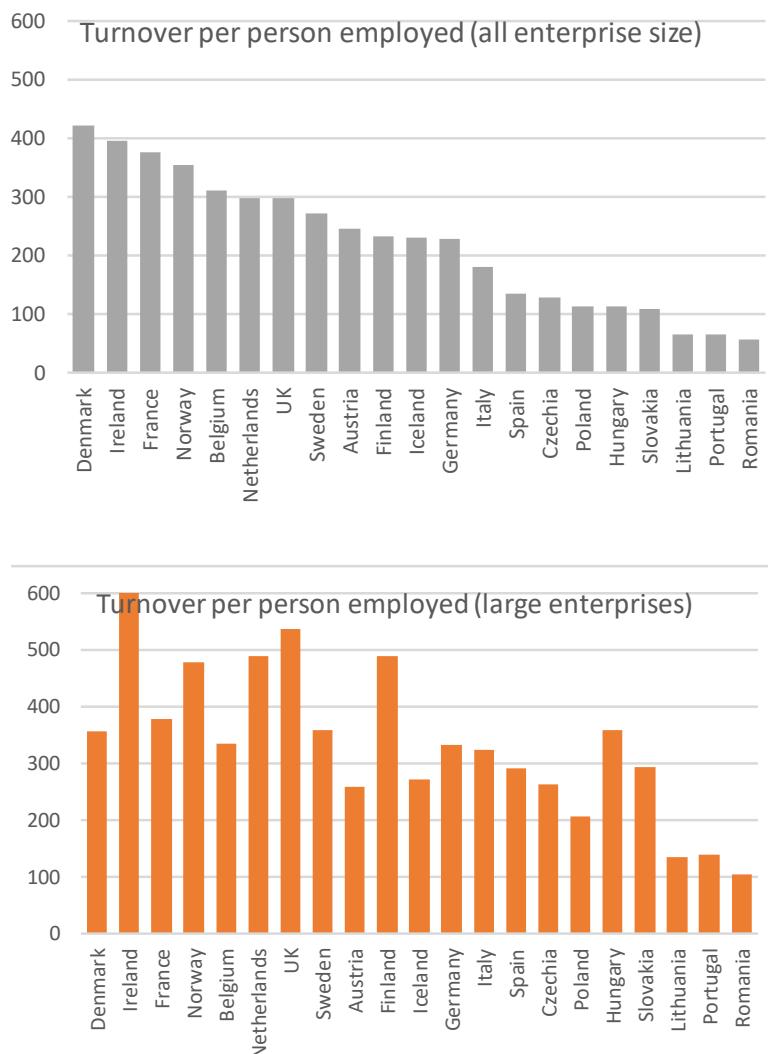
However, a certain inequality appears if these turnover figures are compared to the number of people employed by these companies. The graphs below show that **it is the larger companies that generally perform better in most countries**. It is also important to note the **income imbalance between the different countries** with extremes such as Denmark with an average of more than 400 k€ / person employed (all company sizes included) against Romania with less than 60 k€ / person employed. Without intervention it is likely that the situation will remain similar in the coming years.

²⁰¹ McKinsey (2019) report: <https://www.mckinsey.com/business-functions/operations/our-insights/value-creation-in-european-building-materials-where-do-the-opportunities-lie#>

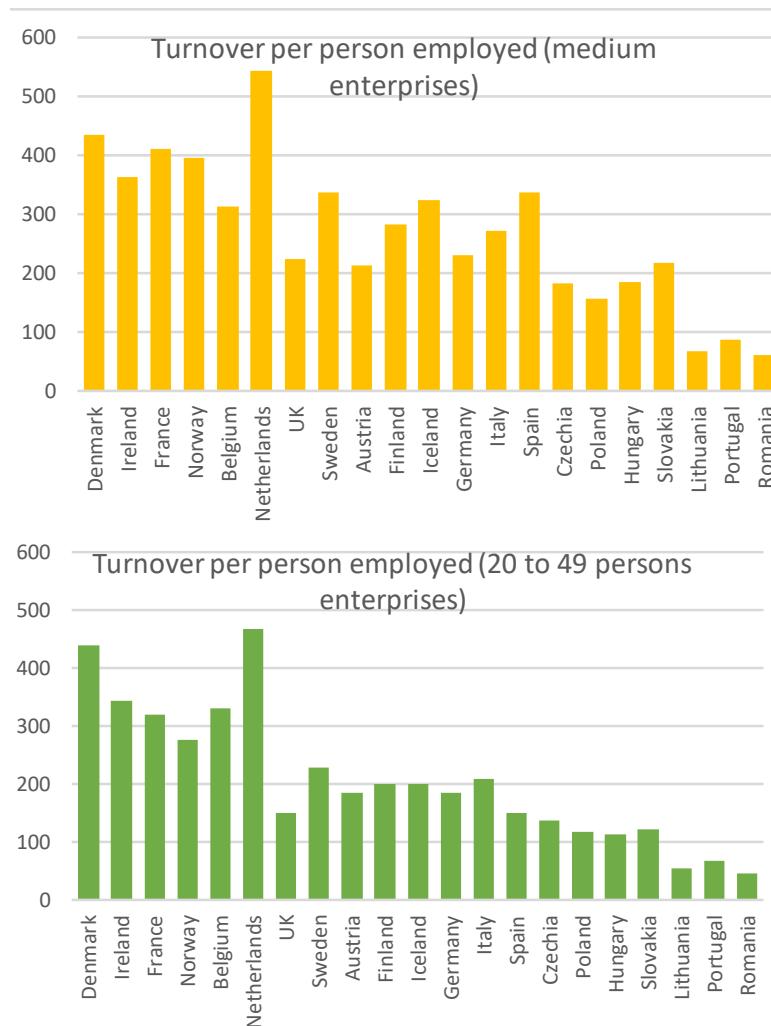
²⁰² Statista: Construction industry in Europe - Statistics & Facts | Statista

²⁰³ Eurostat, 2017, Construction of buildings statistics - NACE Rev. 2 - Statistics Explained (europa.eu)

Figure 10 : Turnover per person employed (k€) per enterprise size in various European countries, 2018 (only countries with enough data are presented)²⁰⁴



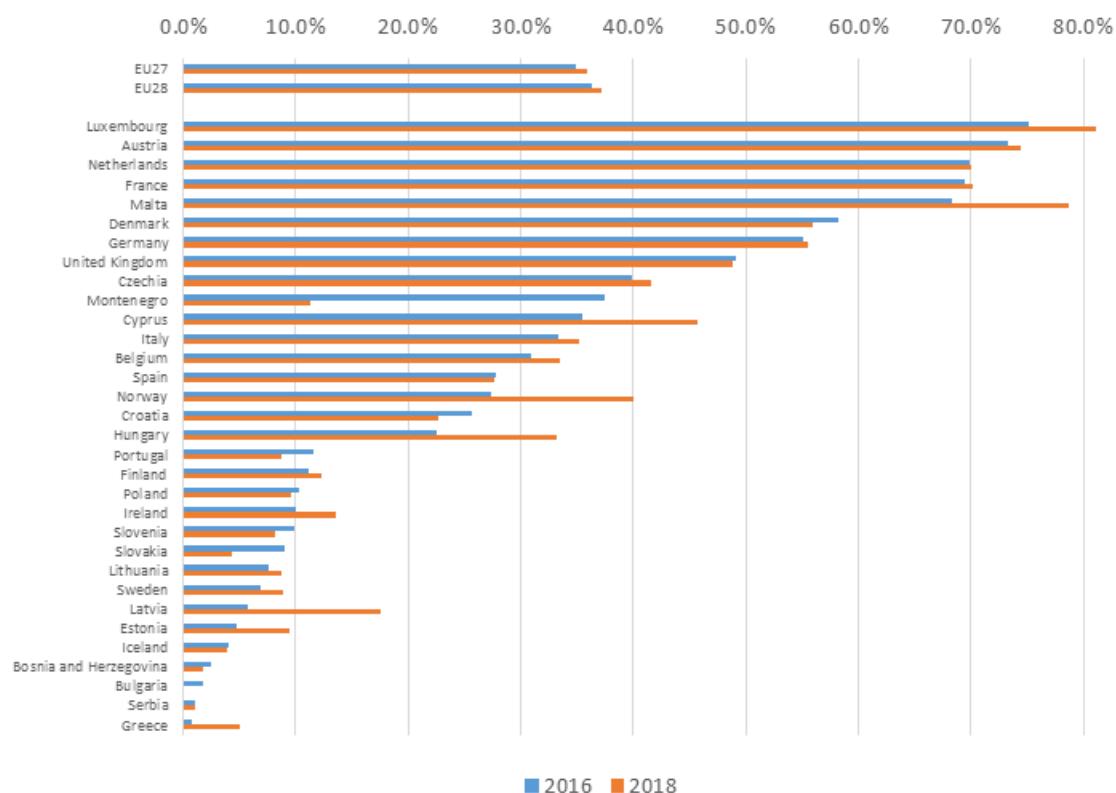
²⁰⁴ Eurostat, 2017, [Construction of buildings statistics - NACE Rev. 2 - Statistics Explained \(europa.eu\)](#)



ENVIRONMENTAL TRENDS

The impact of the sector is not limited to the construction of buildings, but also to their maintenance, use, renovation and waste treatment. The last topic is particularly relevant to the circular economy, especially concerning construction waste, which is one of the most relevant areas of application of circular economy principles. In the EU 28 the generation of the construction waste between 2016 and 2018 has increased from 37.7 to 41.2 million tonnes²⁰⁵. Between 2004 and 2018 the generation of construction waste has increased by 19.7%. A similar trend of growth in the building sector is observed for construction waste, which is more or less pronounced depending on the country.

²⁰⁵ Eurostat, 2016, 2018, [Waste statistics – Statistics Explained \(europa.eu\)](https://ec.europa.eu/eurostat/statistics-explained/index_en.htm)

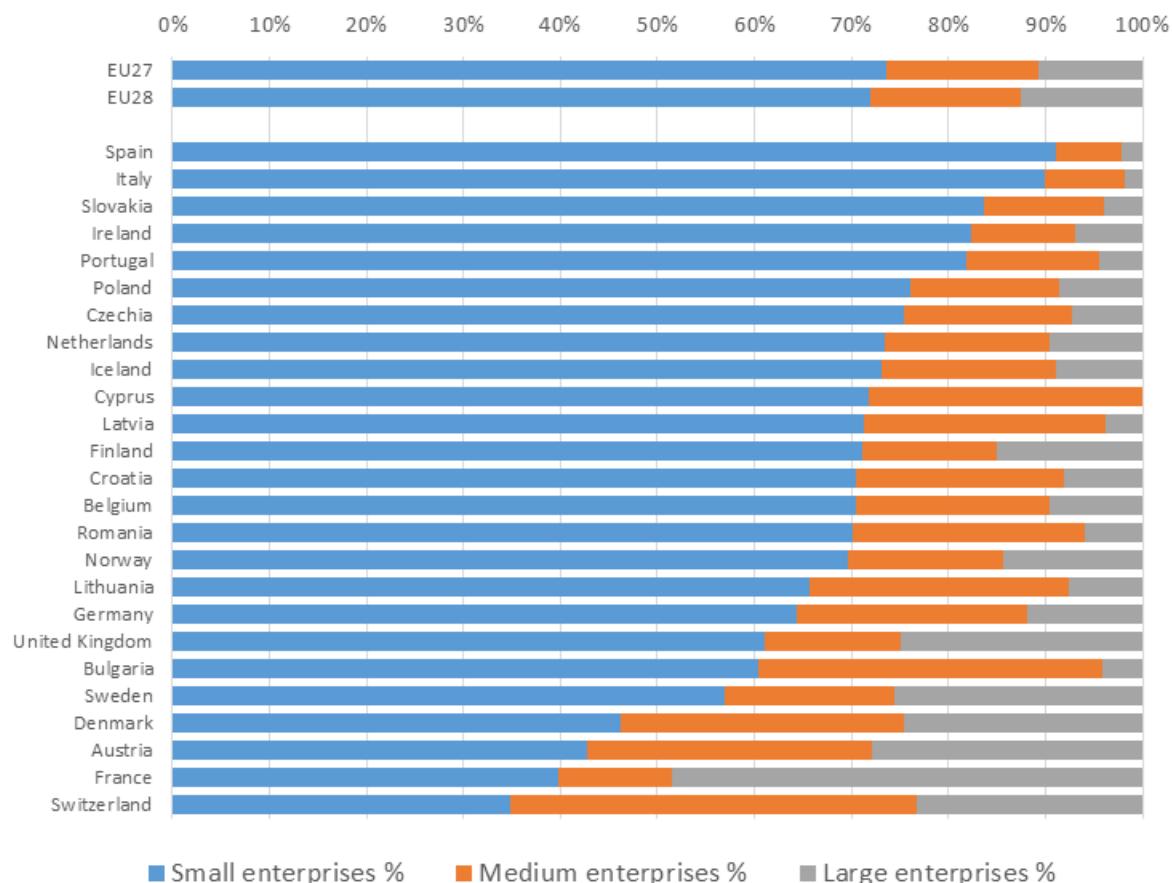
Figure 11 : Share of construction waste in Europe²⁰⁶

SOCIAL TRENDS

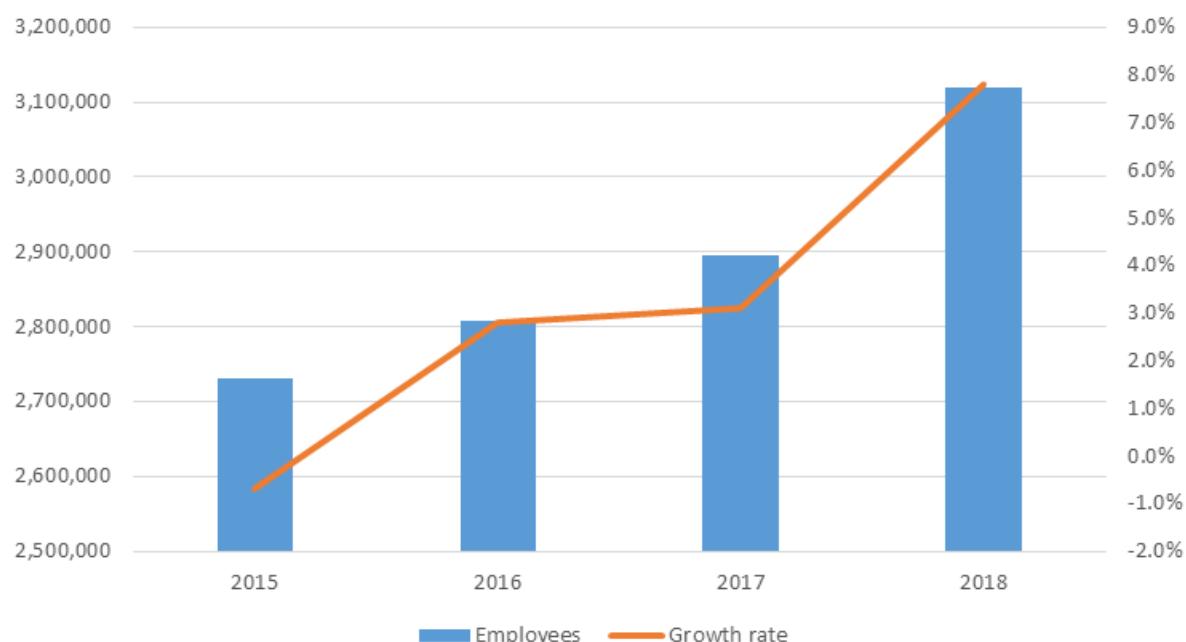
The building construction sector is a major sector of economic activity and employment in Europe accounting **for 2.3 % of the total employment in the EU in 2017 (EU28)**²⁰⁷. Although the relative importance of small and medium-sized enterprises may vary from one country to another, it is nevertheless significant, with nearly 90% of jobs in the sector at the European level, as shown in the graph below.

²⁰⁶ Eurostat, 2016, 2018, [Waste statistics - Statistics Explained \(europa.eu\)](#)

²⁰⁷ Eurostat, 2017, [Construction of buildings statistics - NACE Rev. 2 - Statistics Explained \(europa.eu\)](#)

Figure 12 : Distribution of employment in the building construction sector, 2017²⁰⁸

Furthermore, with regard to employment, the trend is also towards growth with an **increase in the number of people working in the sector**.

Figure 13: Growth of employment in the European building construction sector

²⁰⁸ Eurostat, 2017, [Construction of buildings statistics - NACE Rev. 2 - Statistics Explained \(europa.eu\)](#)

ANNEX 2: SUMMARY OF CASE STUDIES

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	
H. Waste Reduction	✓

KEY LEARNINGS

Be Circular Construction Monitoring Dashboard is considered a first step towards gathering data and measuring the state of circular economy for the construction sector in the Brussels region and its potential for improvement. The programme is promoting market creation for materials reuse. Rotor Deconstruction, a company that is active in the salvage of building materials has received funding through Be Circular for two research and demonstrator projects

However, it was quite challenging to gather relevant and robust data, as there was no previous systematic data collection in the construction sector, and also a lack of clear regulatory framework for distinguishing recycling, reuse (avoiding material destruction), and preservation of existing buildings (avoiding building demolition). Business support such as public subsidies and dedicated trainings can help overcome these challenges.

OWNER(S)

- Brussels Environment (the public service responsible for the environment and energy at the Brussels-Capital Region) including several other ministries and public agencies.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

1. BE CIRCULAR – CONSTRUCTION FOCUS

Belgium, 2017-Ongoing

www.circulareconomy.brussels/wp-content/uploads/2019/06/BE_beCircular_feuille-de-route-CD_def_FR1.pdf

BACKGROUND

Strategy 2025 for Brussels gives a regional objective to reduce greenhouse gas (GHG) emissions by 30% in 2025 compared to 1990. It led to the establishment of the PREC (Programme Régional en Economie Circulaire) in 2017 in Brussels – the principal organisation responsible for the launch of the particular focus on circular economy for the building & construction sector within Be Circular.

KEY OBJECTIVES

Be Circular is a programme aiming at promoting and enhancing circular economy in the Brussels region in Belgium. It covers many sectors, including the construction sector. Two initiatives were chosen as most representative of the work done globally by Be Circular on Circular economy for the construction sector:

- The **Construction Monitoring Dashboard** which aims to collect data on circular economy (CE) aspects in buildings and to measure the state of circular economy for the construction sector in the Brussels region and its potential for improvement.
- The **Roadmap for the construction sector in Brussels** sets both specific CE targets for buildings as well as for cities at a more general level.

The Dashboard is a subset of a government led voluntary initiative, and the roadmap is voluntary aiming to make way for a mandatory initiative for public buildings in 2030, which will be expanded to all buildings in 2040.

Rotor Deconstruction, a company that is active in the salvage of building materials has so far received funding through Be Circular for two research and demonstrator projects; however, more business support is needed such as subsidies and training.

KEY OUTCOMES

- The main anticipated outcome is to develop circular economy indicators and provide specific data for the Building and Construction sector in the Brussels region.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

- A. Standards
- B. Whole Lifecycle
- C. Reuse Market
- D. Proportionality
- E. Deconstruction
- F. Durability
- G. Adaptability
- H. Waste Reduction

KEY LEARNINGS

Some key challenges have been to reduce the stakeholder's perceived risk associated with new building techniques and circular design approaches, as well as the lack of trust between actors in the sector. It appeared that circular innovation can be difficult as contractors and investors prefer to avoid risks associated and prefer traditional techniques. For this reason, it is important to stimulate research and innovation, not only from a technical point of view, but also from a systemic one.

OWNER(S)

- OVAM, the Public Waste Agency of Flanders (initiator and main financier)

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

VOLUNTARY INSTRUMENT
INFORMATION PROVISION
REGULATORY
BUSINESS SUPPORT

2.CIRCULAR FLANDERS

Belgium, 2016-Ongoing

www.vlaanderen-circulair.be

BACKGROUND

The Government of Flanders has set circular economy as one of seven transition priorities and appointed OVAM as the initiator of Circular Flanders. Circular Flanders is a hub gathering representatives of governments, companies, the civil society and the knowledge community to work on circular economy. It is focusing on 3 themes: circular city, circular business strategies and circular purchasing. The focus is not only on the construction sector but across the economy. Three initiatives deployed through Circular Flanders are linked to construction: Green Deal aims at spreading knowledge on circular projects and engage public and private actors, the Living Lab's purpose is to conduct experimentations and researches, and finally, in 2020, Circular Flanders launched a project call related to systemic challenges in the construction sector.

KEY OBJECTIVES

Circular Flanders aims at being a networking platform, linking partners together, it acts as a hub, spreading and sharing knowledge on circularity. Its objective is also to stimulate and accelerate circular innovation and to act as a laboratory to support new ideas. Finally, Circular Flanders also provides policy guidance and supports coordination with public authorities. Overall, Circular Flanders' goal is to help all stakeholders to embed good practices and scale-up initiatives linked circular economic principles. All these objectives are embodied in different ways in the different initiatives supported by Circular Flanders. Green Deals are focused on networking and spreading knowledge, the Living Lab and project calls stimulate innovation.

KEY OUTCOMES

Outcomes depends on the initiatives supported by Circular Flanders. For the Green Deals, the key outcome is the engagement of stakeholders and their commitment to share information. The Living Lab's objectives is to come up with recommendation for the construction sector and policy makers, as well as taking inspiration from the conducted researches to draw a transition plan. Project calls aims at financing pilot project and share the main results. Overall Circular Flanders is a tool helping and spreading good practices in circular economy to all stakeholders.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

It is difficult for private projects to embrace the circular economy principles of the policy as there is currently limited knowledge in industry and there is perception that it will be more costly and risk competitiveness. Some designers have successfully adopted the principles but overall, the industry would prefer mandatory guidance so there is a level playing field for competing businesses.

In future revisions there is a desire to include more examples of circular economy initiatives in practice. The policy may also be adapted to ban demolition in certain situations, requiring existing structures to be retained.

OWNER(S)

- City of Copenhagen

*European Commission (2020). Designing buildings in the context of the circular economy.
https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

3.COPENHAGEN ARCHITECTURE POLICY

DENMARK, 2017-2025

https://kk.sites.itera.dk/apps/kk_pub2/pdf/1904_4b203fafa9a8.pdf

BACKGROUND

Denmark and Copenhagen architectural policies have been in place since 2007 and 2010 respectively and are updated every 7 years or so. They include typical architectural aspects of character, cultural heritage and liveability. Driven by Copenhagen's 2025 Climate Plan Roadmap 2017-2020 and Resource and Waste Management Plan 2024, the new Architecture Policy 2017-2025 embeds circular economy principles in design. The policy is a requirement for city projects and the aim is to lead the industry by example, particularly on evolving circular economy aspects. There is a strong desire to retain architectural heritage in the city.

KEY OBJECTIVES

The objective is to facilitate dialogue with building clients, architects, planners and landscape architects about construction projects, plus give an insight into Copenhagen's key goals and focus areas. A number of circular economy principles should be considered during design. Responsible design needs to: meet environmental and climate challenges; provide flexibility, durability and resource efficiency including design for deconstruction; and adapt the city to the climate of the future. The policy also encourages the use of materials that can be recycled, lifecycle assessment and total cost of ownership analysis.

City officials also require the use of a new Sustainability dialogue tool to demonstrate how projects are addressing design goals. This helps to raise dialogue on key issues early in the planning and design process.

KEY OUTCOMES

- 6 pilot projects (public buildings), both renovation and new build, are being used to develop experience with circular economy principles.
- A series of lectures, public debates, further education training of municipal employees, and annual architectural design awards are coordinated by the City.
- Requirements on city funded projects valued over 20M DKK or on city-owned land as a condition of sale or development. LCA and DGNB assessment are required conditions in sales contracts.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	
D. Proportionality	✓
E. Deconstruction	
F. Durability	
G. Adaptability	
H. Waste Reduction	✓

KEY LEARNINGS

A challenge when the new circular economy aspects were introduced was a lack of examples for the industry to follow and lack of knowledge on LCA methodologies and tools. The transfer to DGNB provides a more holistic and standardized approach that is already familiar to the sector and reduces the burden of multiple approaches. The City's 2016 sustainability standard is still valid on smaller value projects as not all projects are suitable for DGNB certification, i.e. small projects or civil works. Future versions will continue to align with the requirements in DGNB for consistency.

Overall, there are insufficient resources available for the City to carry out regular implementation reviews, validating the extent to which the standard is implemented or how the criteria are being met.

OWNER(S)

- City of Copenhagen

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

4.SUSTAINABILITY IN CONSTRUCTION & CIVIL WORKS

DENMARK, 2016+ (1st Version 1998)

www.kk.dk/sites/default/files/sustainability_in_construction_and_civil_works_2016.pdf

BACKGROUND

Copenhagen's Sustainability in Construction & Civil Works is not formal regulation but is a mandatory client standard for construction and civil works commissioned or supported (funded, or on land being sold) by the City to ensure that substantial city works are managed in an environmentally responsible way. There is overlap with the Copenhagen Architecture Policy 2017-2025 as both have requirements for LCAs and recycled/ recyclable materials, but the Architecture Policy specifically targets designers. This sustainability standard is more focussed on the construction phase.

KEY OBJECTIVES

The aim is to set performance standards that exceed the existing regulatory requirements but are achievable, thus leading by example and pushing the construction industry towards improved sustainability. There are a number of elements in the latest version that contribute to circular economy such as: requiring LCA and choosing a design with the least possible environmental impact; ensuring key building materials have an Environmental Label; the assessment of reusable building components; sorting and source-cleaning of materials suitable for recycling during demolition/renovation; and the requirement of a plan for sorting and managing building waste. The aim is to inspire private developers to also use the criteria. Revisions take place every 4 years or so to ensure updates are made in line with developing policies. In 2020, municipal projects over DKK 20M (approx. €2.5M) must instead achieve DGNB certification in place of this standard.

KEY OUTCOMES

It has driven improved standards on City projects and encourages stakeholders to upskill, adapt, and develop new expertise, which brings benefits in line with policy aspirations. Practitioners agree that although the standard was quite forward-thinking when introducing circular economy elements in 2016, it has made a difference over time and the principles are now becoming normalized. In general, practitioners are also positive about recent alignment with DGNB, as it provides a more holistic and standardised approach to delivering against sustainability requirements. DGNB is already popular in private (mostly commercial) buildings, so practitioners are familiar with the process.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

The intention of the testing phase was to understand user experiences working with Level(s) as well as how it impacted their possibilities to work more sustainably.

The main challenges reflected by stakeholders during the pilot were data availability, user friendliness (since it is targeted to the entry level of the market) and upskilling. Another highlighted issue was the integration of Level(s) with existing standards. To overcome those challenges, Level(s) needs to be part of a wider ecosystem e.g. to work with existing databases. Some online training will be available for the targeted actors and notes have been added in the guidance document to explain how issues with national legislation compatibility should be reported. Business support to regional/local entities would also boost dissemination and implementation of the tool.

OWNER(S)

- European Commission – DG Environment

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

VOLUNTARY INSTRUMENT GREEN PUBLIC PROCUREMENT SUSTAINABLE FINANCE

5.LEVEL(S) FRAMEWORK TESTING PHASE

Europe, 2017-2021

- https://ec.europa.eu/environment/topics/circular-economy/levels_en
- <https://ec.europa.eu/environment/eussd/levelsnewsletters/documents/levels%20newsletter%202019%20feb.pdf>

BACKGROUND

As part of the EU Circular Economy Action Plan, now an essential element of the European Green Deal, the European Commission developed Level(s) – the European framework for sustainable buildings. It builds upon the objectives of both the EU Green Deal and the EU Circular Economy Action Plan, by supporting efforts of the building sector in improving life cycle performance and bringing the building sector into the circular economy. This includes the improving of energy and resource efficiency, thereby reducing overall carbon emissions.

KEY OBJECTIVES

As a voluntary initiative, the Level(s) framework aims to promote a common language across Europe to assess and report on the sustainability of buildings. Level(s) proposes several indicators covering three main areas (Resource use and environmental performance; Health and comfort; Cost, value, and risk), which have been developed based on existing standards as well as a life-cycle approach to measure and support improvement from design, construction, use and end of life, for both residential buildings and offices.

The pilot phase of the Level(s) framework aimed to test and validate the choice of indicators and to guide future design of supporting tools under the initiative. It involved a wide range of stakeholders across several EU Member States, from investors to designers and manufacturers, in order to identify the most effective approaches for scaling up the tool. Half of the test phase case studies received direct support from local organisations:

- Italy - iiSBE supervised 18 projects along with partners such as the Catalan government and a French regional environmental agency.
- Finland - the Ministry of Environment oversaw 20 projects with a directory of mixed public and private actors.
- Denmark - the Danish Association of Architectural Firms offered technical support.
- France - the French building council organised workshops.

KEY OUTCOMES

The Level(s) framework builds on, as much as possible, existing standards and aims to provide a common language to measuring the sustainability of buildings throughout the life-cycle. It also aims for a global alignment of tools if certification schemes pick up the Level(s) Framework (which DGNB has already started doing). In addition, Green Public Procurement criteria for offices and schools, new build and renovation should be published in 2022, based on the Level(s) Framework.

VOLUNTARY AGREEMENT

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

The approach is very new for the sector so effort must be placed on awareness raising and training. There was an initial roadshow and there are regularly scheduled workshops. Demolition processes are being reviewed in parallel with construction processes to also improve design and construction that facilitates demolition.

The lack of baseline quantitative data made it challenging to determine and set quantifiable targets acceptable to all stakeholders. Targets and actions are therefore heavily reliant on sector feedback; however, the initiative will gather data towards improving this position.

OWNER(S)

- Ministry of the Environment
- RAKLI ry (Finnish Association of Building Owners and Construction Clients) represents around 75% of Finland's real estate/construction market. Companies report their commitment through Finland's official commitment 2050 website.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

6. GREEN DEAL AGREEMENT ON SUSTAINABLE DISMANTLING

FINLAND, 2020-2025

<https://situomus2050.fi/sv/kestavapurkaminen#/>

BACKGROUND

85% of Finland's CDW is generated during the repair and demolition of buildings. The National Waste Plan to 2023, titled 'From Recycling to a Circular Economy', identified various measures to prevent, reuse and recycle CDW. In 2019, the Ministry of Environment released a series of demolition guides to support higher quality planning and implementation of demolition works.

KEY OBJECTIVES

By 2022, 50% of RAKLI property owners will complete demolition surveys before applying for a demolition permit and this will increase to 75% by 2025. The aim is to stimulate the market for materials arising from renovation and demolition and thus increase the reuse and recycling of demolition materials. The main objectives are:

- develop guidelines for material-efficient decommissioning
- improve the collection and quality of data on materials that will arise from renovation and demolition projects along with their re-use and recycling potential through the introduction of demolition mapping (pre-demolition audits)
- strengthen the knowledge base on demolition materials and their utilisation
- develop and expand digital tools that enable reuse and recycling such as the government administered, free to use, web-based material exchange platform – 'Materiaalitori'.

The Materiaalitori service aims to show that 'waste' materials are valuable raw materials that should be circulated as long as possible. Under the Waste Act, its use is mandated for public waste holders and certain supplementary waste management services.

KEY OUTCOMES

- Significant increase in quality and quantity of data on materials that will arise from demolition and large renovation
- Determination of the level of detail and accuracy required for demolition reporting (to help guide amendments to the Land Use and Building Act)
- Identification of potential materials for reuse and recycling at the earliest possible stage for web-based exchange platforms

**CIRCULAR ECONOMY
PRINCIPLES FOR BUILDINGS
DESIGN***

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	✓
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

**7. PROCUREMENT CRITERIA FOR LOW
CARBON BUILDING**

FINLAND, 2017 - 2025

https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160737/EG_2017_Producement%20criteria.pdf?sequence=1&isAllowed=y

KEY LEARNINGS

Defining the low carbon requirements of a building is sometimes challenging for public procurers and it is overall a challenge to adopt new ways of doing things for both contracting authorities and suppliers. Though it is a voluntary initiative, it is fully administered by the government and therefore, time and resources must be allocated to implementation, monitoring and evaluation. Unfortunately, there has not been enough capacity to fully sustain this.

Finland's rapid increase of low carbon initiatives led to significant advancement in the development of GPP and lifecycle assessment guidance while this initiative was still in early stages. The assessment method has subsequently changed and there are still some technical questions regarding the new assessment method and database. Ultimately, the Ministry of the Environment also aims to set carbon emission limits for different building types before 2025.

OWNER(S)

- Ministry of the Environment.
- KEINO Competence Centre for Sustainable and Innovative Public Procurement (funded by The Ministry of Economic Affairs and Employment) also supports public organisations in the promotion of sustainable and effective public procurement.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

BACKGROUND

In 2013, Finland's government adopted a decision-in-principle on the promotion of new and sustainable environmental and energy solutions in all public procurement. In 2017, the National Energy and Climate Strategy for 2030 set further construction objectives to: promote wood construction for long-term carbon storage; reduce the carbon footprint of construction materials; improve the material efficiency of construction; and provide procurement instructions to reduce the carbon footprint of construction. The Act on Public Procurement was updated to enhance its use as a strategic tool for sustainable development and voluntary low carbon public procurement criteria (being revised and transitioned to mandatory) were developed for building projects implemented with public funds under the Act.

KEY OBJECTIVES

The initiative aims to enhance lifecycle thinking in construction, encourage more efficient use of public funds and promote high quality innovative and sustainable procurement. The guide provides GPP suitability requirements for tenderers and cost estimates. It includes considerations for energy, materials and innovation. Recommended criteria include categories for: designing a low-carbon new building; designing low-carbon renovations; contracts/ material and equipment procurement; and Design, Build & Operate model in low-carbon building. The included comparison and calculation methods are largely based on the European Commission's recommendations on green public building and Finnish public procurement and lifecycle design guides. This enables comparable calculations across projects. It covers all publicly owned and operated buildings such as schools and clinics, also new build and renovations.

KEY OUTCOMES

- 9-city roadshow across the country for dissemination seminars on the lifecycle benefits of sustainable procurement for the municipal economy, the environment and the business community.
- The creation of a low carbon construction developer group to support the government's goal. Tasks include: dialogue with public procurers and other relevant stakeholders for feedback on challenges and opportunities; publication of procurement examples; providing public procurers with information on building lifecycle climate impacts and the importance of renovating existing buildings (instead of demolition) where feasible.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	✓
E. Deconstruction	
F. Durability	✓
G. Adaptability	
H. Waste Reduction	

KEY LEARNINGS

The implementation of the road map requires the expertise of the Finnish real estate and construction sector to be developed. There is also feedback that responsibilities for assessments need to be clearly assigned in the requirements.

Thresholds for different types of buildings are still being developed and these will be strengthened over the years to push the construction sector enough to meet overall climate targets.

Generally, designers and architects are very interested in the roadmap and several actors want to make their own tools based on the methodology to support low carbon design and create new business services.

OWNER(S)

- Ministry of the Environment

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

8. LOW-CARBON ROAD MAP FOR BUILDINGS AND BUILDING MATERIALS

FINLAND, 2017 - 2025

https://www.ymparisto.fi/fi-FI/Rakentaminen/Selvitys_rakennusten_hallitustaloustoimien_vaiheesta_1

BACKGROUND

The 2017 Finnish roadmap to low-carbon construction aims to incorporate whole life carbon (WLC) assessment of buildings within Finnish building regulations by 2025. Regulations will include a standard method for assessing the carbon footprint of buildings that complies with EU Level(s) and EN15978. The regulations will be targeted at asset managers and building owners of new buildings and buildings undergoing extensive repairs. The roadmap contributes to the broader Nordic declaration from August 2019 for the Nordic region to become a global leader in combating climate change and achieve a more sustainable society. It also contributes to the reform of the Land Use and Building Act in Finland, which is in progress.

KEY OBJECTIVES

The method for assessing the carbon footprint of buildings aims to help with the calculation of the climate impact of construction over a building's entire life cycle. The roadmap's projects aim to deliver a solid starting point for further national regulation and the development of official guidelines for the construction industry in Finland. Development has already started on a national emissions database that is managed by the Finnish Environment Institute in close collaboration with industry. The database will contain emissions data on building materials, construction, transport and waste management.

KEY OUTCOMES

The overall proposed outcomes are the reduction of the carbon footprint of construction and construction materials and promotion of climate objectives related to the Finnish construction and real estate sector. Financial assistance from the low carbon construction advisory service was available for organisations that wanted to test the methodology on their building projects. The assessment method was also supported by an external website launched by Green Building Council Finland for both public and private operators where more than 40 projects were registered for testing the calculation method.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	
H. Waste Reduction	✓

KEY LEARNINGS

The establishment of an EPR scheme targeting construction materials will help improve waste management and address illegal dumping in the sector. There are industry concerns that the scheme will lead to additional costs and eventual bankruptcy but municipalities and environmental NGOs have welcomed the law as a potential solution to the problem of uncontrolled waste disposal.

There may be some overlap due to existing EPR schemes and associated PROs for furniture, paint and WEEEs such as lamps. It will be decided whether one dedicated EPR scheme should be exclusively in charge of buildings, or if the existing EPR schemes will evolve to cover this new waste stream.

For the recycling sector, higher collection rates are needed to further encourage reuse and recovering of building materials. Practical implementation should be adapted at the operational and local level, taking into account what has already been put in place for example on waste sorting by some start-ups and through awareness raising campaigns

OWNER(S)

- French Ministry for Ecological and Inclusive Transition.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

9. FRENCH ANTI-WASTE LAW FOR THE CIRCULAR ECONOMY (AGEC)

FRANCE, 2020-Ongoing

https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

BACKGROUND

The building sector generates about 42 million tonnes of waste in France. This waste stream is often littered or thrown into illegal dumps. Each year, the removal and clean-up of these dumps represents a cost for cities, and therefore for taxpayers, estimated between 340 and 420 million euros. In this context, several measures of the recent French anti-waste law for a circular economy target the building sector and are intended to improve construction waste management and fight against illegal dumping.

KEY OBJECTIVES

The French Anti-Waste Law for the Circular Economy (AGEC) was established under the French Environmental Code and contains about 50 measures aiming to help change the French society model "from a linear economy to a circular economy," where waste is minimized and resources are reused as much as possible. Some of these measures target the building sector, including the establishment of a new Extended Producer Responsibility (EPR) scheme based on the polluter pays principle that will cover construction products materials by 2022.

The new EPR scheme for the construction sector will establish a free return scheme for sorted waste; requirements related to transparency and traceability on environmental & health impacts of the materials concerned; new waste prevention and eco-design action plans to be updated every 5 years to improve recyclability and inclusion of recycled materials; and new professional waste collection centers, including improvement of network density for building waste collection points. There may be several producer responsibility organization –PROs in charge of this scheme.

KEY OUTCOMES

The proposed outcome is the establishment of a free take-back system for sorted building waste, which would help to improve the recovery rates of construction /materials. For example, an impact study estimated that overall 67% of building materials/waste can be recovered following the launching of the scheme: the volume of inert waste produced annually in France is approximately 9.7 million tons, as such the establishment of a clear legal framework for this waste flow would help to reduce 300 to 400 kilotons of uncontrolled waste deposits, which mainly comes from demolition sites.

VOLUNTARY AGREEMENT
FINANCIAL INSTRUMENT
INFORMATION PROVISION

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	
D. Proportionality	
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	

KEY LEARNINGS

The E+C- trial scheme encouraged the industry to produce data for their products and allowed national authorities to gather some representative information to help prepare and adjust future regulation. However, stringent performance threshold levels set under the E+C- label led to low participation in the trial and while there was overall encouragement for manufacturers to produce better data on their products, some of the submitted data was of very low quality and not useable. The requirements were considered burdensome for smaller manufacturers and the use of generic data was also problematic, emphasizing the need to establish comprehensive national databases.

OWNER(S)

- Ministry of the Ecological Transition
- The Higher Council for Construction and Energy Efficiency (CSCEE)

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

10. ENERGY-PLUS & CARBON REDUCTION BUILDINGS (E+C-) TRIAL SCHEME

FRANCE, 2016-2020

<http://www.batiment-energiecarbone.fr/en/>

BACKGROUND

In line with the Paris Agreement, France is engaging the building industry towards the ambition to produce buildings with positive energy and low carbon footprint, through the enforcement of a new environmental regulation (RE 2020) for new buildings (replacing the Heating Regulation – RT 2012). Within this framework, the Ministry of Ecological Transition in collaboration with the representatives of the construction industry launched a trial phase of this legislative project.

KEY OBJECTIVES

The main goal of the E+C- scheme was to reduce the overall carbon footprint of buildings by using low carbon and energy efficient materials. The activities and objectives of this trial scheme included:

- Preparing the industry for the construction of energy efficient buildings and promoting the adoption of eco-friendly technologies and procedures
- Getting operators involved in the development of the future legislation towards creating high-performance buildings in a cost-effective way;
- Driving innovation in the construction sector, in terms of both energy systems and building methods with lower carbon footprints.

The trial scheme also involved the development of the E+C- label which indicates that a building meets precise performance targets based on a lifecycle approach. Calculation software (Elodie) was developed for participants and it used data from the national database on the environmental and health assessment of buildings in France or generic data from the software.

KEY OUTCOMES

- The E+C- trial scheme will allow to define an effective methodology for assessing the impacts of buildings within the framework of future regulation i.e. to establish for each type of building the minimum performance levels to be achieved in terms of carbon footprint and energy consumption.
- Regarding the carbon indicator, new buildings aiming for certification must perform a full lifecycle carbon analysis (LCA), with two levels of performance recognised: "Carbon 1" and "Carbon 2" which will support the implementation of low-carbon practices and reduce the overall carbon footprint of buildings.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Building labeling can be an effective consumer information scheme, addressing the lack of transparency issue in the construction sector. It would also create a market signal placing a higher value on a higher-performing building in terms of lifecycle carbon footprint and energy performance. However, there has been low uptake with the BBCA scheme due to the voluntary nature of labeling hampering the effective deployment of the approach, and also due to a lack of local promotion. In some cases, there are also opposing recommendations such as encouraging the use of concrete over wood.

As part of local plans, some municipalities are encouraging the labelling process of buildings by requiring real estate developers to certify new buildings or renovation projects. For example, the city of Paris and the Ile-de-France region have integrated the BBCA label in their housing policies and propose some financial incentives to BBCA certified (low-carbon) buildings.

OWNER(S)

- French Association for the Development of Low Carbon Buildings (Association BBCA)

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

VOLUNTARY AGREEMENT INFORMATION PROVISION

11. BÂTIMENT BAS CARBONE LABEL

FRANCE, 2016-Ongoing

www.batimentbascarbone.org/label-bbca

BACKGROUND

The association for the development of low carbon buildings, Association BBCA, launched the first French label to measure the carbon footprint of new buildings over its entire life cycle. This was in response to studies that demonstrated the important contribution of the conception and construction phase to the total carbon footprint of new buildings (which represent about half of the carbon emissions in weight over a 50-year lifecycle of buildings). The label is now being used in the E+C- trial scheme to develop the future national environmental regulation RE 2020 for the construction sector.

KEY OBJECTIVES

The low carbon building label certifies the exemplary nature of a building in terms of carbon footprint by taking into account the carbon emissions over its entire lifecycle (for a reference period of 50 years), on the basis of a LCA. The aim of this labelling scheme is to promote initiatives that are contributing to the development of low-carbon practices for buildings and not only focus on the energy efficiency issue. The label promotes not only circular economy principles such as reuse and the use of recycled materials, but also the use of renewable materials e.g. wood which is considered as carbon sinks. Following the success of the label for new buildings, the association launched in 2018 a label dedicated to renovation projects (BBCA renovation), which provides a framework for assessing the carbon footprint for renovation operations. The labelling process (for new buildings and renovation) is based on a voluntary approach targeting builders and more broadly the real estate sector. To obtain the label for new builds, buildings shall meet the following criteria:

- For residential buildings, a threshold of 1,150 t for the total carbon emissions including 650 kg for the construction phase. A BBCA point corresponds to the equivalent of 10kg of CO₂ not emitted or stored.
- For offices, the threshold is set at 1,150 t for the total emissions, including 900 kg for the construction phase.

KEY OUTCOMES

The proposed outcome of this initiative is to halve the carbon emissions of buildings. Currently, it is estimated that 1m² of new buildings generates around 1.5 tonnes of CO₂ over a 50-year lifespan. The BBCA label aims to lower these emissions to 750 kg of CO₂ per m² built, over the same lifetime. By considering the use of recycled materials, products and equipment in the LCA, the BBCA renovation label promotes circular economy.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	

KEY LEARNINGS

The Circularity Dataset Initiative aims to develop an accessible cross-sector open and easily accessible circularity data framework for construction products.

Actors along the value chain participated to the pilot projects by providing the information needed for the PCDS tool, however did not show particular interest for the initiative. This was especially the case for actors involved at the very beginning of the value chain. Nonetheless, interest is growing, and the potential of the initiative is better understood.

In addition, there are concerns that implementation could require significant additional effort, especially regarding education on how to effectively use the framework, and managing confidentiality within information exchange; however, there is overall interest and support at the EU level for this type of solution.

OWNER(S)

- Ministry of the Economy (Ministère de l'économie), Luxembourg.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

12. PRODUCT CIRCULARITY DATA SHEET

Luxembourg, 2018-Ongoing

<https://meco.gouvernement.lu/fr/le-ministere/domaines-activite/ecotechnologies/circularity-dataset-initiative.html>
www.pcdis.lu

BACKGROUND

The Circularity Dataset Initiative addresses the lack of standardisation for data sharing on products in the Building & Construction sector. The lack of standardised and harmonised reporting forces manufacturers to send out different data sets in diverse formats to customers and product platforms that evaluate the circularity of the product. In addition, there is a formal opposition between the need for transparency in order to determine the actual circularity and the wish to protect sensitive manufacturing data from the industry.

The circularity dataset initiative has collaborated with Horizon 2020 Buildings, the BAMB project and the DOEN Foundation-supported Healthy Printing initiative.

KEY OBJECTIVES

The Circularity Dataset Initiative aims to develop an accessible cross-sector standard and easily accessible circularity data framework, the Product Circular Data Sheet (PCDS), based on a future ISO industry standard. It will provide a structured framework for circular economy data on products throughout the entire value chain, from raw materials to finished products, from the use phase to recycling. Suppliers will be the starting point, unravelling directly the line of information to their direct consumers, instead of leaving responsibility for data gathering to the producer at the end of the supply chain.

In 2020, about 50 stakeholders were working on the project from 12 different countries in Europe and North America. The phase 2 is dedicated to piloting the tool, including 3 pilots in the construction sector and further are explored in materials and textiles: modular parking, a research unit with the Product Circular Data Sheet (PCDS) standards and an industrial building with BIM model.

KEY OUTCOMES

The initiative aims to develop and apply circularity criteria instead of circularity metrics and labels, which are the main practices that are usually applied. The idea is that criteria are more universal, whereas target values for metrics may vary, and calculation methodologies differ depending on the label. The PCDS will provide information for the different labels and aims to deliver an ISO standard for material datasets including its auditing system and data exchange protocol.

GPP

**VOLUNTARY AGREEMENT
BUSINESS SUPPORT
GUIDLINES**

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	
F. Durability	
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Adding circularity in procurement for the first time takes time (and thus, money), but afterward it will take the same amount of time as it previously did. In a longer timeframe, it can save money (buying less, longer lifetime, second life is valuable). Shifting to circularity will create 50k jobs and that at least € 7 billion will be earned.

OWNER(S)

- Ministry of Infrastructure and Environment

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

13.GREEN DEAL 159: CIRCULAR PROCUREMENTS

NETHERLANDS, 2013-Ongoing

BACKGROUND

The idea of joining forces and developing knowledge in the form of a 'Green Deal' arose during a Circular Economy Bootcamp. With a bottom-up approach, Green Deal asks participants to implement two pilot projects. One of them was about Circular Procurement.

The 'Green Deal on Circular Procurement' was signed by 18 (in the end 45) public and private parties on 12 November 2013 during the central government's Innovation Relay. Circular Procurements guarantee that the producer or processing party will use products and materials in new cycles at the end of their lifespan.

KEY OBJECTIVES

The objective is to learn how procurement can be used as a lever to accelerate the transition toward a circular economy.

KEY OUTCOMES

It encourages parties to get involved in circular procurements and allows to share knowledge. It also provided insights on the obstacles to circularity implementation to the government. It also contributes to the Netherlands objectives of becoming circular by 2050 and contributes to mitigate risks in other areas (material hazard, social risks...) by implementing some measures like material passports, which gives information on the products.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	
D. Proportionality	
E. Deconstruction	
F. Durability	
G. Adaptability	
H. Waste Reduction	

KEY LEARNINGS

It is essential for standards to be in coherence with other regulation related to environment.

Flexibility is important so that the legislation does not act as a barrier to the construction of new buildings. There is a necessity to develop a more collaborative culture and transform a still traditional construction sector.

It is critical to involve relevant stakeholders during policies development to enable wide implementation.

Costs to implement the assessment method are negligible compared to other costs.

OWNER(S)

- Ministry of the Interior and Kingdom Relations

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

REGULATORY MEASURES STANDARDS

14.DUTCH BUILDING DECREE

NETHERLANDS, 2012-ongoing

BACKGROUND

Among the Netherlands' sustainability goals, one is to reach circular building economy by 2050. In that context, the Government included environmental performances requirements in building permits. When applying for a permit for the construction, use, and demolition of all new residential and commercial buildings above 100m², an LCA evaluation must be conducted covering 11 impact categories (19 from 2021 onward). A single score is extracted from the results and it should be situated above a define (evolving) threshold. The method developed follow a harmonized approach as the same assessment method is prescribed by BREEAM-NL and Green Public Procurements for office buildings and civil engineering works. It also follows common standards: Methodological requirements (LCA) EN 15804:2019 ; Calculation rules environmental performance of buildings and civil engineering works EN-15978.

KEY OBJECTIVES

The goal of this Decree is to lower the environmental impact of buildings with the use of more sustainable materials by making visible the specific environmental impact of materials.

KEY OUTCOMES

The objective is to make construction more sustainable and for the sector to be circular by 2050.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Project managers appeared afraid of changing thing and it was essential to discuss and compromise. It was also important to explain why it is important to evolve toward circularity (resources scarcity, GHG emissions, etc.)

Well-constructed criteria allow to make circularity more measurable. It makes project managers think of sustainability in the early stages of the projects, as well as think of the whole lifecycle of materials.

Current regulation is blocking the reuse of building product.

It is essential to improve dissemination and training sessions to the contracting professionals and technical support for effective implementation.

OWNER(S)

- City of Amsterdam

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

GPP
STRATEGY

15.ROADMAP FOR CIRCULAR LAND TENDERING

NETHERLANDS, 2017

www.amsterdamsmartcity.com/projects/roadmap-circular-land-tendering

BACKGROUND

The Roadmap for Circular Land Tendering is part of Circular Amsterdam, a policy drawing the city's strategy to shift toward a circular economy. The Roadmap is one of the 23 municipal projects designed to promote Amsterdam's transition to circularity. It proposes criteria that the City of Amsterdam can use in its tendering procedure to assess the extent to which buildings and the construction process comply with the principles of circular building. The Roadmap will initially be used for tenders for land allocation, primarily for new-build projects, but the ultimate aim is to use the Roadmap also for transformation, renovation and demolition projects. For some public tenders, the municipality makes some selected criteria mandatory, but every contractor can get inspiration from the Roadmap for their tenders.

KEY OBJECTIVES

The key objective of the Roadmap is for project managers and contractors to implement more circularity in constructions by including a selection of criteria, generally between 1 and 3, in the specifications of their projects. It is intended to be used in the thinking phase of projects, to help implement more circular economic principles. Project managers can use the criteria that are the most relevant to their situation

KEY OUTCOMES

Some circularity criteria, along with calculation methods, are made mandatory for public tenders. This helps the city to shift toward circularity.

The Roadmap is mainly used by public parties, but it can also be an inspiration for private project managers who wishes to make their project more circular. Some consultants also use the Roadmap when sustainability is a key concept in their project.

The Roadmap and its criteria are not specific to Amsterdam and can also inspire other municipalities. BREEAM used some of them to update and add circularity to their credits.

The criteria's scope is holistic and bring impacts on the city living qualities, the local biodiversity, as well as the energy and material management.

As there is no inventory of actors using the Roadmap, it is difficult to assess more accurately what is its impact.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

It appeared difficult to make existing buildings sustainable as their stakes do not focus on circularity but more on energy saving. The Agenda included 10 rules to implement circularity in existing buildings.

It is important for stakeholders and civil society to be able to see the positive changes brought by circularity.

OWNER(S)

- Government of the Netherlands

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

**STRATEGY
GUIDELINES**

16.CIRCULAR CONSTRUCTION TRANSITION AGENDA

Netherlands, 2018-2021

www.circulairebouweconomie.nl

BACKGROUND

The Netherlands Circular Construction Transition Agenda describes the national strategy for achieving a circular construction economy by 2050 and contains the Agenda for the 2018-2021 period.

KEY OBJECTIVES

In 2016, the Dutch Social and Economic Council issued its recommendation "Working on a circular economy: no time to waste" that emphasises the necessity and urgency, but also clarifies the economic effects, of a transition toward a circular economy.

Shortly after "A Circular Economy in the Netherlands in 2050" was published: a national programme explaining the way the government wishes to shape a circular economy. The construction industry is mentioned as one of five priorities. In that context, "De Bouwagenda" (the Circular Construction Transition Agenda) was presented to the government by chairman Bernard Wientjes March 2017. The ambition is that the construction sector is circular by 2050, but preferably sooner. The Agenda draws up the strategy for the sector and makes concrete recommendations.

KEY OUTCOMES

The output is a series of proposed mandatory and non-mandatory actions for the government (such as: make all public tenders fully circular from 2023 onward; embed circularity in construction laws; use material passports; integrate circular construction in education; create a knowledge institute; execute circular construction awareness campaign; pilot projects for EPR; and subsidize circular businesses and revenue models).

The proposed outcome is also to halve CO₂ emissions and use of virgin material in the construction industry by 2030 and fully eliminate them by 2050.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	
D. Proportionality	
E. Deconstruction	
F. Durability	
G. Adaptability	
H. Waste Reduction	

KEY LEARNINGS

Lack of knowledge of the individuals responsible for making technical specifications related to environmental criteria.

It appeared essential to improve dissemination and training sessions to those professionals and technical improvements on the platform.

Annual budgets of entities make difficult to include medium- and long-term benefits of public acquisitions.

OWNER(S)

- Portuguese Environment Agency
- Public Administration Shared Services Entity
- Shared Services of the Ministry of Health
- Institute of Public Markets, Real Estate and Construction

These entities constitute the GAM (Monitoring and Evaluation Group of the Strategy)

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

17. NATIONAL SYSTEM FOR PUBLIC PROCUREMENT - ENCPE

PORTUGAL, 2017-2020

www.batimentbascarbonate.org/label-bbca

BACKGROUND

Portugal identified public procurement as a tool to integrate economic, social and environmental policies. ENCPE 2020 defines environmental criteria for public purchase, for a set of priority goods and services in alignment with the EU's GPP criteria.

KEY OBJECTIVES

ENCPE 2020 is a complementary tool for environmental policies to reduce the environmental impact of public works projects throughout their life cycle.

ENCPE 2020 focuses on defining environmental criteria for a set of priority goods and services for which the European Union's GPP criteria are already available, which will be adapted by multidisciplinary working groups to the national market. Some of the priority product group related to the building sector are: office buildings, construction and maintenance, wall panels and indoor lighting.

KEY OUTCOMES

The Government committed to purchase 60% of its goods and services using environmental criteria by 2020.

This aims at reducing the environmental footprint of public works, as well as stimulating supplies of goods and services with a reduced environmental impact.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

- A. Standards
- B. Whole Lifecycle
- C. Reuse Market ✓
- D. Proportionality
- E. Deconstruction
- F. Durability
- G. Adaptability
- H. Waste Reduction ✓

KEY LEARNINGS

There is a lack of trust in recycled aggregates because the construction industry can be conservative. It is essential to produce some studies to support the use of recycled aggregates, as well as improve their quality and availability at low prices. Tax could be a incentive to use of recycled and reused materials from CDW.

There is also a limited awareness of sustainability stakes.

OWNER(S)

- Portuguese Ministry of Environment

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

GPP
REGULATORY MEASURES

18.SMART WASTE

Portugal, 2011-ongoing

BACKGROUND

The Decree-Law nº 73/2011 is the third amendment of the Decree-Law nº 178/2006 managing waste in Portugal. In 2006 appeared the first definition of Construction and Demolition Waste (CDW) as known as today.

Prior to 2006, CDW were considered one of nine flows of waste in Portugal with PERSU (Plano Estratégico de Resíduos Sólidos Urbanos). In 2008, a CDW framework was implemented in response to European legislation. This was further updated as part of the review of the national waste management legal framework in 2011 (D.L. 73/2011).

KEY OBJECTIVES

The goals to be met in the management of CDW, highlight:

- 70% of CDW in preparation for reuse, recycling, and other forms of material recovery.
- Obligation to use at least 5% of recycled materials, as long as it is technically feasible, in construction and infrastructure maintenance contracts under the Public Contracts Code.

KEY OUTCOMES

It improved traceability of CDW, allowed the implementation of inspection processes which further encouraged recycling and improved quality of recycled materials.

STRATEGY**CIRCULAR ECONOMY PRINCIPLES
FOR BUILDINGS DESIGN***

- A. Standards
- B. Whole Lifecycle
- C. Reuse Market ✓
- D. Proportionality
- E. Deconstruction
- F. Durability
- G. Adaptability
- H. Waste Reduction ✓

KEY LEARNINGS

That it is essential for national and local conditions to be considered. Each city is different (e.g. local infrastructure, demographics, etc.) and it therefore may not be feasible or relevant to replicate strategies across cities in the exact same way.

Legislation is often written according to a linear economy logic and can be a bottleneck when implementing circular principles

Implementing more circularity had a positive impact on Maribor's economy and contributed to the creation of new green jobs

OWNER(S)

- Maribor City Council
- Wcycle Institute Maribor

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

19. STRATEGY FOR THE TRANSITION TO CIRCULAR ECONOMY IN THE MUNICIPALITY OF MARIBOR

Slovenia, 2018-2030

BACKGROUND

The municipality of Maribor in Slovenia has defined a strategy using strategic areas as the pillars of circular efficient resource management in the circular transition of the city. The use of processed construction and demolition waste and soil in urban construction is a key strategic area. It is now mandatory for the 5 public utility companies to implement the strategy through projects that reflect the action plan.

In that context, WCYCLE Institute was created to increase implementation capacity and has identified 18 joint projects for the City and public utility companies aligned with these focus areas: material waste – construction, organic waste and soil; lost energy; waste water; unused space; and improvement of social collaborative and the sharing economy.

KEY OBJECTIVES

The strategy aims at implementing more circularity in strategic projects. WCYCLE was created to increase the implementation capacity of Maribor in order to reach its full circular potential, including regarding use of processed construction and demolition waste and soil in urban construction.

Overall, objectives are to strengthen the local economy and reduce environmental impact in the municipality, with the creation of new green jobs, reduction of use of natural resources, increased use of recovered materials, energy and water savings, and use of new technologies.

KEY OUTCOMES

An impact assessment from ESPON has been conducted on one of the projects that have emerged from the initiative related to the building thematic (Cinderela), which shows substantial environmental positive impact, limited job creation (short-time contracts) and no social impact. Otherwise, there is no official impact assessment.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	
C. Reuse Market	
D. Proportionality	
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	

KEY LEARNINGS

Climate declaration can be an effective tool to improve transparency in the Swedish construction sector and encourage data development on construction products and processes.

However, it will require significant investment to develop national data at least for the most common construction products. Besides, the introduction of reporting requirement could lead to administrative burdens and high additional costs for companies, especially for SMEs. One of the proposed action to overcome this challenge is to not introduce a full LCA of building as a first step and only focus on the construction stage. Other types of support such as guidance documents and training will also help SMEs in the implementation process.

OWNER(S)

- Boverket – The Swedish National Board of Housing, Building and Planning.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

REGULATION STANDARDS/METHODOLOGY

20.ROADMAP FOR FUTURE REGULATION ON CLIMATE DECLARATIONS

SWEDEN, 2020-Ongoing

www.boverket.se/sv/om-boverket/publicerat-av-boverket/publikationer/2020/utveckling-av-regler-om-klimatdeklaration-av-byggnader/

BACKGROUND

As part of the national climate policy adopted in 2017, the Swedish Government through the memorandum Ds 2020:4 that contains proposals for laws and ordinance for buildings, intends to introduce a new regulation requiring climate declaration when new buildings are constructed. The regulation is planned to enter into force on 1 January 2022. Within this framework, Boverket –the National Board of Housing, Building and Planning was appointed by the government to propose a plan for the continued expansion of regulations on climate declarations from 2022 covering the entire lifecycle and limit values.

KEY OBJECTIVES

Climate declarations will require developers to report climate data on new buildings and submit it to the authority appointed by the Swedish government –Boverket. The aim of introducing this reporting requirement is to promote the transition towards more sustainable construction with reduced climate impact.

- As a first step, it is proposed to only report data at the construction stage with the possibility to expand the scope to other stages such as renovation or extension of an existing building. The construction elements proposed to be covered by reporting requirements include load-bearing structural elements, thermal envelopes and interior walls.
- Boverket will also develop some guidance documents and a national database containing basic climate data –emissions of greenhouse gases for the most common building materials and construction process –that is openly available (funded by the State).
- For implementation in 2022, there are no limit values set. As such, there is no requirement for the developer to implement active measures to reduce the climate impact based on the calculation results. However, Boverket has proposed to set a limit value of approximately 20–30% lower for climate emissions than a reference value produced in a study with climate calculations as of 2027. The limit value is proposed to be tightened in 2035 and 2043 to be in line with the Riksdag's climate goal 2045.

KEY OUTCOMES

The main outcomes of these measures is to address the lack of transparency throughout the sector by providing information on products to consumers, lower climate impacts of the construction sector and take actions to be able to reach national targets on climate-neutrality; the suggested benchmarks as of 2027 are expected to result (applying the first benchmark of 20% improvement) in yearly savings of 820ktonnes CO₂eq, which is valued to 1-6 billion SEK (~ €98-586 million).

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	
H. Waste Reduction	✓

KEY LEARNINGS

The fossil free initiative aims to promote broader and stronger collaboration between government and the industry, and thus drive more coherent and effective policy instruments on circular economy. Since the launching of the project, up to 140 companies, municipalities and organisations have committed to implement the roadmap. However this commitment is not "legally" binding. The Swedish Construction Federation and Fossil free Sweden plan to carry out an evaluation every year to determine how key players deliver on targets and how the Government contributes.

The main challenge in implementing the roadmap is to involve small and medium-sized companies. SMEs have strong ambitions, however not enough knowledge, time and resources to engage more. Both financial incentives and regulatory changes will be needed for more efficiency: business support for ongoing industrial projects especially for SMEs / use public procurement as an engine for carbon transition/ changes in regulations on the classification of waste to remove obstacles to circular business models/ stimulate low-carbon investing by lowering capital adequacy requirements for green financing.

OWNER(S)

- Skanska supervised the production of the roadmap and the Swedish Construction Federation is responsible for implementation.

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

21.FOSSIL FREE SWEDEN – ROADMAP FOR THE CONSTRUCTION AND CIVIL ENGINEERING SECTOR

SWEDEN, 2018-Ongoing

http://fossilfritt-sverige.se/wp-content/uploads/2018/02/roadmap_for_fossil_free_competitiveness_klar.pdf

BACKGROUND

The Fossil Free Sweden initiative was launched in 2018 by the Swedish Government following the decision of the parliament to make Sweden climate neutral by 2045. It has encouraged business sectors to draw up their own roadmaps towards becoming fossil free, while also increasing their competitiveness. In these roadmaps, industry must describe how and when they will be fossil free, what technological solutions need to be developed, what investments need to be made and what obstacles need to be overcome. To date, 22 roadmaps have been submitted to the Government, representing about 70% of Sweden's carbon emissions. The climate plan and budget from the Government have been influenced by the roadmaps.

The construction and civil engineering sector is one the main sectors targeted by this initiative and has developed a detailed roadmap with the actions and challenges that need to be overcome to reach the targets set by the Government.

KEY OBJECTIVES

Within the framework of the Fossil Free Sweden initiative, and under Skanska's project management, the construction sector has united around a common roadmap for a carbon-neutral and competitive sector. The roadmap establishes goals to achieve a carbon-neutral value chain in the construction and civil engineering sector. The main goals and targets include:

- 2020–2022: Key players within the construction and civil engineering sector have mapped their emissions and established carbon reduction/neutrality goals.
- 2025: Greenhouse gas emissions clearly demonstrate a declining trend.
- 2030: 50% reduction in greenhouse gas emissions (cf. 2015).
- 2040: 75% reduction in greenhouse gas emissions (cf. 2015)
- 2045: Net zero greenhouse gas emissions.

To reach zero emissions by 2045, the construction sector needs innovations and new technology but also public policies promoting sustainable practices in the sector. As such, there are a few ongoing regional processes for regional/local roadmaps, some of which are even more ambitious than the national roadmap e.g. LFM30 of Malmö City, aiming at reaching climate neutrality by 2030.

KEY OUTCOMES

The main outcome is to increase the awareness of all relevant actors across the value chain on sustainable construction and thereby, incentivise the implementation of new models and processes. The objective is to make sustainable construction, the new reality in the sector.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	
D. Proportionality	✓
E. Deconstruction	
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Public consultations led to:

- tightening requirements on metrics
- better alignment with existing accreditations (e.g. BREEAM), performance tools, good practice and policies (e.g. energy statements)
- incorporating language used by developers.

From an early stage, expert stakeholder groups were created to discuss the policies. It was important to understand from developers what was already becoming common practice to create higher requirements.

The initial plan for WLC assessments was to apply the policy to all major developments with more than ten units; however, there were concerns that the scope was too broad given the various methodologies and some inconsistencies with WLC data. This led to starting with referable applications that have the biggest carbon impacts. London Boroughs can still apply WLC policy to smaller scale developments and the guidance was drafted with that in mind. As the process becomes more streamlined, it will be easier for boroughs to do this. There are regular workshops for borough planning officers and case studies are important for information sharing. Overall, the initial outcomes will inform how policy requirements are further developed.

OWNER(S)

- Greater London Authority (GLA)

*European Commission (2020). Designing buildings in the context of the circular economy. https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

22.LONDON PLAN 2021

ENGLAND, UK, 2021-Ongoing

<https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/london-plan-2021>

BACKGROUND

London Plan 2021 includes circularity requirements for referable planning applications (>150 residential units; development over 30m high (outside the City of London), development on Green Belt or Metropolitan Open Land). Under Policy S17, a Circular Economy Statement is required on how waste will be reused and recycled, end of life design considerations and how much waste will be generated (<https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance-and-spgs/circular-economy-statement-guidance-consultation-draft>).

Under Policy S12, whole life-cycle carbon (WLC) assessments are required that calculate emissions using a nationally recognized methodology and demonstrate actions taken to reduce emissions (<https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance-and-spgs/whole-life-cycle-carbon-assessments-guidance-consultation-draft>). These requirements are driven by London's commitment to becoming a zero carbon, zero waste and zero pollution city.

KEY OBJECTIVES

Circular Economy Statements and WLC assessments require key metrics from new developments such as: material use (kg) and intensity (kg/m²); recycled content percentage of materials; estimated reusable and recyclable materials; waste arisings and diversion from landfill. WLC current and aspirational benchmarks are provided for projects to carefully examine how WLC emissions can be reduced. Applicants are required to provide reasons for exceeding benchmarks. As more data is gathered, the benchmarks will be improved.

KEY OUTCOMES

The policies are still in very early stages but a major proposed outcome is savings on disposal costs for the construction industry. This also helps London achieve construction, demolition and excavation waste reduction and material recovery targets. In general, circular economy activity in London could:

- create 12,000 new jobs by 2030
- retain the value of products and materials through re-use and high-level recycling
- create a positive financial business case for sustainable practices
- create a significantly reduced demand for virgin materials and reduce the environmental impacts associated with manufacturing and processing those materials
- help to protect supply chains from market volatility by managing supplies of existing resources through re-use and remanufacture.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	✓
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Support for the construction sector was initially ad-hoc but this was addressed by preparing a sector specific offering. For SMEs there are challenges with committing to change, as it can be a (perceived) risk to change business models (e.g. move to lower carbon materials) due to the already small profit margins in construction (2-3%). There are also challenges with policy and standards that have not kept up with the sector's pace of change. ZWS has therefore increased 1 to 1 SME support and skills development and continues to provide evidence for policy development.

Overall, most of the stakeholder feedback is positive but ZWS are constrained by their own resources. Activities therefore need to be prioritized but ZWS aspires to do more in areas such as facilities management, infrastructure and housebuilding.

OWNER(S)

- Zero Waste Scotland (supported by the Scottish Government)

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

23. ZERO WASTE SCOTLAND

SCOTLAND, UK, 2012-Ongoing

<https://www.zerowastescotland.org.uk/>

BACKGROUND

Zero Waste Scotland (ZWS) provides resource efficiency support to businesses (primarily SMEs) and individuals through funding provided by the ERDF and Scottish Government. Specialist consultants are available to the construction sector, at no cost, to help embed circular economy principles and thinking. The Scottish Government regards it as a vital part of its success in accelerating progress and delivering results from the Scottish Circular Economy Strategy: Making Things Last, business resource efficiency and low-carbon heating.

KEY OBJECTIVES

The key objectives for the 2019 to 2023 corporate plan are to: establish critical evidence on material production, consumption and waste; form new partnerships that extend reach and increase achievements; inspire people and businesses by providing compelling stories; and test and evaluate new ideas with partner organisations. There is a 4-year programme for the construction sector that involves the delivery of 10 key circular economy principles: collaboration, whole life value, health and wellbeing, long life/loose fit, low carbon/ sequestration, smart construction, material recoverability, refurbishment and reuse, design out waste, circular products and services, material management.

KEY OUTCOMES

Between 2013 and 2018 the Resource Efficient Scotland Advice and Support Service helped business and organisations make changes that will save over 1.2 million tCO2eq, from a combination of energy, waste, and material efficiency measures over their lifetime. Lifetime cost savings for the organisations are estimated to be over £200 million. There are no specific reports for construction as it is too early in the programme but proposed outcomes are the: design of construction products, buildings and infrastructure; use of sustainable procurement clauses and delivery mechanisms; material management and building material reuse; and, digital technology adaptation and building organisational capacity.

50 SMEs were supported in construction under ERDF from 2019 to 2020 and the Accelerator programme helped over 40 businesses in adopting circular business models. Examples in construction include: Egg Lighting offering a circular design and product as service model; JML using Structured Insulated Panels and reusing offcuts. There is also support to towns and cities such as the Circular Glasgow Initiative, which provides support to SMEs including in construction.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Initially the scale of projects was too small to be of interest to large scale developers, but often too big for SMEs. The sizes have been adjusted year on year to address this. From Year 2, all projects were also required to undergo an independent Design Review to minimize projects being encumbered by fundamentally poor design. Some highly innovative approaches raised concerns about unknown defect levels and long-term maintenance.

A circular economy theme was added from Year 3 and shortlisted projects were reviewed by Welsh Government's Head of Waste Strategy and the proposed Circular Economy Strategy to review strategy alignment and provide feedback on strengthening projects.

Overall, it can take a long time from funding to completion (at the end of 2020 homes were still being constructed from the Year 1). This makes it difficult to assess outcomes during the funding period. Over the long term, the funding mechanism for such innovations should transfer to the Social Housing Grant, which is the main source of Welsh Government funding for affordable housing.

OWNER(S)

- Welsh Government

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

24. WELSH INNOVATIVE HOUSING PROGRAMME

WALES, UK, 2017-2021

<https://gov.wales/innovative-housing-programme>

BACKGROUND

The Welsh Innovative Housing Programme (IHP) is a competition for funding that supports innovators with demonstrator projects while supporting local employment and the development of local supply chains. The initiative provided £90 million of funding over 3 years between 2017-2020, with a further £25 million added in 2020 for a 4th year. It is aligned with the Well-being of Future Generations (Wales) Act 'sustainable development principle' and some years of funding were restricted to Registered Social Landlords (RSLs) and Local Authorities. Proposals are judged by an independent panel of reviewers and scored based on the level of innovation and potential future impact/ replicability.

KEY OBJECTIVES

IHP projects test new innovative approaches to increase the scale and pace of high quality social and affordable housing delivery in Wales. Potential innovations include construction techniques, delivery pathways and housing models to reduce the impact of house building on the environment, reduce fuel poverty, and reduce health and wellbeing inequalities that are exacerbated by poor quality housing. The initiative aims to contribute 1,000 affordable homes to the target of 20,000 affordable homes during the government's term. IHP should also contribute to policy objectives around reducing waste and the circular economy, e.g. low embodied energy and future flexibility.

KEY OUTCOMES

Though all projects do not primarily focus on circular economy principles, some have considered: whole life carbon; the use of recycled and recyclable materials; construction that can allow for future internal reconfiguration; and, moveable constructions that could be reused in different locations as needed. The number of projects supported:

- Year 1: 18 developments by 14 Social Landlords
- Year 2: 23 developments by 18 organisations
- Year 3: 9 developments by 9 organisations
- Year 4: TBD

Overall, construction partners have been positive about the opportunity to prepare for construction approaches of the future with the 'safety net' of demonstrator funding.

VOLUNTARY AGREEMENT
FINANCIAL INSTRUMENT
GUIDELINES

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	✓
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

LQH should be integrated with the existing housing performance system as owner's currently need to apply for both certifications, which is burdensome. Procedures also vary depending on the administrative agency in charge. Since there are few incentives beyond the 10th year, some homeowners also do not maintain certification. Maintenance and renewal processes need to be simpler and more flexible. The sustainability of financial subsidies and regulatory effort must also be considered.

Initial investigations into the low uptake with apartments indicated this is due to deterioration countermeasures and earthquake resistance, which increase costs.

Future plans for the LQH focus on increasing government led promotion of the benefits and reducing administrative, financial and technical barriers. There are no current plans to end or change the policy.

OWNER(S)

- Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

*European Commission (2020). Designing buildings in the context of the circular economy. https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

25.ACT FOR THE PROMOTION OF LONG-LIFE QUALITY HOUSING (LQH)

JAPAN, 2009-Ongoing

https://elaws.e-gov.go.jp/search/elawsSearch/elaws_search/lsg0500/detail?lawId=420AC0000000087

BACKGROUND

In 2009, the Act for the Promotion of Long-life Quality Housing (LQH) was enacted to encourage extending the life and quality of new housing. In 2016, it was expanded to include renovation and extensions. Guidelines were developed from Japan's decades of experience in flexible and adaptable housing design, which began with experimental housing projects in the 1970s (Kodan experimental housing, Century Housing System, etc.). LQH incorporates a two level approach - unchangeable 'skeleton/support' and changeable 'infill/fit-out' - commonly referred to as the SI system or Open Building.

KEY OBJECTIVES

LQH is a voluntary certification system that promotes the long-term durability and adaptability of housing towards improving housing quality and performance, reducing the economic burden of housing expenses for families and solving global environmental and waste problems in the future. Compliant properties can apply for various tax reductions, insurance discounts and housing mortgage support. For detached houses, the certification criteria include:

- measures against deterioration (durable design for 100+years)
- resistance to earthquakes (easier to repair damage)
- readiness for maintenance and replacement (SI system)
- indoor temperature and energy saving (energy efficiency)
- local environment (maintenance of the surrounding landscape)
- total floor area (sufficient space for reasonable living standards)
- maintenance plan (inspection every 10 years).

For apartments/condominiums, there are two additional criteria:

- preparedness for future change of room arrangement
- sufficient space in common areas for improving accessibility.

KEY OUTCOMES

From 2009-2019, 1.02 million units were certified. Around 11% (100,000) of total housing starts are certified annually (25% if only considering new detached housing). While there is good uptake for detached housing, the percentage of apartment certifications is low and for rental housing it is even lower (split incentives dilemma). There is also no certainty around the increase of property valuations after certification.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

Vancouver Zero Emissions Building Plan helps create demand in the deconstruction and reuse market by directly requiring a small percentage of material reuse or incentives. The initiative builds on the objectives and intent of Vancouver's Green Demolition Bylaw, whereby 75% of the weight of the building must be recycled.

Some lessons learnt from this programme include the following:

- Modern materials such as spray foam insulation have been found to be much more difficult to recycle. Spray foam insulation contaminates the materials hindering recycling and reuse, emits toxic smoke and is potent GHGs. For all these reasons, it is likely that this product will be banned as part of the policy.
- Declarations-based LCAs at early design don't necessarily make it to actual implementation. As such, in the future, it is expected that whole building LCA may be resubmitted at stages beyond early design, for example, at the construction stage and later, to further advance and demonstrate impacts on reducing embodied carbon in practice.

The plan recognizes that the procurement process needs to be shifted from a culture of "lowest bid" to focus increasingly on quality and "whole-life" value. Expanding the plan in future to include existing buildings will significantly grow the benefits and the economic opportunity.

OWNER(S)

- City of Vancouver, Canada.

*European Commission (2020). Designing buildings in the context of the circular economy. https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

REGULATION STANDARDS/ METHODOLOGY

26. VANCOUVER ZERO EMISSIONS BUILDING PLAN

Canada, 2016-Ongoing

<https://bylaws.vancouver.ca/Bulletin/bulletin-green-buildings-policy-for-rezoning.pdf>

BACKGROUND

In January 2019, Vancouver Council declared a climate emergency in recognition of the urgent threat posed by climate change, and as a call to scale up Vancouver's efforts to cut carbon pollution. In April 2019, Council approved the Climate Emergency Response, which established six new targets (referred to as "Big Moves") to guide the City's efforts in response to the climate emergency. To achieve the City of Vancouver's target of limiting warming to 1.5°C, lower carbon construction materials and design was one of "Six Big Moves" in the ambitious push to drop Vancouver's carbon emissions by 1.2 million tonnes by the year 2030. The two Big Moves pertaining to buildings are:

- Big Move 4: By 2030, the carbon pollution from buildings will be cut in half from 2007 levels.
- Big Move 5: By 2030, the embodied emissions from new buildings will be reduced by 40% compared to a 2018 baseline.

KEY OBJECTIVES

The Zero Emissions Building Plan positions Vancouver as the first city in North America with a roadmap for eliminating emissions from new homes and buildings by 2030. New construction operational energy is targeted to be reduced to zero by 2030 or sooner and for embodied emissions from new buildings and construction projects to be reduced by 40% by 2030, compared to a 2018 baseline. This would represent a reduction of 78,000 tonnes per year of carbon emissions by 2030. Approximately 40% of buildings existing today will be replaced with new buildings by 2050.

The purpose is to build long-term capacity and enable further research into potential policy approaches to pave the way for reducing embodied emissions over time. Target new construction and rezoning projects for public and private buildings including residential and most commercial building types. Initial focus was on operational energy but the focus will increasingly include all life cycle stages as embodied emissions gain in relative importance.

KEY OUTCOMES

- The key outcome is to build capacity and allow further research into potential policy approaches for reducing "embodied emissions". The policy could drive a shift in construction practices, including the use of more mass timber and low carbon concrete and rely more on prefabricated and modular construction.

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards
B. Whole Lifecycle
C. Reuse Market ✓
D. Proportionality
E. Deconstruction ✓
F. Durability ✓
G. Adaptability ✓
H. Waste Reduction ✓

KEY LEARNINGS

The Minnesota Sustainable Building Guidelines (B3) is a mandatory sustainability programme for state funded buildings from pre-design to construction and for ten years of operation (energy and carbon policy). It was developed between the State's government and the Centre for Sustainable Building Research (CSBR) at the University of Minnesota. A publicly accessible case study database provides information on each building's achievement.

B3 is continually updated and improved in collaboration with state agencies and industry stakeholders and serves as a model for localized green building programmes. Though it is voluntary for the private sector, some local (sub-state) units of government require portions of the programme for their projects. For instance, the municipality of Saint Paul, MN has adopted the guidelines as a part of their green building program.

There have been challenges in regards to education of project teams, funding challenges, especially regarding support for smaller projects, and difficulty in achieving stakeholder agreement but overall, the programme has received positive feedback.

OWNER(S)

- State of Minnesota, Departments of Administration and Commerce

*European Commission (2020). Designing buildings in the context of the circular economy.

https://ec.europa.eu/growth/content/design-buildings-context-circular-economy_en

REGULATION GUIDELINES

27. MINNESOTA SUSTAINABLE BUILDINGS GUIDELINES (B3)

USA, 2001-Ongoing

www.b3mn.org

BACKGROUND

The Minnesota Sustainable Building Guidelines is a progressive sustainability program for state funded buildings which serves as a model for sustainability in Minnesota buildings. The program was created by the State of Minnesota in 2001 and developed by a team led by the Center for Sustainable Building Research (CSBR) at the University of Minnesota. Unlike other green building programs, it focuses on measured performance improvements, using a list of required metrics instead of a menu of potential options. The program is structured to provide a feedback loop to the building design, construction, and operations industry in the state. Elements of the program are required to be used through all phases of the development of state-funded buildings in Minnesota from pre-design through design, and construction and for ten years of operations. It is continually updated and improved in collaboration with state agencies and industry stakeholders and could serve as a model for localized green building programs.

KEY OBJECTIVES

The program is designed to target broad sustainability goals for state funded construction which includes roughly 35 projects of various type and size each year. The lessons learned from this pilot program is used to inform future requirements for all construction on the state.

The program is mandatory for state funded construction, and voluntary for private sector. Some local units of government require portions of the program for projects that they construct and/or fund.

The MSBG has the following five sections: performance management, site water, energy and atmosphere, indoor environmental quality, and materials and waste. Each section has a number of requirements that are tracked during five phases of a project life: pre-design, design, final design, close-out and occupancy. The occupancy tracking of actual performance related to projected performance is required by legislation to be submitted annually for 10 years to show actual compliance of a project.

KEY OUTCOMES

Outcomes vary by guideline area. For example, energy carbon goals are to achieve 90% reductions in operational energy / carbon by 2025 and the tracking of whole building LCA for embodied carbon with a 10% reduction. A principal outcome for the program is to facilitate the achievement of the MN Sustainable Building 2030 Energy Standard (SB 2030).

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

The mandatory nature of CAM can active a true cultural change, bringing the attention to environmental purposes in the foreground. Large contracting authorities can play an important role in driving the process by the various stakeholders, providing exemplary practical cases.

Time and effort for the development of the criteria were significant because there was not enough scientific knowledge in the Ministry of Environment. This lengthens the time for agreeing on the most appropriate requirement/threshold.

The limited awareness and knowledge of the contracting authorities in relation to environmental issues was and is still the most critical and unexpected challenge.

In order to be effective, criteria must be very detailed and have specific thresholds.

There needs to be a consistent number of tenders implementing CAM in order to move the market to adapting to the requirements and provide adequate solutions. New recovery chains are required, or adapting existing ones, as the producers using recycled materials do not have enough quality secondary raw materials available.

OWNER(S)

- Italian Ministry for the Environment, Land and Sea
- National Anti-Corruption Authority (ANAC) (monitoring)

*European Commission (2020). Designing buildings in the context of the circular economy. https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

28.GPP COMPULSORY MINIMUM ENVIRONMENTAL CRITERIA (CAM) FOR BUILDINGS

ITALY, 2015 – Current

- <https://www.minambiente.it/pagina/i-criteri-ambientali-minimi>

BACKGROUND

The GPP Minimum Environmental Criteria (CAM) for the "Awarding of design services and works for the new construction, renovation and maintenance of public buildings" (DM 11/10/2017) are an implementing tool of the Italian National Action Plan on Green Public Procurement (DM 10/04/2013). The first version was approved in 2015 (DM 24/12/2015). The Criteria are supposed to be updated every 2/3 years to progressively introduce innovative and increasingly restrictive thresholds.

KEY OBJECTIVES

As well as the criteria on all the different energy and environmental performance of buildings, CAM contains technical specifications for materials and components, clearly promoting the circular approach. In particular, CAM requires a 15% of recycled content in the materials used for each construction/refurbishment intervention. They also set specific minimum recycled content thresholds for 7 types of materials and require specific product certifications, EPDs, environmental labelling or producer declarations in order to prove that products are "CAM" compliant. CAM also require that at least 50% (by weight) of components and materials can be disassembled. In the case of refurbishment, maintenance and demolition CAM also enforce pre-demolition audits and the use of selective demolition. The Criteria are mandatory for any type of building intervention on any kind of public buildings, without thresholds.

KEY OUTCOMES

- There has been a low level of implementation, despite the mandatory nature of CAM: only 17.9% of the contracting stations that participated in a survey declare that they always adopt the Criteria in their tenders (2019), 7.1% not always, 75% still never adopt them. However, almost all the contracting authorities know what the CAM are and are learning how to implement them.
- There has been progressive adaptation of the production chains and the updating of the contracting authorities, both aimed at raising the level of environmental quality of public works.
- The impact should also extend to the private construction market, through the consolidation of the offer of products and construction systems with a lower environmental impact. It is hoped that the distrust of construction materials with recycled content will be definitively overcome.
- Companies in the supply chains of products/components for construction are rather quickly investing in research and innovation and, overall, in the certification of their products, according to CAM requirements (recycled content certification, EPDs or others).

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	✓
G. Adaptability	✓
H. Waste Reduction	✓

KEY LEARNINGS

The political willingness towards the adoption and promotion of the Protocol in the national/regional policies has been a challenge.

There have been, and still are, problems of dialogue with stakeholders: for example, ITACA is thought by some as a competitor to commercial certification systems while being of public initiative, it has rather different goals.

There is a need to evolve the Protocol in order to include more indicators relating to Life Cycle impacts and circularity: this evolution is hindered by the lack of reliable reference LCA databases at the national level.

Training is necessary to improve the skills of professionals to follow the whole certification and verification path.

OWNER(S)

- ITACA (Institute for transparency, updating and certification of contracts and the environmental compatibility)
- iiSBE Italia (International Initiative for a Sustainable Built Environment)
- Regional authorities

*European Commission (2020). Designing buildings in the context of the circular economy.
https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

MANDATORY (IN SOME REGIONS) AND VOLUNTARY INSTRUMENT
REGULATION
ASSESSMENT METHODOLOGY

29. ITACA PROTOCOL

ITALY, 2004 - Current

https://www.itaca.org/valutazione_sostenibilita.asp

- <https://www.minambiente.it/pagina/i-criteri-ambientali-minimi>

BACKGROUND

The public national assessment system owned by the Italian Regions, the ITACA Protocol is integrated in many different policies such as funding programs, housing plans, laws and regulations on land consumption and urban regeneration, GPP and authorization processes. The Protocol has been adopted by a large number of Regions in Italy. Most of the regional protocols are all formulated differently (including a selection of criteria from the national version) but rely on the same methodology, are applied in tenders, incentive programs (Home Program for public housing) and in public House Plans, based on financial and building volume incentives, or give access to EU structural funds. ITACA Protocol is linked to iiSBE as it relies on the SBTool (a framework for rating the sustainable performance of buildings and projects).

KEY OBJECTIVES

The Protocol assesses the level of sustainability of buildings and verification with reference not only to consumption and energy efficiency, but also taking into consideration its impact on the environment and human health. It encompasses all types of buildings, both residential and non-residential, and addresses new construction and refurbishment. The Protocol guarantees the objectivity of the assessment using indicators and verification methods compliant with the technical standards and national reference laws. ITACA will be adapted in order to become Level(s) compliant, including a full life cycle approach and national benchmarks. For circular economy, the Protocol provides the following requirements: reuse of existing structures (60-100% of structures and envelope); recycled/reused materials/components (3-5% more than the CAM GPP for Buildings requirement, which is 15% by weight of all materials used); disassemble materials that can be recycled or reused within each technological unit (50-80% of the materials used).

KEY OUTCOMES

The Protocol is the main public sustainability rating systems for buildings in Italy and a progressive increase in its diffusion in all regions is hoped for. The aim is to establish a common method for measuring the sustainability of buildings in Italy, which can however adapt to the profound climatic and construction differences that characterize the Italian regions.

The National Protocol doesn't have a large appeal from private operators, in comparison with commercial rating systems, because it has not been promoted since it is publicly owned. However, the Regional versions have had positive feedback from private owners/investors when it has been made mandatory to access incentives.

More than 2000 buildings have been assessed with ITACA Protocol through the Regional Protocols (in most cases, within mandatory implementations).

CIRCULAR ECONOMY PRINCIPLES FOR BUILDINGS DESIGN*

A. Standards	✓
B. Whole Lifecycle	✓
C. Reuse Market	✓
D. Proportionality	
E. Deconstruction	✓
F. Durability	
G. Adaptability	
H. Waste Reduction	✓

KEY LEARNINGS

- Importance of stakeholder engagement and business involvement and support. Communication, deliberation and consensus are essential, as well as learning from other countries.
- It took a lot of time and work to implement the standard at large scale.
- Importance of increasing sourcing opportunities for eco-materials
- Additional costs for developers are reimbursed by increased property sales and value.
- Importance to improve collaboration and transparency.

OWNER(S)

- Ministry of Environmental Protection
- Israel Standards Institute

*European Commission (2020). Designing buildings in the context of the circular economy.
https://ec.europa.eu/growth/content/designing-buildings-context-circular-economy_en

REGULATORY MEASURES / STANDARDS/ METHODOLOGIES / INFORMATION PROVIDED

ISRAEL GREEN BUILDING STANDARD Israel, 2016

www.gov.il/departments/topics/green_building

BACKGROUND

The Israel Green Building Standard - SI 5281 - Sustainable Buildings, establishes criteria and minimum requirements for a variety of elements of green building, including design, construction materials, heating and cooling systems, health and safety, innovation etc. The standard is based on a point rating system awarding up to 5 stars based on the number of points achieved in 9 categories (55 – 100 pts.) Within the standard some criteria relate to circular economy in construction (about 7 points). They relate to materials, construction waste, site management and land use. Complementing this standard are standards SI 5282 and SI 1045, related to energy and thermal insulation. Compliance with all three Israeli green building standards is now becoming mandatory. Since 2021, SI 5281 is mandatory nationwide for most types of building. It includes three stages, each is enforced by a different agency, from building permit with local committees to post evaluation with third parties. Trained and certified green building consultants accompany the process.

KEY OBJECTIVES

The main objective of the standard is to promote the construction of green buildings. In terms of circularity in construction, the standard also rewards, and thus stimulates, reuse of existing structures and recycled/reused materials markets.

The standard enables objective assessment and verification. It is an important tool intended to enable reaching the goals set by government for energy consumption and CO₂ emissions reduction.

KEY OUTCOMES

The key outcome is a market shift toward green building, and more specifically: energy saving; promoting bio-climatic design; water saving; waste and runoff water treatment; reuse; reduction of construction waste and soil surplus; reduction of construction noise and dust; use of recycled and local materials; eliminating VOC's; promoting circular economy in construction.

It also boosted: investments in green building, especially locally; green jobs; international trade through compliance with EU and other regulations.

It also decreased the environmental impact of the construction sector with a more efficient use of materials, water, land, and resources in general, as well as a more responsible sourcing.

ANNEX 3: IMPACT ASSESSMENT OF POLICY OPTIONS

Assessment of the potential revision of the Construction Product Regulation

The tables below summarise the assessment of the economic (Table 20), social (Table 21) and environmental impacts (Table 22) of the revision of the CPR for each of the indicators listed in the previous sector. The assessment is conducted against the current situation and trends described in Annex 1. The table also includes the rationale of the assessment of each indicator together with evidence collected from relevant case studies (see Annex 2).

Table 20: Assessment of the economic impacts

Indicator	Assessment	Rationale	Evidence
Functioning of the internal market and competition	+	A level playing field across the EU will be ensured as the legislation will be implemented in a harmonised manner across the EU. Cross-border market opportunities can be created from the harmonisation of data.	The case studies did not reveal any relevant impact data.
Operating costs and conduct of business/Small and Medium Enterprises	+	<p>Additional costs of implementation, particularly for SMEs (e.g. for data collection and reporting processes), unless product & material level databases are created. In addition, demand of circular products is expected to be stimulated in the construction sector through the development of robust data. In addition, new opportunities can be expected from a more effective implementation of aspects of circular design/built environment. This would not only impact the costs of SMEs but of the whole industry.</p> <ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • The Swedish Roadmap on Climate Declarations indicate that the implementation of methods to enhance circularity in products might be more challenging for SMEs that do not have enough knowledge, time and resources to engage more. • The Dutch Building Decree shows that the costs to implement the assessment method are negligible compared to other costs. • The Swedish Roadmap on Climate Declarations indicates that sustainable constructions and renovation are more expensive in regard to start-up investments, but are almost always more cost effective in the long run. • In addition, the Swedish Roadmap on Climate Declarations indicates that the additional costs are addressed through lower capital adequacy requirements and other incentives for green financing solutions aiming at stimulating investments with lower carbon emissions. • The integration of aspects that relate to the integration of Level(s) indicate that the only investment required is for training. • The implementation of the French labelling system 'Bâtiment bas carbone' does not require a significant level of investment for large real estate groups.

Indicator	Assessment	Rationale	Evidence
			However, a change of habit, especially of processes is necessary and can be costly for SMEs.
Administrative burdens on businesses	-	Additional administrative burdens for adapting the current enforcement, monitoring and reporting mechanisms. Nevertheless, the costs are expected to be limited by the digitalised and harmonised provision of the circularity information. Certification costs are to be included in the administrative burdens	The case studies did not reveal any relevant impact data.
Costs to public authorities	-	Additional costs of implementation is expected for the public authorities in the short term for the development of databases and the provision of financial incentives for the development of pilots.	<ul style="list-style-type: none"> In the Danish guidelines on Sustainability in Construction & Civil Works numerous technical personnel of various specialisms are involved in the updates carried out every 4 years, due to its wide topic coverage. The French agency for ecological transition has required more than 3 M€ for the technical and financial support of environmental impacts assessment of new buildings in France using the 'Energy – Carbon' frame of reference. The implementation of the Italian Protocol ITACA, indicates that training is necessary to improve the skills of professionals to follow the whole certification and verification path. In addition, investments are needed to create financial/tax incentives to support the voluntary implementation of the Protocol. An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be £5,000,000 waste disposal cost savings.
Innovation and research	+	Innovation will be boosted, particularly on the eco-design of products and the overall efforts to reduce embodied carbon of built assets over their life cycle. Innovation is also	The case studies did not reveal any relevant impact data.

Indicator	Assessment	Rationale	Evidence
		expected to increase on the digitalisation of processes (e.g. in the form of BAM-B templates).	
Costs to consumers and households	-/+	An increase of costs of construction materials, particularly at the initial stages of design. Nevertheless, construction products will gradually be recirculated and retained at their highest value and property value will increase.	<ul style="list-style-type: none"> In Israel any additional costs for developers are reimbursed by increased property sales and value. The Product Circularity Data Sheet developed in Luxembourg is expected to lower the additional cost required to meet circularity targets with regard to environmental labels; circular-compliant buildings will have a lower price than they are estimated today.
Costs and benefits to specific regions or sectors	+	Reduction of differences caused by national marks and certifications between Member States as well as uneven implementation and market surveillance of EU regulations	The case studies did not reveal any relevant impact data.
Effects on the macroeconomic environment, including impacts on international trade and competition	+	The establishment of a common technical language would promote a cross-border market opportunities, selling and sourcing construction products from other EU countries.	The case studies did not reveal any relevant impact data.

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 21: Assessment of the social impacts

Indicator	Assessment	Rationale	Evidence
Employment and labour markets	+	<p>Deconstruction and reuse can support greater job creation compared to low level recycling or disposal.</p> <p>2nd workshop: New job opportunities may also be offered by the integration of maintenance and disassembly in business models</p>	<ul style="list-style-type: none"> An assessment carried out in the context of a project developed under the New London Plan showed that with the right investment the circular economy could create 12,000 new jobs in London by 2030. A recent study of the Zero Emission Building Plan in Vancouver showed that it creates a \$3.3 billion job opportunity in

Indicator	Assessment	Rationale	Evidence
			the lower mainland of British Columbia (in combination with other related provincial policies).
Standards and rights related to job quality	+	Alternative business models and reuse/repair/remanufacturing capability comes further opportunities for new business start ups (e.g. through the improved marketing and confidence of demolition products) and higher skilled/ paid job creation. Quality and skilled jobs are also expected to be created for the digitalisation and harmonisation of standards.	<ul style="list-style-type: none"> The Dutch Building Decree show that circular buildings are linked to the creation of diverse jobs (e.g. for repair and maintenance). The implementation of the Danish guidelines on Sustainability in Construction & Civil Works, has driven improved standards on City projects and encourages stakeholders to upskill, adapt, and develop new expertise, which brings benefits in line with policy aspirations.
Governance, participation, good administration, access to justice, media and ethics	+	The revision of the CPR Directive, by default will increase participation of different governmental authorities (e.g. due to the different types of buildings and products). The same applies for the participation of the industry that will be significantly involved in the development of harmonised standards.	<ul style="list-style-type: none"> The implementation of the Danish guidelines on Sustainability in Construction & Civil Works indicate that such initiatives require the participation of many public authorities due to the wide range of public building types that are required, e.g. schools, housing, leisure facilities.
Public health and safety	+	A positive impact is expected as the future impact of hazardous substances could be reduced, should the requirement for including compositional data.	

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 22: Assessment of the environmental impacts

Indicator	Assessment	Rationale	Evidence
Climate change	+	<p>Reduction of embodied carbon of built assets over their life cycle through the creation of a more reversible, reusable and adaptable system.</p> <p>2nd stakeholder workshop: New ways to construct using renewable materials</p>	<ul style="list-style-type: none"> An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be 7,760 tCO₂e savings. Currently, it is estimated that 1m² of new buildings generates around 1.5 tonnes of CO₂ over a 50-year lifespan. The French BBCA label aims to lower these emissions

Indicator	Assessment	Rationale	Evidence
			to 750 kg of CO ₂ per m ² built, over the same lifetime.
Transport and the use of energy	+	The creation of a more reversible, reusable and adaptable system will allow products and materials to be more readily recirculated, thus reducing the need for transportation. The move from recycling to repair & reuse will further reduce the energy consumption and the transportation that is required for the extraction of raw materials.	<ul style="list-style-type: none"> An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be 16,500 fewer HGV movements.
Biodiversity, flora, fauna and landscapes	+	The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	The case studies did not reveal any relevant impact data.
Water quality and resources	+	The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	The case studies did not reveal any relevant impact data.
Soil quality or resources	+	The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	The case studies did not reveal any relevant impact data.
Land use	+	The future impact of hazardous substances could be reduced, should the requirement for including compositional data go to a sufficient level of detail.	The case studies did not reveal any relevant impact data.
Renewable or non-renewable resources	+	Products and materials can be more readily recirculated and retained at their highest value, which in turns tends towards reuse and reduction of demolition waste generated. In addition with the introduction of labelling or other identifying features will be assumed hazardous. Non-renewable resources can be used and reused for a longer time, reducing the use of virgin resources in general	<ul style="list-style-type: none"> An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be 122,000 tonnes of virgin material use avoided.
The likelihood or scale of environmental risks	+	Improved information about the conditions for better hygiene, health and environment - potential impacts related to Basic Work	The case studies did not reveal any relevant impact data.

Indicator	Assessment	Rationale	Evidence
		Requirements 3 and 7 concerning environmental protection and sustainability.	

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

Assessment of the potential revision of the Energy Performance of Buildings Directive

The tables below summarise the assessment of the economic (Table 23), social (Table 24) and environmental impacts (Table 25) of the revision of the Energy Performance of Buildings Directive, for each of the indicators listed in the previous sector. As in the case of the assessment of the revision of the CPR, the assessment is performed against the current situation and trends of the building sector with evidence from the case studies.

Table 23: Assessment of the economic impacts

Indicator	Assessment	Rationale	Evidence
Functioning of the internal market and competition	+	The development of harmonized circularity indicators at the EU level could promote cross-border market opportunities. A common EU framework along with these indicators could also allow national policymakers to learn from each other, creating synergies and increasing benefits for the internal market.	The case studies did not reveal any relevant impact data.
Operating costs and conduct of business/Small and Medium Enterprises	+	The boost in efficiency renovations has the potential to stimulate demand in the construction sectors. Businesses and SMEs would especially benefit from the boost of the efficiency renovation market.	<ul style="list-style-type: none"> The construction sector contributes to about 9% of the EU's GDP but the sector has been hit particularly hard by the economic crisis. SMEs in particular benefit from a boosted renovation market, as they contribute more than 70% of the value-added in EU's building sector. The renovation wave estimates that around 35 million buildings will be renovated over the next decade. The Dutch Building Decree process found that costs to implement assessment methods are negligible compared to other costs. Thus, implementing a systematic lifecycle carbon approach, based on Level(s) simplified LCA method should be economically feasible. Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated that their support to SMEs regarding resource efficiency influenced over £17 million in capital investment.
Administrative burdens on businesses	-	It may cause an initial additional burden on businesses, especially SMEs, to implement new harmonized indicators. The collection and monitoring of data could also be a burden. Nevertheless, these limitations are expected to be short term as work continues to improve digitalisation and harmonisation of the whole process.	<ul style="list-style-type: none"> GBC Finland received feedback that adding requirements are a burden and more consultants are needed. GBC Finland also concluded that there are not enough Finnish architects trained for carbon calculation and more training schemes would be needed. This need would also appear in other areas covered by the policy (for other sustainability performance criteria). GBC Finland also stated there is a need to implement smoother assessment methodologies and tools to save time and prevent burdens.

Indicator	Assessment	Rationale	Evidence
Costs to public authorities		Additional costs for the implementation of new policies and for the monitoring of data is expected in the short term. However, common EU frameworks eventually reduce costs on member states, increase benefits and allow national policymakers to learn from each other. Moreover, the boost of circular marketplaces could allow local authorities to save money by preventing waste.	<ul style="list-style-type: none"> The Swedish Roadmap on Climate Declarations indicates that the additional costs are addressed through lower capital adequacy requirements and other incentives for green financing solutions aiming at stimulating investments with lower carbon emissions.
Innovation and research		The emphasis on sustainable materials and products, on sustainable methods (renovation, demolition processes, etc.), as well as the increased collection of data would boost innovation and research in the sector	The case studies did not reveal any relevant impact data.
Costs to consumers and households		Efficiency renovations have initial costs but allow buildings to have longer lifespans and lower operational costs. There are also various energy performance business models that reduce upfront costs.	<ul style="list-style-type: none"> In Israel, additional costs for developers are reimbursed by increased property sales and value. The Swedish Roadmap on Climate Declarations indicates that sustainable constructions and renovation are more expensive upfront but are almost always more cost effective in the long term. The Swedish Roadmap on Climate Declarations also indicates that additional costs are addressed through lower capital adequacy requirements and other incentives for green financing solutions aiming at stimulating investments with lower carbon emissions. One of the purposes of Japan's LQH is to lower the economic burden of housing by improving housing quality, performance and durability. Certified houses can apply for several tax reductions, insurance discounts and housing mortgage support.
Costs and benefits to specific regions or sectors		It may be easier, and thus less costly, for more advanced regions on sustainability and circularity matters to implement lifecycle thinking approaches. They may also benefit from more dynamic secondary materials and products marketplaces.	The case studies did not reveal any relevant impact data.

Indicator	Assessment	Rationale	Evidence
Effects on the macroeconomic environment, including impacts on international trade and competition	+	<p>The establishment of a common technical language would promote cross-border market opportunities, allowing to sell and source sustainable and secondary raw construction products and material from other EU countries.</p> <p>The European secondary raw materials and recycled materials marketplaces could also be booster by waste prevention measures.</p> <p>A common EU framework along with common indicators could also allow national policymakers to learn from each other, creating synergies and increasing the influence of the EU market internationally.</p>	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated that their support to businesses regarding resource efficiency measures influenced over £17 million in capital investment.

Legend: '+': Positive economic impact; '-': Negative economic impact; '-/+': Positive or negative economic impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 24: Assessment of the social impacts

Indicator	Assessment	Rationale	Evidence
Employment and labour markets	+	<p>Efficiency renovation as well as financial measures linked to sustainability performance criteria could support job creation and the development of new expertise (e.g. integration of simplified LCA approaches, requirement of indicators implementation and monitoring, data collection)</p>	<ul style="list-style-type: none"> The construction sector provides 18 million direct jobs, but the sector has been hit by the financial and economic crisis. A recent study of the Zero Emission Building Plan in Vancouver showed that it creates a \$3.3 billion job opportunity in the lower mainland of British Columbia (in combination with other related provincial policies). Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated that their support in resource efficiency influenced around 520 jobs, of which 110 were created and 410 safeguarded, in 2017-2018. The Dutch Building Decree shows that circular buildings are linked to the creation of diverse jobs (e.g. for repair and maintenance). GBC Finland received feedback that there are not enough Finnish architects trained to conduct carbon calculations, thus, more training schemes would be required.
Standards and rights related to job quality	?		The case studies did not reveal any relevant impact data.

Indicator	Assessment	Rationale	Evidence
Governance, participation, good administration, access to justice, media and ethics	?		The case studies did not reveal any relevant impact data.
Public health and safety	+	<p>The implementation of indicators on the safe handling of hazardous substance (as proposed in the financial measures linked to sustainability performance criteria) would increase safety, as well as raise awareness on linked health hazards.</p> <p>Other types of health and safety indicators could also be implemented.</p>	<ul style="list-style-type: none"> The Israel Green Building Standards SI 5281 for sustainable buildings incorporate a criterion limiting exposure to Volatile Organic Compounds and other indoor contaminants, which limits related health injuries.

Legend: '+': Positive social impact; '-': Negative social impact; '-/+': Positive or negative social impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 25: Assessment of the environmental impacts

Indicator	Assessment	Rationale	Evidence
Climate change	+	<p>The focus on energy efficiency renovation would allow a reduction of operational and embodied carbon emissions over the whole lifecycle of buildings.</p> <p>The integration of lifecycle carbon emissions in NCEP would decrease the impact of buildings on climate change by reducing GHG emissions.</p>	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the tonnage of CO₂eq savings linked with their support (focusing on resource efficiency measures) to be of 71,000t in 2017-2018, of which 63,000 tonnes come from energy measures and 7,500 tonnes come from material savings, counted on a lifecycle basis.
Transport and the use of energy	+	<p>The focus on efficiency renovation activities would lower the transport and use of energy by decreasing operational energy needs and embodied carbon emission.</p> <p>It would also decrease the energy use linked to construction and product/material manufacturing by promoting reuse and recycling.</p>	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the energy savings linked with their support (focusing on resource efficiency measures) to be of 130,000 MWh in 2017-2018.
Biodiversity, flora, fauna and landscapes	+	The focus on renovation could decrease the needs for new construction and prevent to denaturalized landscapes and erode linked biodiversity.	<ul style="list-style-type: none"> None yet, but GBC Finland informed that they intend to study the impact on biodiversity of Low-Carbon Road Map for Buildings and Building Materials published by the Ministry of Environment of Finland
Water quality and resources	+	The integration of circularity thinking could decrease the pressure on water resources	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the water savings

Indicator	Assessment	Rationale	Evidence
		(this is dependent on other factors such as a well-functioning market for secondary materials). The increase of reuse and recycling would also reduce construction material and products being landfilled at end of life, decreasing pollution leakage to underground water.	of their support focusing on resource efficiency measures to be of 57,000 m ³ in 2017-2018
Soil quality or resources	+	Encouraging renovations and deconstruction could reduce high excavation waste arising from new builds. The increase of reuse and recycling would reduce construction material and products being landfilled at end of life, decreasing leakage to the soil and eroding its quality (this is dependent on other factors such as a well-functioning market for secondary materials). Overall, the integration of circularity thinking would decrease waste, landfilling and pressure on soil resources.	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the waste prevention tonnage linked with their support (focusing on resource efficiency measures) to be of 82,000t in 2017-2018.
Land use	+	The focus on renovation would lead to a decrease of land needs.	The case studies did not reveal any relevant impact data.
Renewable or non-renewable resources	+	The implementation of circularity thinking, for example the integration of Level(s) simplified LCA approach, would enable the increase of renewable resources usage and decrease raw material needs. This could overall boost the secondary materials and products markets, expanding benefits beyond the construction sector.	<ul style="list-style-type: none"> Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the prevented material consumption linked with their support (focusing on resource efficiency measures) to be of 1,800t in 2017-2018 Resource Efficient Scotland, delivered by Zero Waste Scotland, evaluated the recycled and reused resources linked with their support (focusing on resource efficiency measures) to be of 82,000t in 2017-2018
The likelihood or scale of environmental risks	0	No change is expected.	The case studies did not reveal any relevant impact data.

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

Assessment of the development and potential revision of GPP criteria

The tables below summarise the assessment of the economic (Table 26), social (Legend: '+': Positive economic impact; '-': Negative economic impact; '-/+': Positive or negative economic impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 27) and environmental impacts (Legend: '+': Positive social impact; '-': Negative social impact; '-/+': Positive or negative social impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 28) of the revision of development and revision of GPP criteria, for each of the indicators listed in the previous sector.

Table 26: Assessment of the economic impacts

Indicator	Assessment	Rationale	Evidence
Functioning of the internal market and competition	+	With GPP, authorities can create and escalate the market as the public sector take a role of lead consumer in green products and services. Public sector can either makes a contract of procurement green technologies (including energy efficient building materials, sustainable raw materials taking into account the environmental impacts, etc.) that are not yet commercialized, or procures green products which are commercialized but have not enough demand in large quantities. In most cases, contracting authorities require the use of recovered or recycled material content, creating new markets by providing market signal to potential suppliers with incentives for developing these kind of products.	<ul style="list-style-type: none"> GPP CAM, through the obligation to use products with recovered or recycled material content, create demand and stimulate the development of a qualitatively and quantitatively adequate offer in the market of construction products. As part of the Italian GPP CAM, a partial implementation of the Criteria is required for thermal insulation interventions on existing buildings by the so called "Re-Launch Decree" released in 2020. The Criteria regarding insulation materials (requiring various different percentages of recycled content for each type of product, for example at least 1-10% for polyurethane foam, 60% for glass wool, 15% for rock wool) <u>must be implemented by private clients in order to access to incentives</u> (tax deductions which can be anticipated as discount by the suppliers of goods/services or as assignment of the tax credit). In this way GPP CAM have recently been extended to private building interventions, thus linking the policy to the Green Deal and refurbishment policies, as well as to policies for economic recovery and employment in the construction sector.
Operating costs and conduct of business/Small and Medium Enterprises	+	Promoting green procurement gives important incentives for industry to develop 'green' technologies and products and promote them in the market place. In particular, small- and medium-sized companies may profit from environmental procurement, as it offers an opportunity to find markets for their innovative solutions and products.	No impact data from case studies
Costs to public authorities	-/+	In general the development and implementation of GPP criteria in tender procedure require additional costs for example for setting thresholds (national GPP criteria and environmental credentials have	<ul style="list-style-type: none"> For the implementation of GPP CAM, time and effort for the development of the criteria were significant because there was not enough scientific support for the choices, since the Ministry of Environment does not include all

Indicator	Assessment	Rationale	Evidence
		<p>to be developed for each building product groups to facilitate the selection procedure) and develop tools/methods to assess proposals as well as for reporting. For example, LCA benchmark values could improve GPP criteria required for the construction sector and support the GPP verification process made by public administrations/contracting authorities. However, it will require the development of national databases which can be costly (costs for development and maintenance). Besides, GPP implementation requires some additional resources/capacity for monitoring as well as ensuring that assessment methods and guidance are regularly reviewed and updated.</p> <p>Nevertheless, GPP can support extended lifespans of public buildings with reduced operational and maintenance costs in the long run.</p>	<p>types of skills (for example, in the design field). This lengthens the time for agreeing on the most appropriate requirement/threshold. For example, the present, third revision of the Criteria, has been under work for almost 2 years now, because it takes much time to acquire information and opinions from all stakeholders. As such, to get to the point of implementation, EU and national funds were used, by means of Projects such as CReIAMO PA, financed by Priority Axis 1 of the National Operational Programme (NOP) on Governance and Institutional Capacity 2014-2020, for three quarters by European funding.</p> <ul style="list-style-type: none"> • In the Dutch Green Deal 159 Circular procurement, adding circularity in procurement for the first time takes time (and thus, money), but for the times afterward it will take the same time as it usually did. In a longer timeframe, it can save money (buying less, longer lifetime, second life is valuable) • For Finland's procurement criteria for low carbon building, though it is a voluntary initiative, it is fully administered by the government and therefore, time and resources must be allocated to implementation, monitoring and evaluation. Unfortunately, there has not been enough capacity to fully sustain this.
Innovation and research	+	<p>One of the main goals of GPP, which is the demand-side innovation policy, are the emergence of new products and the enhancement of quality of the products by innovation, and the improvement of competitiveness of green industry e.g. development of products with high recycled content and which are energy efficient and have less environmental impacts. It help the private sector discover and develop the market for new products and new technology, with the role of the public sector as testing-ground of the innovative products.</p>	<ul style="list-style-type: none"> • No impact assessment was carried out as part of the monitoring of CAM GPP implementation. However, it has been reported that companies in the supply chains of products/components for construction are rather quickly investing in research and innovation (for example Ital cementi – Calcestruzzi S.p.A., one of the largest concrete firms in Italy, which has developed a specific line of GPP compliant materials) and, overall, in the certification of their products, according to CAM requirements (recycled content certification, EDPs or others).

Indicator	Assessment	Rationale	Evidence
		In addition, because GPP contracts usually include green or environment standards for the procured products, suppliers who already have relating technology increase their investment on product and technology development, and it leads incremental innovation. Also, GPP for new technology accelerate technology diffusion in the private sector because the authorities guarantee enough demand for the market for the private firms, leading to the expansion of the markets for greener buildings.	
Costs to consumers and households	+	The construction of energy efficient buildings with reduced use of toxic chemicals, in particular in the case of social housing can considerably reduce energy consumption for households saving money and also improve housing lifespans with reduced operational costs in the long run.	The case studies did not reveal any relevant impact data.
Costs and benefits to specific regions or sectors	+	As previously mentioned GPP will create and gives significant incentives for the development of greener technologies and products and promote them in the market place. In addition the resilience of the supply chain will increase as a result of using more locally sourced materials.	The case studies did not reveal any relevant impact data.
Administrative burdens on businesses	+	It may cause an initial additional burden on businesses to implement the procurement processes but the development of more standardised approaches will gradually decease the cost of administrative procedures.	The case studies did not reveal any relevant impact data.
Effects on the macroeconomic environment, including impacts on international trade and competition	+/-	Introducing 'green' tendering criteria can influence the marketplace and result in new entrants in the field of environmental technologies and products - potentially resulting in increased competition and reduced prices.	<ul style="list-style-type: none"> The Finnish procurement criteria for low carbon building is focussed on ecological sustainability but encourages contractors to set more holistic quality requirements. Overall, it supports Finland's 2013 GPP goal of acquiring new cleantech solutions for at least EUR 300 million annually (around 1% of the total value of public procurement).

Legend: '+': Positive economic impact; '-': Negative economic impact; '-/+': Positive or negative economic impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 27: Assessment of the social impacts

Indicator	Assessment	Rationale	Evidence
Employment and labour markets	+	Introducing 'green' tendering criteria could support job creation and the development of new expertise (e.g. development of tools and calculation methods, integration of simplified LCA approaches, requirement of indicators implementation and monitoring, data collection). New job opportunities are also expected for less qualified workforce at the local level.	<ul style="list-style-type: none"> As part of the Dutch Green Deal 159: Circular Procurement, it is stated that shifting to circularity will create 50k jobs and at least € 7 billion will be earned. It also contributes to the Netherlands objectives of becoming circular by 2050, and contributes to mitigate risks in other areas (material hazard, social risks...) by implementing some measures like material passports, which gives information on the products.
Standards and rights related to job quality	+	Greening procurement could lead to the development of a more skilled and environmentally aware EU construction workforce. For example, a healthier operational place for the workers can reduce sickness and boost productivity.	The case studies did not reveal any relevant impact data.
Public health and safety	+	The implementation of some measures such as material passport and the ban of the use of toxic materials or chemicals in processes will enhance quality of life as well as improve health and safety both in the workplace and the living environment (low emitting-products, less toxic materials use, etc.)	The case studies did not reveal any relevant impact data.

Legend: '+': Positive social impact; '-': Negative social impact; '-/+': Positive or negative social impact (depending on certain conditions); '0': no effect; '?': unknown effect

Table 28: Assessment of the environmental impacts

Indicator	Assessment	Rationale	Evidence
Climate change	+	<p>GPP allows public authorities to achieve environmental targets, in particular related to climate change, by reducing greenhouse gas emissions through the purchase of products and services with a lower CO₂ footprint throughout their life-cycle.</p> <p>More generally, awareness of how circularity contributes to attaining</p>	<ul style="list-style-type: none"> The new procurement method developed by Rijkswaterstaat and applied as part of the project on the construction of the harbour entrance in IJmuiden as described above, yielded 88,639t reduction in CO₂e over a period of 75 years (including 61% assigned materials for construction, 13% for operating and maintenance, and 26% for end-of-life) or 25,262 toe energy, which is 1,181.9t less emission of CO₂e each year or 336.8toe each year. The calculated emissions value for the reference design was 221,598t (63,155 toe energy), or 2,954.6t CO₂e/year (842.1 toe energy), for a design lifetime of 75 years. The winning

Indicator	Assessment	Rationale	Evidence
		objectives of carbon neutrality (life cycle) will increase.	<p>tender proposed a CO₂e reduction of 132,959t (37,893 toe energy) or 1,772.8t CO₂e/year over the same lifetime period, which represents 40% lower than the reference model. To note that the CO₂e emissions were calculated based on all processes involved; production, transport, construction, demolishing, reuse, etc. of all the building materials, and the reduction was estimated by subtracting the environmental costs indicator (ECI) value of the offered design from the reference design. 48.66% of the ECI value is caused by the emission of CO₂e.</p> <ul style="list-style-type: none"> In 2013, the City-State of Berlin launched a pilot project with the aim of encouraging greater reuse of recycled concrete in building construction. A total volume of around 5,400m³ of certified 'circular economy' recycled concrete was used in the construction of a slurry wall and building shell of the new life science laboratory building at the Humboldt University. In comparison with concrete made from primary aggregates, the recycled concrete alternative saved 880m³ of virgin gravel (for approx. a 45% displacement of primary aggregates with RC – concrete with recycled concrete aggregates), 66% of the energy required for production and transport (or 225 megajoule (MJ) per tonne of recycled concrete), and 7% of the associated CO₂ emissions (0.6kg CO₂e/t of recycled concrete).
Transport and the use of energy	+	Introducing green tendering criteria in the construction projects could considerably reduce energy consumption in particular by choosing products which are more efficient and implementing environmentally conscious design principles, e.g. cradle-to-cradle. Contracting authorities can choose products and proposals with the lowest energy consumption.	<ul style="list-style-type: none"> See above.
Biodiversity, flora, fauna and landscapes	+	GPP could be used to address some environmental issues such as deforestation through the purchase of wood and wood products from legally harvested and sustainably managed forests, and help preserve	The case studies did not reveal any relevant impact data.

Indicator	Assessment	Rationale	Evidence
		biodiversity by reducing environmental pollution through controlling chemicals and limiting the use of hazardous substances.	
Water quality and resources		The integration of circularity criteria in GPP procedure would allow to decrease the pressure on water resources (this is dependent on other factors such as a well-functioning market for secondary materials) through water-efficiency measures such as rainwater harvesting, recycling and reuse of grey water, low-flow fixtures, sensors etc. The ban or reduction in the use of toxic chemicals will also limit soil pollution and thus groundwater and surface waters pollution	The case studies did not reveal any relevant impact data.
Soil quality or resources		GPP criteria generally promote the use of recycled materials and reuse which would reduce waste landfilling, decreasing soil pollution (this is however dependent on other factors such as a well-functioning market for secondary materials). Overall, the integration of circularity thinking would allow to improve resource efficiency, decrease waste production and pressure on soil resources.	The case studies did not reveal any relevant impact data.
Renewable or non-renewable resources		The implementation of circularity thinking, for example the integration of Level(s) simplified LCA approach, would allow to increase renewable resources usage and decrease raw material needs. This could overall boost the secondary materials and products markets, expanding benefits beyond the construction sector.	The case studies did not reveal any relevant impact data.

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect

Assessment of the development of regional and local guidance and influencing financial instruments

The tables below summarise the assessment of the economic (Table 29), social (Table 30) and environmental impacts (Table 31) of the development of planning guidance and funding requirements for each of the **indicators** listed in the previous section.

Table 29: Assessment of the economic impacts

Indicator	Assessment	Rationale	Evidence
Functioning of the internal market and competition	-/+	Strengthened implementation and spreading of knowledge will be ensured, as national and local levels will be supported and incentivized in the spatial planning of EU Directives and networks at the city-level will be created. However, these initiatives may also create gaps of implementation between certain regions.	<ul style="list-style-type: none"> The implementation of Level(s) underlines that support to regional/local entities would boost dissemination and implementation of circularity tools. A case study on the "Green Deal Agreement on Sustainable Dismantling" in Finland highlighted that governments' guides enable companies to understand the economic benefits of circularity and how to reach its criteria. In the municipality of Maribor, stakeholders from the Wcycle project stated that the European Commission might help in creating and harmonising standards for circular construction by the publication of an EU strategy.
Operating costs and conduct of business/Small and Medium Enterprises	-/+	SMEs may face operating costs in the implementation of circularity requirements in building design, for example through upskiling. However, these costs may be eased by the local and regional initiatives and support (such as public programs or networks) that indirectly impact and boost local economies. Digitisation is important to offset some of these costs. Some of the innovative solutions could be provided by SMEs. Some SME's could merge/be acquired by those that have the capacity for change.	<ul style="list-style-type: none"> A case study on the "Green Deal Agreement on Sustainable Dismantling" in Finland pointed out the necessity of public authorities to support local operational changes by, for instance, promoting initiatives or aggregating reports. In the municipality of Maribor, the Wcycle project has a positive impact on the economy. The study case on Minnesota Sustainable Building Guidelines highlights the financial challenges for small projects.
Administrative burdens on businesses	-	Provision of new guidance and tools at regional and local levels may cause additional burden on businesses to implement circularity, especially in the beginning. The collection and monitoring of data, but also the implementation of strengthened requirements may, also be a burden.	<ul style="list-style-type: none"> The implementation of Level(s) highlights costs and challenges on businesses, such as data availability. The AGEC Law in France shows that the recycling of construction materials may bring additional burdens to companies and that practical implementation should be privileged to adapt to what already exists. The businesses faced important administrative burdens through the implementation of the Long-Life Quality

Indicator	Assessment	Rationale	Evidence
			Housing Act in Japan. Additionally, there is a lack of integration with the existing housing performance system (applying two certification systems).
Costs to public authorities	+	Eased costs to public authorities through the development of European funds providing financial incentives. However, there remains a need to ensure alignment between Circular economy and other planning requirements.	<ul style="list-style-type: none"> The Municipality of Maribor, in Slovenia, managed to develop a circular project thanks to the European Cohesion Funding. EU funds (UIA, Horizon2020, Interreg) subsidized the Wcycle project with a total of €50 million for phase 1. There is an overlap with the Copenhagen Architecture Policy (2017-2025) and Denmark's sustainability in Construction & Civil Works.
Innovation and research	+	Promoting and funding partnerships between stakeholders, along with enhancements of knowledge spreading and sharing, would stimulate innovation. This would also allow research projects to benefit from synergies.	<ul style="list-style-type: none"> Circular Flanders, which aims at incorporating more circularity in Flanders, focus partially on simulating innovation and entrepreneurship. They implemented an experimental lab on circular construction, centred around urban mining and circular design. They indicate that circular innovation can be difficult in the construction sector, as contractors and investors prefer to avoid risks associated, and prefer traditional techniques, so it is important to stimulate research and innovation, not only from a technical point of view, but also from a systemic one. The city of Copenhagen provides 20% additional budget for 6 pilots projects to help cover additional costs related to circularity. They indicate that this extra funding allows innovation and creativity to consider new aspects without (or reduced) financial limitations. Through funding, the Welsh Government's Innovative Housing Programme allowed the development of 3-4 projects with circular innovation as their main focus. They also report that the funding was an opportunity for participants to test innovation with reduced risk. Also, subsequent rounds of funding after an

Indicator	Assessment	Rationale	Evidence
	0		initial one allowed further circular innovation compared to the original project and allow for scale up.
Costs to consumers and households	0	There would be no costs to consumers and households, since it would be funded by European subsidies.	The case studies did not reveal any relevant impact data
Costs and benefits to specific regions or sectors	+/-	Some regions could receive economic gains, through promotion and financial subsidies of green constructions and green jobs. They would also benefit from capacity building on circularity subjects. Planning interventions could change the viability of developing certain sites. In the short term this could have a negative impact for land owners and investors (for long term gains). According to how it is implemented, some regions may benefit more than others, especially urban areas.	The case studies did not reveal any relevant impact data
Effects on the macroeconomic environment, including impacts on international trade and competition	0	No manifest effect	The case studies did not reveal any relevant impact data

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Table 30: Assessment of the social impacts

Indicator	Assessment	Rationale	Evidence
Employment and labour markets	+	The embedment of circularity in building design through EU funding schemes and the provision of guidance and tools can support greater job creation by incentivising more circular projects and green jobs. On housing, could provide a more affordable supply.	<ul style="list-style-type: none"> A case study on the 'Green Deal on Circular Procurement' in the Netherlands stated that shifting to circularity will create 50k jobs. In the municipality of Maribor, the Wcycle project has contributed to the creation of new green jobs. An assessment carried out in the context of a project developed under the New London Plan showed that with the right investment the circular economy could create 12,000 new jobs in London by 2030.

Indicator	Assessment	Rationale	Evidence
Standards and rights related to job quality	+/-	Embedded circularity in building design will lead to the upskilling of workers, supported by national, regional and local trainings. However there could be a risk to the existing labour market through low to high skilled jobs	<ul style="list-style-type: none"> The Welsh Innovative Housing Programme aims to support local employment and the development of local supply chains. The implementation of the Level(s) shows the importance of the implementation of online trainings contributing to the upskilling of workers. The development of a new standard in Denmark's Sustainability in Construction and Civil Works case has encouraged stakeholders to upskill, adapt and develop new expertise.
Governance, participation, good administration, access to justice, media and ethics	?	Some guidance document or requirements could ask for citizen participation, in particular when public buildings or infrastructures are involved.	<ul style="list-style-type: none"> One respondent identified the opportunity of a more systematic consultation and co-design of solutions with concerned public at urban plans level (notably brownfield renovation) as well as at building level (notably public building)
Public health and safety	+	Promoting circularity at urban planning level leads to increased good practices in waste, air pollution, biodiversity and water management for example, which brings circular economy's positive transversal impacts. This promotes well-being and healthier urban areas.	<ul style="list-style-type: none"> Health and comfort are one of the three main areas covered by Level(s) framework's indicators. One of the seven themes developed by the Welsh Innovative Housing Programme is "A healthier Wales", to support physical and mental wellbeing. This was supported by the Health Department. This demonstrates that public health and wellbeing can be part of circular economic measures influenced by urban planning tools

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Table 31 : Assessment of the environmental impacts

Indicator	Assessment	Rationale	Evidence
Climate change	+	Reduction of carbon emissions through the investments in projects contributing to a shift to a low-carbon economy (ESI, ERDF and Cohesion fund) and the sustainable planning of cities. Note, need to look at all environmental impacts, to reduce any	<ul style="list-style-type: none"> The Copenhagen Architecture Policy highlights the link between local initiatives and wider climate carbon reduction plans by ensuring the city can be adaptable to climate change and be carbon neutral. An assessment of the New London Plan for a specific project showed that the benefits

Indicator	Assessment	Rationale	Evidence
		unintended consequences. Ability to consider whole life impacts.	<p>for demolition and construction to be 7,760 tCO₂e savings.</p> <ul style="list-style-type: none"> According to the study case on Minnesota Sustainable Building Guidelines, the energy carbon goals are to achieve the tracking of whole building LCA for embodied carbon with a 10% reduction.
Transport and the use of energy	+	Local initiatives are more likely to contribute to improvements in transport and the use of energy.	<ul style="list-style-type: none"> An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be 16,500 fewer HGV movements. According to the study case on Minnesota Sustainable Building Guidelines, the energy carbon goals are to achieve 90% reductions in operational energy / carbon by 2025.
Biodiversity, flora, fauna and landscapes	+	Local implementation, and more specifically urban-scale implementation, will lead to strengthened consideration of biodiversity in urban areas and of local ecosystems. The provision of guidance and tools on the impact assessment process before project launching would also contribute to assess the potential effects on biodiversity and landscapes of the building sector.	<ul style="list-style-type: none"> Within the Copenhagen Architecture Policy, architects noted that the climate adaptation aspect of the policy is being particularly well adopted in City works, with high social quality and addition of green spaces.
Water quality and resources	0	No manifest effect	The case studies did not reveal any relevant impact data
Soil quality or resources	0	No manifest effect	The case studies did not reveal any relevant impact data
Land use	+	At regional level, a prioritisation of the reuse of asset could reduce land use	The case studies did not reveal any relevant impact data
Renewable or non-renewable resources	+	It would promote use of sustainable materials in constructions and renovation, for example through requirements of reused/recycled content requirements in permit deposit, or through fiscal incentives (monies could be refunded if some requirements are achieved). Use of locally sourced bio-based materials.	<ul style="list-style-type: none"> An assessment of the New London Plan for a specific project showed that the benefits for demolition and construction to be 122,000 tonnes of virgin material use avoided.
The likelihood or scale of environmental risks	0	No manifest effect	The case studies did not reveal any relevant impact data

Legend: '+': Positive environmental impact; '-': Negative environmental impact; '-/+': Positive or negative environmental impact (depending on certain conditions); '0': no effect; '?': unknown effect



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