Construction and demolition waste

New regulation for waste prevention, source separation and recycling rates

NHP-Network

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Contents

1. Introduction

The Norwegian Network for handling of Construction and Demolition Waste (C&D waste) (NHP-nettverket) is interested in the relation between waste prevention and the legal requirements in the Norwegian regulation for source separation of C&D waste at the construction site. At the same time, the network is aware of processes in the EU to revise the Waste Framework Directive (WFD), as well as other regulations that may influence the framework for handling of C&D waste in the years to come.

The network wants to identify drivers and barriers for waste prevention in the building sector, and to evaluate how waste prevention might influence the possibility of reaching the Norwegian legislative requirements for onsite source separation of C&D waste.

The network seeks answers to the following questions:

- Will requirements for waste prevention reduce the amount of C&D waste and consequently influence the source separation and recycling rate of C&D waste?
- Is it possible to include requirements for waste prevention in the WFD? If yes - how can such requirements be implemented in the directive?
- What will be the consequences of including requirements for waste prevention in the WFD?

The network would also like to look into how much C&D waste could be reduced before this will influence the source separation of C&D waste at the construction site. The network has made an assumption that reducing the amounts of C&D waste through waste prevention measures will influence the possibility to source separate C&D waste.

NIRAS has used a combination of statistical data and literature searches as well as interviews with stakeholders in Norway, Denmark, The Netherlands and a European association. The findings have been complemented with NIRAS' own knowledge of the construction and waste management sector in Norway and Denmark. The reference group has also made considerable contributions in the form of detailed comments and questions during the work.

The report is written by Håkon Sandven Jentoft, Sabina Syed, Eivind Bøe, Henning Jørgensen, Solvejg Qvist and Mikael Hallstrøm Eriksen. The report is based on the team's shared professional knowledge, combined with a review of relevant literature and statistics. Findings from studies conducted by NIRAS and others as basis for developing policies and initiatives related to C&D waste are also included.

2. Executive summary

In this report, NIRAS tries to answer two main questions:

1. Why is Norway not meeting the targets for 70 % material recovery set in the Waste Framework Directive (WFD)?
2. How may new EU regulations affect the treatment of Norwegian C&D waste?

Why is Norway not meeting the targets for 70 % material recovery set in the WFD?

The Waste Framework Directive includes the following requirement:

- *"by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, shall be increased to a minimum of 70 % by weight".*

According to Norwegian statistics, the material recovery rate for C&D waste was 44 % in 2020. According to Eurostat's statistics, the recovery rate for Norway was 63 % in 2020. The Eurostat statistics is based on the input from Norway, sent either by Statistics Norway (SSB) or Norwegian Environmental Agency (Miljødirektoratet). This shared responsibility could lead to differences in use of terms and data. However, NIRAS has not been able to identify why the differences occurs.

The uncertainties in Norwegian, Danish and European statistics demonstrate that C&D statistics has several limitations and cannot easily be used for comparison between EU member states. NIRAS recommend that consistent use of terms in accordance with the WFD definitions should be required. All reporting of data on European level should be regulated in the Regulation on waste statistics, to ensure uniform collection and reporting of national statistics.

The composition of Norwegian C&D waste differs slightly from other EU member states, as can be seen when comparing to Denmark. In 2020, wood waste was 12,5 % of the total C&D waste in Norway, while it was 3 % in Denmark. Only 6 % of the Norwegian wood waste is sent to material recovery. Although there is a growing market for reuse and recycling of wood waste, a rough assumption suggests that around 40 % of the wood waste is not suitable for recycling. Hence, the large amounts of wood waste may make it more difficult to reach the requirements for material recovery in Norway than in other EU member states.

A comparison of heavy waste fractions from Norwegian and Danish C&D waste statistics, show considerable differences in the composition.

- Asphalt – Norway 14%, Denmark 23%
- Bricks, concrete, etc. – Norway 41 %, Denmark 44 %
- Metal – Norway 1%, Denmark 7%.

Asphalt, concrete and metals are all sent to material recovery in Denmark. In Norway, 58 % of concrete waste is material recovered. As mentioned above, the statistics are not directly comparable. The high volume of fractions like concrete, metals and asphalt all sent to material recovery in Denmark, makes it easier to reach the target of 70 % material recovery and more difficult for Norway to reach the same targets. The handling of concrete in Norway is the key to reach the 70 % material recovery target.

Cr(VI) is, and has been, one of the reasons for the lack of material recovery (backfilling) of concrete in Norway. In 2016, Norwegian regulators introduced a new upper limit value (2 mg/kg Cr(VI)) for recycling of concrete waste. The limit value is probably a barrier for material recovery of concrete waste. From 2016 to 2017, the amount of concrete waste that was landfilled increased from 529 000 tons to 791 000 tons, while the recycling rate decreased from 63% in 2016 to 37% in 2017. In 2018-2020 the recycling rate for concrete waste was between 58%-60%. The limit value for Cr(VI)

was raised to 8 mg/kg in 2020. NIRAS comparison with other EEA member states shows a difference in limit values and indicate that the stricter values have led to a lower material recovery rate for concrete in Norway compared to other countries.

The market for the use of bricks and concrete for backfilling is also different in Norway compared to other EEA-states, as large volumes of primary stone/masses from construction are available in Norway. The demand for secondary bricks/concrete is hindered by:

- Transport costs – generally long distances between construction sites
- Quality requirements
- Fulfilling standards set by large operators for road and railway construction
- A scepsis towards using waste masses

This situation is opposite in Denmark, where bricks and concrete have a positive value and are in demand due to lack of alternatives. The situation is the same in The Netherlands.

In Denmark and The Netherlands as in most European countries, the conditions for waste management of C&D waste is found in waste legislation. There are also conditions laid down in the national counterparts to the Norwegian "Building Acts and Regulations", but the most important regulations are the waste regulations.

How will new EU regulation affect Norwegian C&D waste treatment?

EU legislation effect on waste prevention and material recovery

The EU is launching a set of regulations that will influence the generation, source separation and handling of C&D waste. The overall political ambitions are set in the "Green Deal" document, which is part of the EU Commission working program for 2020-2025. The Circular Economy Action Plan is a part of this political program. It is difficult to quantify the effects of the different initiatives, as most of them are not yet entered into legislation - only the ambitions are known. Also, as far as we know, the effects are not quantified in the EU legislation or policy process.

All stakeholders interviewed by NIRAS as part of this project underline that there is no conflict between waste prevention and material recovery (recycling). There are positive expectations to the new regulations and initiatives. Many of the stakeholders welcome the changes that have been announced by the Commission.

Based on the EU initiatives and feedback from stakeholders, NIRAS has tried to identify some effects of the initiatives. Studied EU initiatives and legislation include:

- Renovation Wave and Directive on the energy performance of buildings
- Eco design and construction products regulation
- Waste framework directive
- Landfill directive

In sum, all studied political initiatives and legislation will have a positive effect on the overall material recovery rate in Norway. All studied initiatives relevant to waste prevention are expected to have a positive effect. A more detailed discussion can be found in chapter 11.

NIRAS has carried out a scenario to illustrate possible effects on waste generation and material recovery rate if a set of initiatives are implemented. In summary, assumptions made for the scenario analysis of construction waste include:

- 25 % wood waste reduction

- 30 % overall waste reduction (all other waste fractions)
- Increase in material recovery of bricks, concrete and plaster by 50 %.
- 30% decrease in residual waste through improved source separation. This leads to an increase in the amount of paper/carboard, glass, plastics, metals, plaster, WEEE and wood waste.

If all other parameters are kept unchanged, this will reduce waste generation for new construction (not including renovation or demolition works) by 25 % and increase the material recovery rate from 52 % to 59 %.

3. Definitions

In the report, all definitions are in line with EU or Norwegian terminology.

Backfilling: any recovery operation where suitable non-hazardous waste is used for purposes of reclamation in excavated areas or for engineering purposes in landscaping. Waste used for backfilling must substitute non-waste materials, be suitable for the aforementioned purposes, and be limited to the amount strictly necessary to achieve those purposes.

Client: any natural or legal person for whom a construction project is carried out. The term developer is used synonymously in this report.

Construction and demolition waste (C&D waste): waste generated by construction and demolition activities.

Construction product: any product or kit which is produced and placed on the market for incorporation in a permanent manner in construction works or parts thereof and the performance of which has an effect on the performance of the construction works with respect to the basic requirements for construction works.

Construction site: any site at which building or civil engineering works are carried out.

Construction works: buildings and civil engineering works.

Designer: any natural or legal person commissioned to draw, calculate, plan or describe the whole or parts of the building or installation to be constructed.

Disposal: any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations;

Material recovery: any recovery operation, other than energy recovery or the reprocessing into materials that are to be used as fuels or other means to generate energy. It includes, inter alia, preparing for re-use, recycling and backfilling.

Recovery: any operation where the principal result is that the waste is serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.

Recycling: any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Performance of a construction product: the performance related to the relevant essential characteristics, expressed by level or class, or in a description.

Preparing for re-use: checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.

Responsible applicant: The initiative holder's (developer's) representative towards the municipality, who is responsible for ensuring that the application contains the necessary information for the municipality to be able to decide whether the initiative is in accordance with the regulation or not.

Responsible contractor: is responsible for the project being built in accordance with the design, as well as the regulation.

Responsible designer: Is responsible for ensuring that the building or construction is designed in accordance the regulation. The designer is responsible for documenting the preconditions and solutions that form the basis of the design.

Waste holder: the waste producer or the natural or legal person who is in possession of waste.

Waste management: the collection, transport, recovery (including sorting), and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.

Waste producer: anyone whose activities produce waste (original waste producer) or anyone who carries out preprocessing, mixing or other operations resulting in a change in the nature or composition of this waste

4. Method

To identify relevant information, NIRAS has used literature searches and interviews. Interviewed parties include

- Norwegian construction companies
- Norwegian demolition companies
- Norwegian waste management companies
- A Dutch C&D association
- A European C&D association

In addition, deeper look into Danish handling of C&D waste has also been carried out.

4.1 Collection of available statistics, policies and strategies

Statistics have been collected from Norwegian and Danish national statistics and from the Eurostat.

Policies and strategies have collected from national as well as EU sources (including the European Environmental Agency, the EU Commission and other EU relevant stakeholders).

A general observation is that C&D statistics are not accurate and should be handled with care. Statistics should be used as indicators and for time trends rather than for the direct comparison of different countries.

4.2 Interviews with Norwegian stakeholders

Interviews have been carried out with Norwegian stakeholders. Contact persons and relevant companies have been made available by the project steering group and the NIRAS network. The following stakeholders have been interviewed:

- Entra
- Future Built
- JM-Gruppen
- Nordic Demolition
- Norsk Gjenvinning
- Norsk riving
- Oslobygg
- Ragn-Sells
- Skanska
- Statsbygg
- Bergene Holm.

4.3 Interviews with European stakeholders

NIRAS has interviewed:

- BRBS Recycling, an association organizing the handling and recycling of construction and demolition waste in the Netherlands
- The International Recycling Federation, based in Brussels.

4.4 Literature study

NIRAS has not carried out a full literature study. Literature sources include reports published by the NHP Network, relevant literature shared by stakeholders and literature known by NIRAS as well literature found by search. A list of relevant literature can be found in chapter 14.

4.5 Deeper look into Denmark

The research into Danish C&D waste describes the handling of construction and demolition waste in Denmark with focus on statistical data, legislation, barriers, drivers and best practices related to increased prevention, reuse or recycling.

5. EU legislation and targets

Current EU environmental policy[1] clearly state the high ambitions for transforming Europe towards a more sustainable and competitive future. All known revisions of EU legislation refer to the environmental policy initiatives, which will also effect on the construction and building sector and the handling of C&D waste. In the following chapters, some of the most important legislation and ongoing revisions are presented.

5.1 Waste Framework Directive (WFD)

The WFD defines C&D waste and includes several articles with specific requirements or ambitions for the handling of C&D waste. This is put forward in the Article 9 Prevention of waste and Article 11 Preparing for re-use and recycling. Most important is Article 11 – 1 (b):

> *by 2020, the* ***preparing for re-use, recycling and other material recovery****, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of* ***70 % by weight***

The Commission is also asked to by 31 December 2024, to

> "*consider the setting of preparing for re-use and recycling targets for* ***construction and demolition*** *waste and its material-specific fractions, textile waste, commercial waste, non-hazardous industrial waste and other waste streams, as well as preparing for re-use targets for municipal waste and recycling targets for municipal bio-waste. To that end, the Commission shall submit a report to the European Parliament and to the Council, accompanied, if appropriate, by a legislative proposal*".

The revision of the WFD may possibly influence the generation and handling of C&D waste. Re-use and recycling targets for specific fractions might lead to more source separation and increased recycling of source separated waste. Based on the WFD text, NIRAS finds that the EU Commission is aware of the downcycling of waste used for backfilling purposes. Implementing material specific targets could possibly stop the backfilling and increase the amounts handled higher in the waste hierarchy, for example recycling.

More information on the WFD and a link to the full version could be found here.

5.2 Landfill Directive

The Landfill Directive sets out strict operational requirements for landfill sites with the objective to protect both human health and the environment. To support the EU's transition to the circular economy, the Landfill Directive also:

- introduces restrictions on landfilling of waste that is suitable for recycling or other material or energy recovery from 2030
- limits the landfilling of municipal waste to 10% by 2035
- introduces rules for calculating the attainment of municipal waste targets and requires EU countries to put in place an effective quality control and traceability system for municipal waste landfilled

[1] European Green Deal, Circular Economy Action Plan, etc.

Evaluation

By 31 December 2024, the Commission shall review the 2035 10% target with a view to

- maintaining or, if appropriate, reducing it
- considering quantitative target per capita on landfilling
- introducing restrictions to the landfilling of non-hazardous waste other than municipal waste

Furthermore, the Landfill Directive gives member states an option to "*draw up national lists of waste which is acceptable or unacceptable for landfill, or define criteria, including limit values, similar to those laid down in this Directive for the uniform acceptance procedure*".

The Landfill Directive gives Member States support on introducing initiatives to lift C&D waste in the waste hierarchy and the Commission revision of the WFD.

More information on the Landfill Directive and a link to the full version can be found here.

5.3 Eco Design Directive

To help reach the Green Deal objectives of lower resource consumption and lower environmental impact, the Commission is developing a sustainable product initiative. A proposal for this was included in the EU Strategy for sustainable products, which was adopted as part of a circular economy package on March 30th 2022.
Using the legal framework from the sustainable products initiative, the EU Commission aims to bring all products which are produced or sold in the EU in line with technical standards for sustainability.
The sustainable product legislative initiative will improve coherence with existing legislative instruments regulating products throughout the various phases of their life cycle.
On 30.03.22, the EU Commission launched a proposal for "establishing a framework for setting eco design requirements for sustainable products and repealing Directive 2009/125/EC". Article 1 states:

> *Those eco design requirements, which shall be further elaborated by the Commission in delegated acts, relate to:*
>
> *(a) product durability and reliability;*
> *(b) product reusability;*
> *(c) product upgradability, reparability, maintenance and refurbishment;*
> *(d) the presence of substances of concern in products;*
> *(e) product energy and resource efficiency;*
> *(f) recycled content in products;*
> *(g) product remanufacturing and recycling;*
> *(h) products' carbon and environmental footprints;*
> *(i) products' expected generation of waste materials.*
>
> *This Regulation also establishes a digital product passport ('product passport'), provides for the setting of mandatory green public procurement criteria and creates a framework to prevent unsold consumer products from being destroyed.*

Article 8 of the directive put forward that "*The information requirements referred to in Article 7(1) shall provide that products can only be placed on the market or put into service if a product passport is available in accordance with the applicable delegated act adopted pursuant to Article 4 and Articles 9 and 10*".

Article 38 and 39, directly references the CE marking of products: "*The CE marking shall be subject to the general principles set out in Article 30 of Regulation (EC) No 765/2008*".

Enlarging the scope of the Ecodesign Directive may possibly have an influence on the construction sector as well as future construction works. A link to the proposal for Ecodesign for Sustainable Products Regulation can be found here.

5.4 Construction Products Regulation (CPR)

"Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products" aims to "*make the single market work better and improve the free movement of construction products in the EU, by laying down uniform rules for the marketing of these products and by providing a common technical language to assess the performance of construction products*". In this way the regulation also enables EU countries to ensure the safety of construction works.

According to this regulation it is mandatory to CE mark construction products which are covered by harmonized standards or which have been issued a voluntary ETA (European Technical Assessment). Most recycled or recovered materials are currently not able to obtain a CE marking, but reused and recycled building materials are largely subject to the same requirements for properties and documentation as new building materials. For developers/builders who want to incorporate reused and recycled materials in a building, it is important to know the specific requirements of the legislation that the materials in question will be met with. Often the developer/builder will need to take on the responsibility for the quality of the recovered materials if they do not have a CE-marking.

The EU Commission launched a proposal for a revised regulation on 30.03.2022. The revised regulation is consistent with the do no significant harm principle, as it contributes to the objectives of the green transition of the European Green Deal (in particular the Renovation Wave) and the Circular Economy action plan. It promotes greener manufacturing, re-use, remanufacturing and recycling of construction products.

Some of the key proposals are:

- (25) A circular economy can be promoted by mandatory deposit-refund systems and the obligation to take back unused products. Member States should therefore be allowed to take such measures.
- (32) To render the reuse and remanufacturing of construction and the use of surplus construction products nonetheless possible at large scale, an alleviated procedure for drawing up the declaration of performance should be set out for those construction products.
- (42) To optimize the pursuit of the goals of the European Green Deal and of the Circular Economy Action Plan, the manufacturers should be obliged to reach a fair level of environmental sustainability, both for their products and their manufacturing.
- (43) With the goals of ensuring sustainability and durability of construction products, manufacturers should ensure that products can be used for a very long time. Such long use requires adequate design, use of reliable parts, reparability of products, availability of information on repair and access to replacement parts.
- (44) In view of enhancing the circularity of construction products, in line with the goals of the Circular Economy Action Plan, manufacturers should favour re-use, remanufacturing and recycling of their products. The (preparation for) re-use, remanufacturing and recycling require certain design, namely by facilitating the separation of components and materials at the later stage of recycling and avoiding mixed, blended or intricate materials. As the usual instructions for use will not necessarily reach the economic operators in charge of (preparation for) re-use, remanufacturing and recycling, the necessary information in this regard should be made available in product databases or systems and on the manufacturer's websites, in addition to the instructions for use.

- (45) To deliver safe, functional and environmentally sustainable construction products, it is necessary to establish comprehensive sustainability and safety obligations for manufacturers. Given the importance of these obligations and achieving the right balance between the functionality, safety and sustainability, the Commission should be empowered to determine the conditions by delegated acts under which, for a specific product family or category, these obligations are fulfilled or presumed to be fulfilled.
- (46) Some construction products become waste though they were never used. To avoid this waste of resources, manufacturers should accept to regain, directly or via their importers and distributors, ownership of products that, after delivery onto a construction site or to the user, have not been used and are in a state equivalent to the one in which they were placed on the market.
- (47) In order to be able to make informed choices, users of construction products should be sufficiently well informed about the environmental performances of products, about their conformity with environmental requirements and of the degree of fulfilment of manufacturer's environmental obligations in this regard. Therefore, the Commission is empowered to adopt delegated acts to establish specific labelling requirements which might include the easily understandable traffic light labelling.
- (48) Certain manufacturer's obligations, such as assessment of environmental sustainability or giving preference to recyclable materials, can hardly be fulfilled in case of used, remanufactured or surplus products. Economic operators enabling reuse or undertaking remanufacturing should thus be exempted from these obligations, the more so as the reuse and remanufacturing are beneficial to the environment.
- (89) In order to incentivize the use of sustainable construction products whilst avoiding market distortions and to remain in line with the Ecodesign for Sustainable Products Regulation, incentives for the use of sustainable construction products provided by Member States should target the most sustainable products and be embedded in an exchange of information amongst Member States.
- (90) In order to enhance the use of sustainable construction products whilst avoiding market distortions and to reach alignment with the Ecodesign for Sustainable Products Regulation, Member States' public procurement practice should target the most sustainable amongst the compliant products. Requirements applicable to public procurement contracts set out by implementing acts should be established according to objective, transparent and non-discriminatory criteria

Article 22 introduces additional environmental obligations for manufacturers and states that "*Unless product safety or the safety of construction works is thereby negatively impacted, the manufacturer has the following obligations:*

- *design and manufacture products and their packaging in such a way that their overall environmental, including climate sustainability reaches the state of the art level,*

The Proposal for Ecodesign for Sustainable Products Regulation may also influence waste prevention and handling of C&D waste. Some of the effects are discussed in chapter 11. More information of the revision of the Construction Products Regulation could be found here.

5.5 Energy Performance of Buildings Directive

The Energy Performance of Buildings Directive mainly focuses on the energy and climate impact of buildings. However, the directive also puts forward a life-cycle perspective of buildings - underlining that buildings are "*responsible for greenhouse gas emissions before, during and after their operational lifetime*". Furthermore, "*the whole life-cycle performance of buildings should be taken into account not only in new construction, but also in renovations through the inclusion of policies for the reduction of whole life-cycle greenhouse gas emissions in Member States building renovations plans*".

The directive does not include requirements that directly influence the prevention or handling of C&D waste. The directive is highlighting renovation instead of demolition – this may provide incentives for both member states and the building sector to increase renovation and to avoid demolition. The exact consequences of this directive are not considered in this report. Instead, emphasis has been laid on the Renovation Wave (see chapter 5.6)

- More information of the initiative can be found here.

5.6 Renovation wave

In 2020, the EU Commission published this strategy to boost renovation in the EU, addressing the dual ambition of energy gains and economic growth.

The EU Commission put forward in communications dated 14.10.2020 that "the construction ecosystem fit to deliver sustainable renovation, based on circular solutions, use and reuse of sustainable materials, and the integration of nature based solutions. The Commission proposes to promote the development of standardized sustainable industrial solutions and the reuse of waste materials. It will develop roadmap for 2050 for reducing whole life-cycle carbon emissions in buildings, including through the use of biobased products, and review material recovery targets.[i]"

The Commission promotes environmental sustainability of building solutions and materials, including wood and bio-based materials, nature-based solutions and recycled materials on the basis of a comprehensive life-cycle assessment approach. It will address the sustainability performance of construction products in the context of its revision of the Construction Product Regulation and it will develop by 2023 a roadmap leading up to 2050 for reducing whole life-cycle carbon emissions in buildings. The Commission will also accelerate work with standardization organizations on climate resilience standards for buildings.

The political initiative Renovation Wave for Europe could considerably influence the prevention and handling of C&D waste, if the initiative leads to a similar political initiative in Norway. If renovation replaces demolition activities, and consequently new construction works to a larger degree, this will affect the generation of C&D waste and the treatment of this waste. Possible consequences are further discussed in chapter 11.

More information of the Renovation Wave can be found here.

5.7 EU Construction and Demolition Waste Management Protocol

The European Commission has launched a protocol to promote better handling of C&D Waste. The Protocol fits within the Construction 2020 strategy, as well as the Communication on Resource Efficiency Opportunities in the Construction Sector. It is also part of the Circular Economy Package.

The overall aim of the protocol is to increase confidence in the C&D waste management process and trust in the quality of C&D recycled materials. This will be achieved by:

a) Improved waste identification, source separation and collection;
b) Improved waste logistics;
c) Improved waste processing;
d) Quality management;
e) Appropriate policy and framework conditions.

The Protocol is a "soft" measure launched by the Commission to stimulate an industry and is typical for EU initiatives.

More information of the protocol can be found here.

6. Norwegian legislation and initiatives

Norwegian regulations regarding construction and demolition waste mainly address waste management, including requirements on source separation at construction sites. In July 2022 some regulatory changes were made to facilitate and increase the reuse of building materials.

6.1 The Pollution Control Act (Forurensningsloven)

The Pollution Control Act includes a general requirement to avoid pollution, as well as littering. The purpose clause (§1) states that the purpose of the act includes reducing the amount of waste and ensuring environmentally sound waste treatment. Furthermore, it is stated in the Act that waste should be reused, prepared for re-use or material recycled unless other waste treatment methods can be justified due to environmental, resource or economic conditions.

The Pollution Control Act §27 includes a definition of waste, although construction and demolition waste is not defined specifically. §32 Management of commercial waste, states that the waste producer is responsible for delivering the waste to an approved waste facility or recovering the waste such that it ceases to be waste or is utilized by replacing materials that would otherwise be used.

Through §33, the waste hierarchy is included in the Act. This is in line with § 2, which states:

> *" Waste must be handled in such a way that it causes as little damage and inconvenience as possible. It must be recovered, preferably by preparing for re-use or recycling, unless recycling is not justified based on a balance of environmental considerations, resource considerations and economic conditions"* (Unofficial translation by NIRAS).

The Pollution Control Act gives the legal authority to develop more detailed regulations, either for specific waste streams or waste treatment operations. The legal act can be found here.

6.2 The Planning and Building Act

Waste is mentioned in §29-8, which states that projects subject to building regulations, must satisfy the requirements for proper waste management in accordance with the law. The actual requirements are described in the Regulation on Technical Requirements for Building Works (TEK17) and the Regulation on Building Applications.

6.3 Regulations on technical requirements for construction works (Byggteknisk forskrift (TEK17))

Chapter 9 in the Regulation on technical requirements for construction works, usually abbreviated TEK17, regulates the environmental aspects of construction works, including the management of construction and demolition waste. The TEK 17 is the most important Norwegian regulation for handling of C&D waste.

- § 9-1. The construction waste should be handled in a way that secures the lowest possible impact on natural resources and the external environment.
- § 9-5. The construction must be ensured a proper and intended lifetime so that the amount of waste over the construction's life cycle is limited to a minimum. Products must be selected that are suitable for reuse and material recycling. From the 1 July 2022, an addition has been made to the paragraph in order to ensure that buildings are designed and built in such a way that they later on can be disassembled, if this is possible to do within a practical and a financially sound framework.
- § 9-6. Projects over a certain size must have waste management plans that provide an account of the planned management of construction and demolition waste by type and quantity.

These projects include:

a) construction, additions, extension and underpinning of a building if the project exceeds 300 m^2 of gross internal area;
b) substantial modification, including façade alteration, or substantial repair of the building if the project affects more than 100 m^2 of the building's gross internal area;
c) demolition of a building or part of a building that exceeds 100 m^2 of gross internal area; or
d) construction, additions, extension, building below, modification or demolition of buildings, construction works and installations if the project generates more than 10 tonnes of construction and demolition waste.

- § 9-7. Mapping of hazardous waste, building fractions that must be removed and materials that are suitable for reuse, as well as requirements for reporting. This paragraph had some substantial additions from 1 July 2022. Previously it only regulated the mapping and handling of hazardous waste. The change in July however, added other types of building components that must be removed, as well as a mapping requirement for building components that can be reused. The paragraph specifies what the report for the mapping of reusable building components should include. The report must for example describe the occurrence of, amount and type of materials or building components that are suitable for reuse, including an assessment of the remaining life span of the components.
- § 9-8. Waste separation. The requirement was before 1 July 2022 to separate a minimum of 60 % of the construction and/or demolition waste in a project and deliver it to an approved waste collection facility or directly to a resource recovery facility. From July, the requirement of sorting is increased to 70%, and reuse is also specified as an accepted downstream solution.
- § 9-9. Final report on actual disposal of the construction and demolition waste.
- § 17-1. Greenhouse emissions from materials. This is an entirely new chapter in the regulation from 1 July 2022, and states that the greenhouse gases from a new construction must be calculated, and that the construction waste generated must be included in the accounting.

The regulation can be found here.

6.4 Regulations relating to Building Application (Byggesaksforskriften (SAK 10))

This regulation states that waste management plans, documentation of the actual management of the waste, and environmental restoration plans are required to be documented in construction projects, in accordance with the regulation on technical requirements for building works. The final report on actual management of waste must be included in the application of the certificate of completion. The regulations also state the responsibilities for the different actors in the project:

- The responsible applicant needs to ensure that a waste management plan, report from the environmental mapping, report from re-use mapping and final report for waste management is prepared and that documentation is obtained for the actual handling of the waste.
- The responsible designer or the responsible contractor has to ensure the necessary design based on the waste management plan and the findings in the report for environmental mapping.
- The responsible contractor must contribute to and follow up the waste management plans and take care of the documentation of the actual handling of waste, as well as preparing the final report for waste management.

The regulation can be found here.

6.5 Regulation on safety, health and the working environment on building or construction sites (Byggherreforskriften)

This regulation secures the safety, health and working environment on building or construction sites, and states what responsibilities the builder has. It states that the builder is responsible for securing storage, handling and removal of waste and hazardous materials.

The regulation can be found here.

6.6 The Regulation on Recycling and Treatment of Waste (Avfallsforskriften)

The regulation is important for the handling of waste in Norway, including C&D waste. The regulation is currently being revised in order to be in accord with EU legislation and to function as a tool for reaching EU targets for waste management. There is potential for including more requirements regarding the management of C&D waste in the regulation. Today, special requirements for C&D waste are found in chapter 14A, which aims to encourage the recovery of concrete and bricks from demolition in construction projects, including material recovery (in general backfilling) when used as noise barriers, roads and backfilling after digging. Chapter 14A also regulates the removal of PCB from the bricks and concrete.

The limit value for chromium 6 (Cr VI) in concrete for material recovery has been raised from two to eight milligrams per kilogram. Material recovery of concrete with more than eight milligrams of chromium 6 per kilogram of concrete is not prohibited, but is subject to approval by pollution control authorities on a case by case basis.

The regulation can be found here.

6.7 The national Waste management plan for 2020-2025

The waste management plan was established in accordance with Article 28 of the European Union's Framework Directive for Waste. It describes waste quantities, status of the management of different types of waste, and the most important treatment and recycling facilities in Norway. The plan also describes the need for changes in waste infrastructure in order to achieve the EU requirements for (preparation for) reuse and material recycling. The waste management plan also includes a waste prevention program, in compliance with Article 29 of the Waste Framework Directive. The program sets targets for waste prevention, describes ongoing and new prevention measures and assesses the usefulness of the EU Commission's examples of such measures. The current waste management plan is a revision and update of the waste strategy with annexes from 2013.

Regarding construction and demolition waste, the waste management plan focuses on how to achieve the EU target of 70 % (preparation for) reuse and material recovery in 2020. A suggested measure was to increase the requirement for source separation at construction sites in the TEK17 (from the level of 60 percent). Another suggested measure was to make it easier to use lightly contaminated concrete waste and bricks for backfilling purposes, by clarifying when such waste can be used without a permit under the Pollution Control Act. Both of these measures have been implemented, with a requirement of 70 % source separation in TEK17, and increased limit values of chromium VI in concrete waste destined for material recovery (backfilling).

The waste management plan also states that the authorities will work together with the industry in order to spread information, e.g. good examples of waste prevention within the building and construction sector. The Norwegian Building Authority (Direktoratet for Byggkvalitet) has introduced provisions in the regulations which ensure that buildings are designed and arranged for dismantling, so that the materials are suitable for reuse at a later stage.

The national waste management plan can be found here.

6.8 Norwegian Green Building Council (Grønn Byggallianse)

Norwegian Green Building Council (NGBC) is a membership association for businesses from the entire construction and property sector. NGBC work to ensure that consideration of the environment and sustainability becomes the natural choice in the sector.

Together with the Association of Norwegian Property Owners (Norsk Eiendom) they have written a Road Map for the Property Sector towards 2050. One of the recommended immediate measures for small and large builders is to require architects to prepare a plan for how the dismantling av reuse of construction materials when rebuilding or demolishing. In addition, solutions and materials that give the least possible amount of waste should be sought.

6.8.1.1 BREEAM-NOR

BREEAM is the most common environmental certification system for buildings in Norway. It is a British certification system, which is managed by the Building Research Establishment (BRE) in Great Britain. NGBC is responsible for it in Norway, and its Norwegian version, BREEAM-NOR.

There are some waste requirements in BREEAM. These encourage sustainable management of construction and operational waste, as well as good design and construction practices that maintains a high degree of reuse, material recovery and sorting (source separation). The main aim of the waste requirements in BREEAM-NOR is to reduce the amounts of waste from the construction and operation of buildings. Projects that reduce the amount of waste generated to less than 40 kg/m2 are awarded. All BREEAM projects must achieve a 75 % sorting level of waste at construction sites. Projects that achieve more than 80 % sorting at construction site *and* 50 % material recovery receive extra points.

6.8.1.2 CEEQUAL

CEEQUAL is a tool for documenting the scope of sustainability efforts during project implementation and the selection of sustainable solutions for various types of infrastructure projects. Infrastructure projects include all building and construction projects within, among other things, civil engineering transport, energy and water supply. Projects undergoing a CEEQUAL certification can achieve points for separating (on or off site) and diverting at least 70 % (by volume) of the inert waste from the project. It is also possible to get points for separating and diverting non-hazardous waste from landfill. For non-hazardous waste, CEEQUAL have different requirements for construction and demolition waste, but the minimum requirement is to divert at least 90 % (by weight) of the waste that is generated from landfilling.

7. Danish legislation and initiatives

The rules, regulations and initiatives related to C&D waste in Denmark fall in two primary categories. One category is related to waste handling as such and is primarily aimed at ensuring the safe and environmentally responsible management of waste. The other category is related to the building sector (and the products in this sector) and is amongst other things aimed at enabling resource efficiency and circular economy within the sector.

Traditionally, the regulatory regime related to buildings/construction products and the regulatory regime related to waste have been quite unrelated. Recently, however, and as a consequence of the increased societal focus on resource efficiency and circular economy, the two regulatory domains have become closer connected. Within recent years there has been a growing acknowledgement of the importance of ensuring coherence between the two regimes.

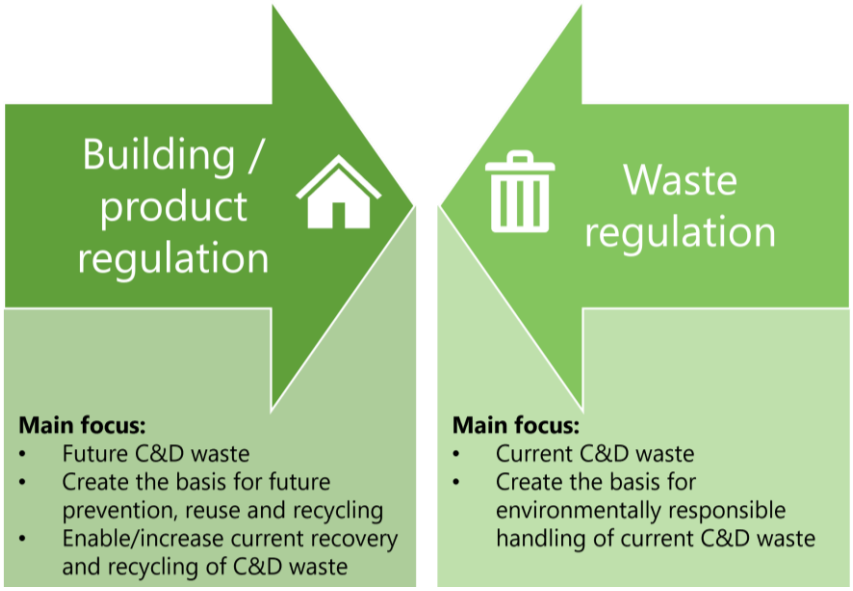


Figure 1: Regulatory regimes of relevance for C&D waste

7.1 Waste regulation

The rules and regulations concerning C&D waste are found in several different laws, executive orders and international regulations. Some of the most important are the Environmental Protection Act[2], the Statutory Order on Waste[3] and the Statutory Order on Residual Products[4]. The rules relate to the various steps in the process of generating construction waste: the duties before demolition/renovation, during demolition/renovation and the subsequent handling of the waste. Furthermore, there exist a number of rules aimed at securing that safe materials can be recycled while hazardous materials are sorted out and disposed of, e.g. the EU regulation on persistent organic pollutants (the POPs Regulation).

In 2019 the Danish Environmental Protection Agency published detailed guidelines on handling C&D waste. The guide is aimed at providing a comprehensive description of all the rules and the Danish Environmental Protection Agency's understanding of the rules[5]. In the following the most important procedures, demands and responsibilities for the handling of C&D waste according to Danish legislation are summarized on basis of the guide.

The rules serve multiple and interconnected purposes:

[2] https://www.retsinformation.dk/eli/lta/2019/1218
[3] https://www.retsinformation.dk/eli/lta/2021/2512
[4] https://www.retsinformation.dk/eli/lta/2016/1672
[5] Miljøstyrelsen 2019b: https://www.retsinformation.dk/eli/retsinfo/2019/9139

1) To prevent and combat pollution of soil and groundwater
2) To limit the use and waste of raw materials and other resources
3) To promote recycling and limit problems in connection with waste management

The waste produced when buildings are demolished or renovated must be handled correctly to avoid damage to the environment and health and to save resources. For construction, the general requirements for waste treatment for commercial actors also includes C&D waste from construction sites. The waste legislation, including the specific rules on C&D waste, contribute to making it possible to recycle most materials by requiring that the problematic substances and materials must be sorted out, so that the amount of waste for disposal due to content of pollutants are limited as far as possible.

Overall, the waste hierarchy applies, which states that recycling must be preferred before other material recovery, material recovery before incineration and incineration before landfilling. Parallel to this, it applies that materials containing hazardous substances must be sorted out and destroyed or disposed of, including by incineration or landfilling, so that these substances are not spread in the surroundings with a risk to health and the environment.

In short, the handling of C&D waste involves four steps:

1) Review and environmental mapping of the building and classification of waste
   It is mandatory to carry out a review (environmental mapping) before a building is demolished or renovated in order to detect any hazardous substances (e.g. PCBs, asbestos, chlorinated paraffins and lead, etc.) and ensure that materials and substances that are not fit to be recycled or recovered are removed safely.[6]

2) Notification to the relevant authority
   Before demolition or renovation of a building begins, the waste must be notified to the municipal authorities. This can be done either in connection with an application for or notification of a demolition or renovation in accordance with building legislation, or no later than two weeks before the demolition or renovation begins.

3) Waste sorting
   The waste producer is responsible for correct sorting of C&D waste. The waste must be sorted into waste suitable for material recovery, waste suitable for incineration and landfill as well as sorting according to material and form of use. Hazardous waste, PCB-containing materials and double-glazed windows must always be identified and separated. The C&D waste suitable for material recovery must be source-separated into at least the following types:
   - Hazardous Waste
   - PCB-containing waste
   - Double-glazed windows
   - PVC
   - Impregnated wood
   - Natural stone
   - Unglazed tile
   - Concrete
   - Mixtures of natural stone, unglazed tile and concrete
   - Iron and Metal

[6] Related to this, the Danish Environmental Protection Agency states: "it is a challenge to take representative samples in buildings prior to renovation or demolition, so that the problematic substances and materials occurring in the building are identified." (Miljøstyrelsen 2019b, page 8: https://www.retsinformation.dk/eli/retsinfo/2019/9139

- Gypsum
- Stone wool
- Soil
- Asphalt
- Mixtures of concrete and asphalt

In addition, it is a requirement that sorting and subsequent handling of C&D waste takes place in a way that ensures the separation of materials that cannot be treated in the same way (throughout the entire logistics or value chain). No trivial limit has been set for when C&D waste can be said to be sorted, but when determining the sorting requirement, the principle of proportionality must be included in the assessment of the extent of the sorting. If a waste producer is in doubt about sorting requirements, the municipality can be contacted.

4) Subsequent handling: Treatment and disposal

Handling is defined as "Collection, transport, recovery and disposal of waste, including supervision in connection with this and after-treatment of disposal facilities as well as the activities of dealers and brokers." Waste-producing companies must ensure that *significant parts* of their source-separated commercial waste, which is suitable for material recovery, is prepared for recycling, reused or used for other material recovery. There has been made no prioritization in the regulation between the options preparation for reuse, re-use or use for other material recovery, and this means that the companies themselves are free to choose between these options. However, the companies cannot choose to send their waste, which is suitable for material recovery, to incineration with energy utilization.

Use of uncontaminated C&D waste

Uncontaminated C&D waste may be recovered (other material recovery) without permit. The waste fractions natural stone, unglazed tile, concrete and mixtures thereof may be used without a specific permit as a substitute for primary raw materials in certain building and construction works, provided the fractions are sorted, uncontaminated and processed.

Use of slightly PCB-contaminated C&D waste

C&D waste that is slightly contaminated with PCBs can be recovered (other material recovery) under certain conditions without a permit, but after a prior notification to the municipality. However, according to our experience, very few (if any) builders/contractors are using the slightly PCB-contaminated C&D waste due to fear of potential future liabilities and risks.

7.2 Building regulations and product regulations

Recently, recommendations and rules related to new buildings have started including measures aimed at enabling resource efficiency, recycling and the shift to a more circular economy within the building sector, including prevention, re-use and recycling of C&D waste. The Danish building regulation has introduced a voluntary sustainability class and there has been a growing demand for various certification schemes.

7.2.1.1 The building act and regulations

The Danish Building Act[7] lays down general framework rules and represents the regulatory basis, which is given concrete expression in the technical requirements set out in the Building Regulations.

[7] Bekendtgørelse af byggeloven. https://www.retsinformation.dk/eli/lta/2016/1178

The Danish Building Regulations (Bygningsreglementet)[8] is the official framework that regulates the design, construction and functions of new build. The current Building Regulations do not contain any specific requirements regarding consumption of raw materials. However, from 2023, sustainability will be a theme in the regulations, where requirements for maximum CO2 emissions during a building's life span will be implemented.

With regard to building materials the current Building Regulations require that:

- Materials that are suitable for the specific purpose must be used
- Contamination from building materials must not affect the indoor climate of buildings, so that there is a risk to people's health or discomfort
- In connection with renovations and the like, it must be ensured that substances harmful to health such as e.g. asbestos, PCB, lead or particles from insulation materials from already built-in materials do not spread into the indoor atmosphere.

7.2.1.2 The voluntary sustainability class

The ambition of the sustainability class is to define and offer an easily accessible and uniform basis for building sustainable construction. The aim of the sustainability class is to embrace the three dimensions of sustainable construction – environmental, social and economic quality. The class, which contains requirements for LCA calculations for new buildings, will now be tested for a two-year period, and is then intended to be implemented in the Danish building regulation.[9]

7.2.1.3 New requirements for selective demolition (expected in 2023)

In order to reduce the amount of waste from the construction industry, rules for selective demolition are expected to be introduced in 2023. As an important step on the way, the Danish Environmental Protection Agency has recently published five reports containing proposals for what implementation of selective demolition might look like[10]. Towards 2023, the proposals will be further fleshed out in dialogue with the industry.

Selective demolition is demolition where materials from a building are separated and sorted in order to achieve maximum utilization of the materials. Demolition, where the building is first demolished and materials then sorted before disposal from the demolition site, is not perceived as selective demolition.

7.3 Other initiatives

Circular construction denotes building processes that ensure that valuable resources are not lost during the building process or when the building has served its purpose and needs to be demolished[11]. Waste prevention, reuse and recycling are at the core of circular construction.

7.3.1.1 National Strategy for Sustainable Construction

The Danish government has recently passed a *National Strategy for Sustainable Construction*[12], which includes the phasing in of requirements in the Building Regulations for the climate footprint of buildings from 2023 and new initiatives such as investigations into waste of materials on construction sites. The goal of the strategy is to support a

[8] https://bygningsreglementet.dk/
[9] Trafik-, Bygge- og Boligstyrelsen (2020): https://baeredygtighedsklasse.dk/-/media/BPST-DA/Byggeri/Lister/Publikationer/Vejledning-om-den-frivillige-baeredygtighedsklasse-maj-2020.pdf
[10] Miljøstyrelsen (2022): https://www2.mst.dk/Udgiv/publikationer/2022/02/978-87-7038-359-2.pdf
[11] https://vcob.dk/vcob/cirkulaert-byggeri/
[12] Regeringen (2021): https://im.dk/Media/C/4/Endelig%20aftaletekst%20-%20B%c3%a6redygtigt%20byggeri%20-%205.%20marts%202021.pdf

sustainable restructuring of the construction sector, which entails a limitation of construction's climate impacts and resource consumption.

The following points are highlighted by the Waste and Resource Network Denmark (DAKOFA) as being of particularly relevance for the waste sector[13]:

- The requirement for an LCA calculation, which calculates the CO_2 emissions of new buildings over their entire life cycle, will be phased in from 2023. The requirement will be introduced in the building regulations in the same way as the building regulations' other technical requirements.
- A new voluntary sustainability class is being tested in a two-year period from 2020-22. The initiative will prepare the introduction of requirements for LCA calculation in 2023 for all new construction and the introduction of a limit value for new construction over 1000 m2 from 2023 and for other new construction from 2025.
- Less waste from materials at construction sites. A survey is carried out which, among other things, will measure waste quantities directly at construction sites. The analysis will uncover relevant focus areas in relation to waste such as digitalisation, phase transitions, collaboration processes, responsibility and risk conditions, and the analysis must form the basis for concrete follow-up measures.
- Safe and healthy recycling in construction. Reuse and recycling require knowledge of how materials' properties can be documented, particularly with regards to documentation of problematic substances and durability. A knowledge base must be created for when and how it makes environmental and economic sense to reuse and recycle materials in construction, while at the same time doing so in a manner that is sound in terms of health and safety.

7.3.1.2 Certification schemes

Recent years have seen a drastic increase in the number of building projects that get certified according to various sustainability schemes. The sustainability certification DGNB is one of the most widely used in Denmark. It consists of of 40 criteria and a number of sub-criteria, which together can be used as a template for designing and evaluating sustainable buildings. Several of the certification's criteria are based on holistic and circular principles, including for example

- ENV1.1 about life cycle assessment (LCA) of the building materials and the building's environmental impacts
- ECO2.1 about the building's flexibility and adaptability
- TEC1.6 about the building's suitability with a view to dismantling and recycling, etc.

Another scheme is the Nordic Swan Ecolabel[14] that sets strict requirements throughout a building's life cycle.

7.3.1.3 Guide on circular tenders

The Danish Association of Architectural Firms has recently published a guide on using circular tenders as a way for builders and developers to increase reuse and recycling in construction.[15]

7.3.1.4 Material passport for buildings

Stakeholders in the construction industry point to the development and implementation of a digital material or product passport for buildings as important means to increase recycling and reuse in the construction sector. The idea is to ensure full traceability by registering information on all products and materials that goes in to a building in a digital

[13] See https://dakofa.dk/element/en-national-strategi-for-baeredygtigt-byggeri-vedtaget/
[14] https://www.ecolabel.dk/da/virksomheder/svanemaerket-byggeri
[15] Danske Arkitektvirksomheder (2021): https://www.danskeark.dk/sites/default/files/2021-09/cirkulaere_udbud_web_faerdig2.pdf

passport. When the building is being renovated or demolished, the passport will contain all relevant data for the environmental mapping A Danish working group are developing how material passports could be used by the sector.[16]

7.3.1.5 Standardization of recycled materials

Stakeholders in the construction industry point to standards for recycled materials as important measures for increasing the recycling of C&D waste. Standards offer a trusted way to ensure the technical quality of recycled and reused building material. Common European standards that can support the circular transformation of the construction sector is currently in development.[17]

7.3.1.6 Collaborative development projects in the building and waste sector

There exists a range of projects and collaborations within the building sector aimed at enabling increased waste prevention, reuse and recycling, e.g. through innovation and demonstration projects, information gathering and sharing of knowledge and best practices. These include:

- Værdibyg (Value Build) is a collaborative development program that includes trade unions and industry associations within the building sector. The program identifies and develops best practices for the building process through workshops, dialogues and studies. The program's recommendations to the industry's parties are published in guidelines. Currently 40 guidelines have been published of which several concern different aspects of circular construction. For more information see: https://vaerdibyg.dk/vejledninger/#nedrivning_sort
- Videnscenter for Cirkulær Økonomi i Byggeriet (Center for Knowledge of Circular Economy in Construction) aims to collect, develop and disseminate unbiased and concrete knowledge about circular economy in the construction industry. For more information see: https://vcob.dk/
- DAKOFA (Danish Center for Competence in Waste and Resources) is a network aimed at preparing the Danish waste and resource sector for new framework conditions, increased demand for resource efficiency, stricter legal requirements as well as external pressure for continual environmental improvement creates. The network collects knowledge and experience on waste and resources from both Denmark and abroad. For more information see: https://dakofa.com/element/about-dakofa/

[16] See for example: https://www.innobyg.dk/blogs/udviklingsprojekter/materialepas/materialepas/ or https://www.teknologisk.dk/ydelser/bygge-og-anlaegsaffald/bygnings-og-materialepas/34248,6

[17] https://www.ds.dk/s-878

8. Standardisation in Europe or Norway

Standards are widely used as additions to regulation, both at European and Norwegian level. Standards either go deeper into requirements to support the regulations or set up validation processes to document compliance with regulation.

The European standardization organization CEN has started a new working group to investigate the opportunities of using standardization as tools towards a circular construction sector. In the field of circular economy in the built environment, standardization can be used to specify circular principles, guidelines and requirements to facilitate the transition towards a more sustainable future. Standards can cover all life stages from design to de-construction, as well as end-of-life scenarios in all current and subsequent life cycles. This applies to new and existing construction works (buildings and civil engineering works), including their products, materials and components.

Standards have the potential of being important tools to achieve waste prevention and better waste management in the construction sector. The first standard that support the using pre-used construction products is developed for Hollow core slabs for reuse. This standard has drawn up a possible route for the re-use of other construction products and consequently lower waste generation.

NIRAS believe that standards and standardization will be an important part of all strategies and regulation initiatives from the EU Commission regarding the building and construction sector. All standards developed by CEN on request from the Commission, will be automatic implemented in Norway. To take part in development of these standards by using Norwegian competence will secure the best possible standards to fulfill the overall policy targets and give Norwegian enterprises an opportunity to innovate business and access to markets both in Norway and Europe.

9. Statistics

9.1 C&D waste statistics, Norway

This chapter presents statistics on construction and demolition waste (C&D waste) generated by Statistics Norway[18]. The statistics provide annual, national figures for waste from both building and construction activities. The waste amounts are divided into materials and treatment methods, and includes waste from new construction, renovation and demolition activities. Statistics Norway uses the statistics on C&D waste in their reports to the EU. Furthermore, the statistics are used for estimating the total, national amount of waste in Norway, as presented in the so called "Avfallsregnskapet" ("The Waste Account")[19]. However, the total amounts of waste are estimated differently, as Statistics Norway include results from waste analyses on residual waste in order to estimate the contents of waste that could have been sorted. As a result, some waste types have higher amounts in the Waste Account than in the C&D waste statistics. Also, the amount of residual waste is smaller in the Waste Account than in the C&D waste.

The statistics for C&D waste show waste from building and construction *activities*. Waste from civil engineering (anlegg) is not included in the official statistics for C&D waste in Norway. An alternative could have been to show the waste amounts from business that are included in the NACE codes[20] 41, 42 and 43. Statistics Norway has however focused on the waste from building and construction activities. As a result, C&D waste generated from private households are more or less[21] included in the C&D waste statistics.

As a source for estimating the volumes C&D waste, Statistics Norway use the final reports that are sent to the municipalities when projects apply for completion certificates. The final reports contain information on the type of measures (new construction, renovation or demolition), number of square meters affected (BRA) and generated amounts of different types of waste. They also contain information on whether the waste has been sent to an approved waste facility or used directly for reuse or recovery (incl. material recovery as backfilling). Statistics Norway have only used final reports from new construction, renovation and demolition activities, as it is mainly on these types of projects that final reports have been collected. The final reports are used to estimate waste amounts per square meter, and this data is combined with data from other sources regarding the size of activity. For new construction, Statistics Norway also use the building area statistics from new construction (Byggarealstatistikk for nybygging) in order to estimate total volume from construction activities. The total amount of renovation activities is estimated with the help of statistics on investments in renovation, repair and maintenance projects compared to investments in new construction. Information on demolition activities is obtained from the Land Registry (Matrikkelen).

Statistics Norway clarify that there are sources of error in the data, e.g. wrong reporting in final reports, errors because not all final reports are included in the calculations and errors in other data sources, such as the Land Registry.

The challenge of using the statistics in order to have accurate information on waste generation and C&D waste management in Norway, as well as to compare waste management with other EEA states, are discussed in chapter 10.1.

[18] Statistics Norway (2020) Avfall fra byggeaktivitet ("Waste from building and construction activities")
[19] Statistics Norway (2021) Avfallsregnskapet ("The Waste Account")
[20] The standard European nomenclature of productive economic activities.
[21] An example of C&D waste not included in the statistics is smaller rehabilitation activities performed on private households, that are not registered on an company.

9.1.1 Total amounts of C&D waste in Norway

Construction and demolition waste is one of the largest waste streams in Norway in terms of mass; 2,1 million tonnes in 2020, excluding excavated soil and waste from civil engineering. Data on C&D waste generation, although not entirely credible, show that it has been relatively stable in recent years with a small increase in waste generated from demolition since 2018.

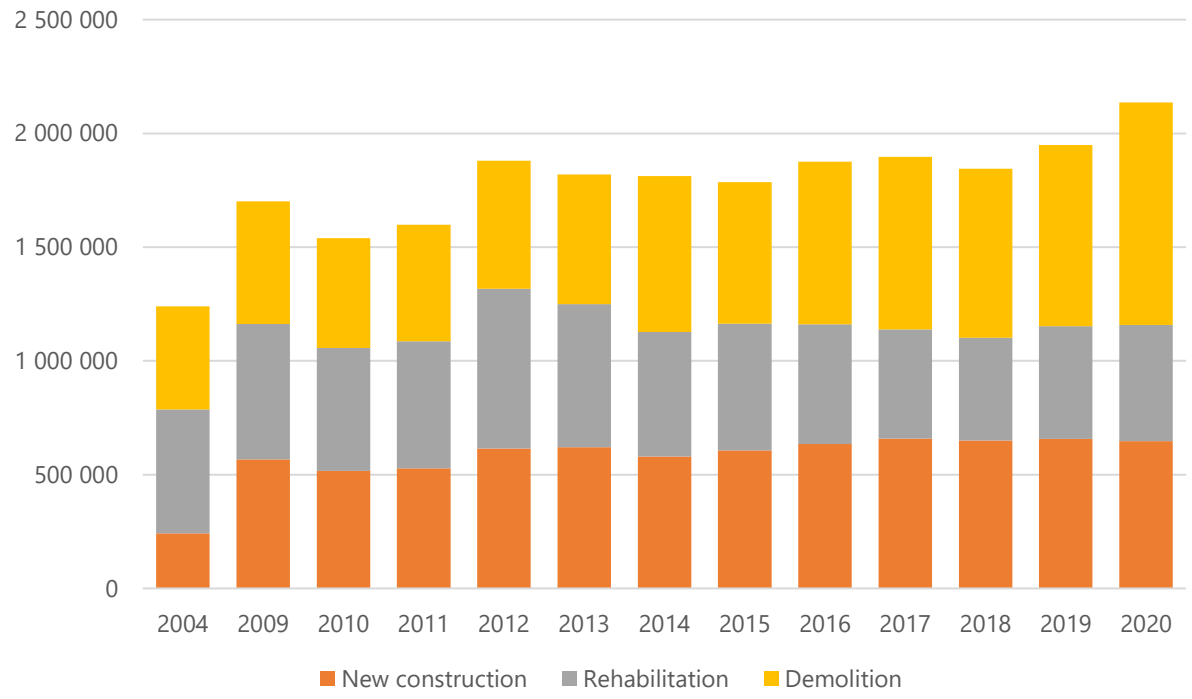


Figure 2: Construction and demolition waste in Norway in tonnes, divided into new construction, renovation and demolition

As shown in figure 3 the C&D waste in Norway in 2020 (including new construction, renovation and demolition waste) is dominated by brick and concrete, followed by residual waste, wood, asphalt and polluted brick and concrete. In total, 44 % of C&D-waste was sent to material recovery, including backfilling of concrete waste, etc. The figure shows the amounts that were *sent to* different treatment options and does not illustrate possible losses in the waste value chains or processes. Furthermore, the figure shows that the waste types that are not being material recovered today are typically bricks, concrete and heavy masses, residual waste, wood waste and contaminated brick and concrete.

The implications of the waste composition of C&D waste in Norway on the challenges for an increase in recycling or other material recovery are discussed in chapter 10.1.

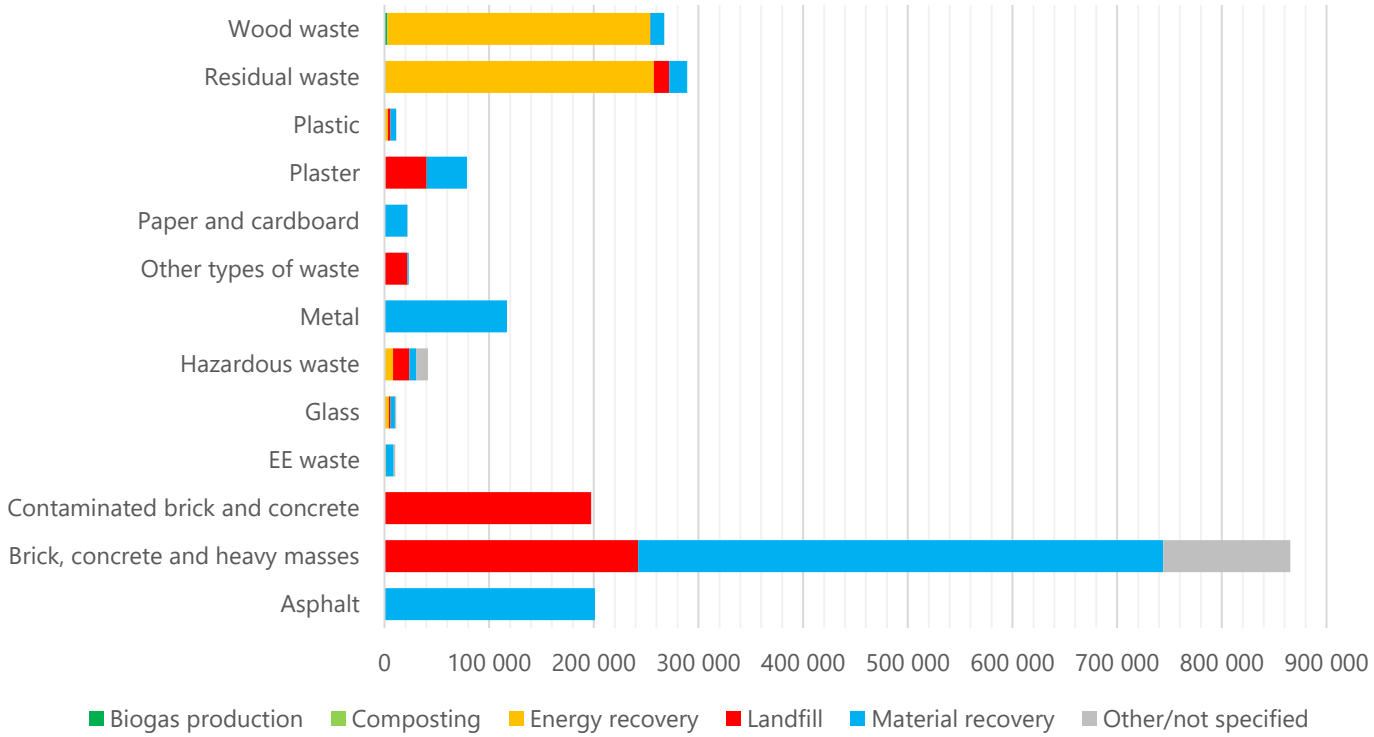


Figure 3: Construction and demolition waste in Norway in 2020, divided into different waste types, tonnes

Figure illustrates the distribution of treatment method for each waste type in 2020. Residual waste accounts for about 290 000 tons or 14% of the total of 2 100 000 tons. According to SSB[22], the different waste types are sorted and sent to different treatment options. Thus, the total sorting rate of the C&D waste, including sorting at both construction sites and waste management facilities, is about 86 %, according to the statistics. A rate of 86 % seems to be very high compared with information given by stakeholders during the work of this report. It could be argued that a more realistic use of the statistics would be to regard Figure 4 as the composition of the C&D waste, rather than the exact amount sorted and deliver for further handling operations. NIRAS has nevertheless used the statistics as an indicator for sorting level in further discussions.

In the statistics, Other/not specified is reported for a large part of the Brick, concrete and heavy masses. According to SSB[23], there is no exact knowledge of the treatment of these masses. SSB have several possible explanations, among them temporary storage or that a treatment is "forgotten to be reported.

[22] Personal message 07.10.2022.
[23] Personal message 07.10.2022

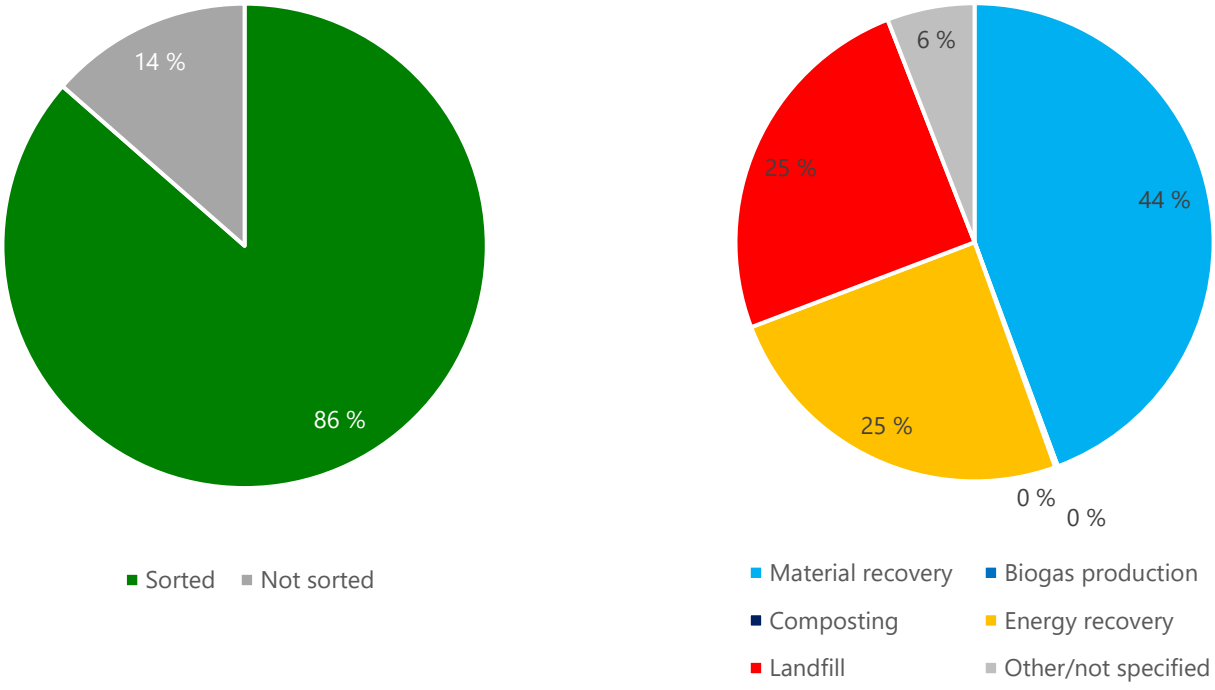


Figure 41: The circle diagrams show C&D waste from building and construction projects in 2020, excluding hazardous waste. The circle diagram to the left differs between sorted vs. non-sorted waste, whereas the circle diagram to the right shows the distribution of treatment methods of the waste.

Figure 4 shows that even though 86 % of the C&D waste is sorted today, it is only 44 % that is sent to material recycling (including biogas production and composting). As commented above, NIRAS believes that a sorting rate of 86 % could be too high compared with reports from stakeholders. NIRAS has not, within the limits of this project, tried to establish another estimate for a sorting rate.

9.1.2 C&D waste from new construction projects

Figure 525 shows the amount of C&D waste in Norway for new construction projects in 2020. Asphalt is the biggest waste type.

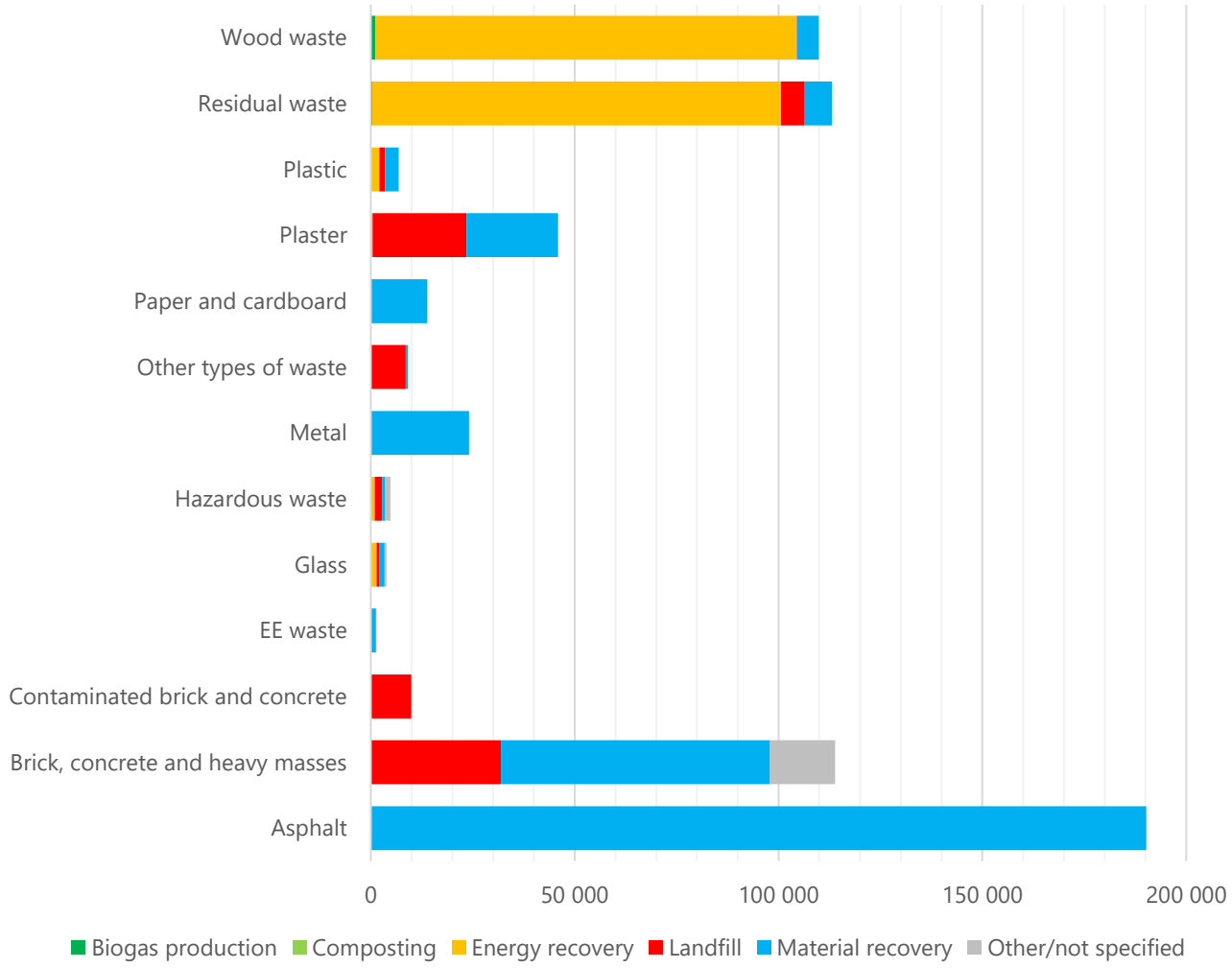


*Figure 52: Construction and demolition waste in Norway in 2020, for **new construction**, divided into different waste types, tonnes*

As shown below in Figure 6, the sorting level is somewhat lower (82 %) compared to the total amount of C&D waste (86 %). The amount of waste being material recovered is however higher 52 % compared to 44 %.

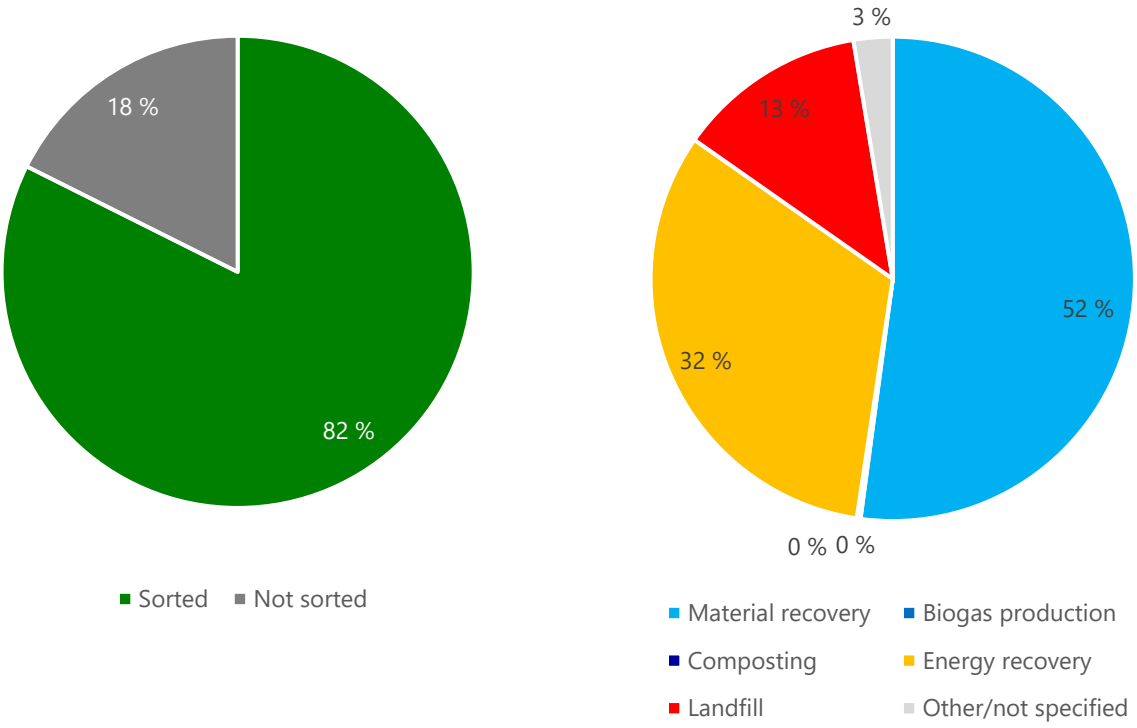


*Figure 6: The circle diagrams show C&D waste from **new construction** from building and construction projects in 2020, excluding hazardous waste. The circle diagram to the left differs between sorted vs. non-sorted waste, whereas the circle diagram to the right shows the distribution of treatment methods of the waste.*

9.1.3 C&D waste from renovation projects

Figure 7 shows the amount of C&D waste in Norway for renovation projects in 2020. Brick, concrete and heavy masses are the waste types with the highest volume. As shown in figure 8, the sorting level is lower (80 %) compared to the total amount of C&D waste (86 %). The amount of waste being material recovered is also lower; 36 % compared to 44 % in all C&D Waste.

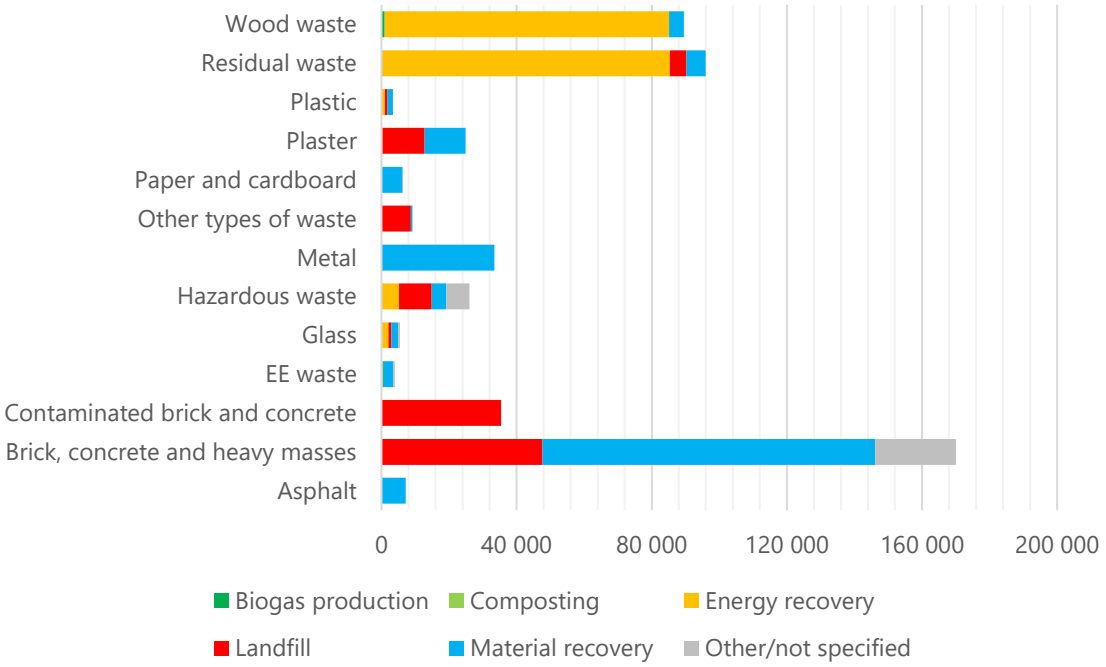
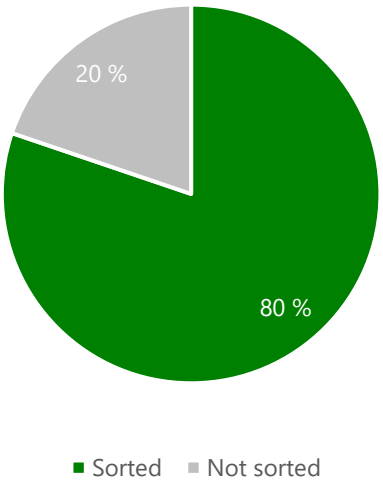


*Figure 7: Construction and demolition waste in Norway in 2020, for **renovation** projects, divided into different waste types, tonnes*



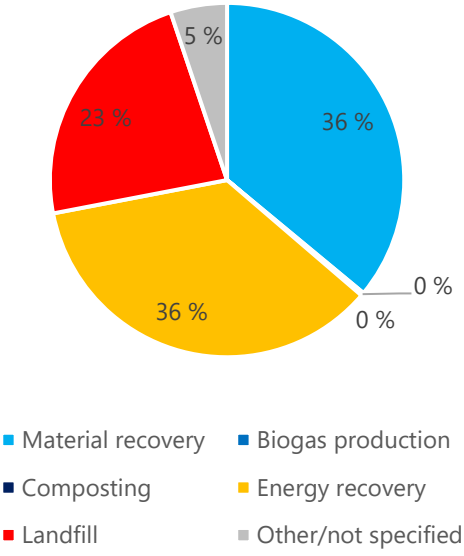


*Figure 8: The circle diagrams show C&D waste from **renovation** projects from building and construction projects in 2020, excluding hazardous waste. The circle diagram to the left differs between sorted vs. non-sorted waste, whereas the circle diagram to the right shows the distribution of treatment methods of the waste*

9.1.4 C&D waste for demolition projects

Figure 9Figure shows the amount of C&D waste in Norway for demolition projects in 2020. Brick, concrete and heavy masses is the most voluminous waste type in tonnes.

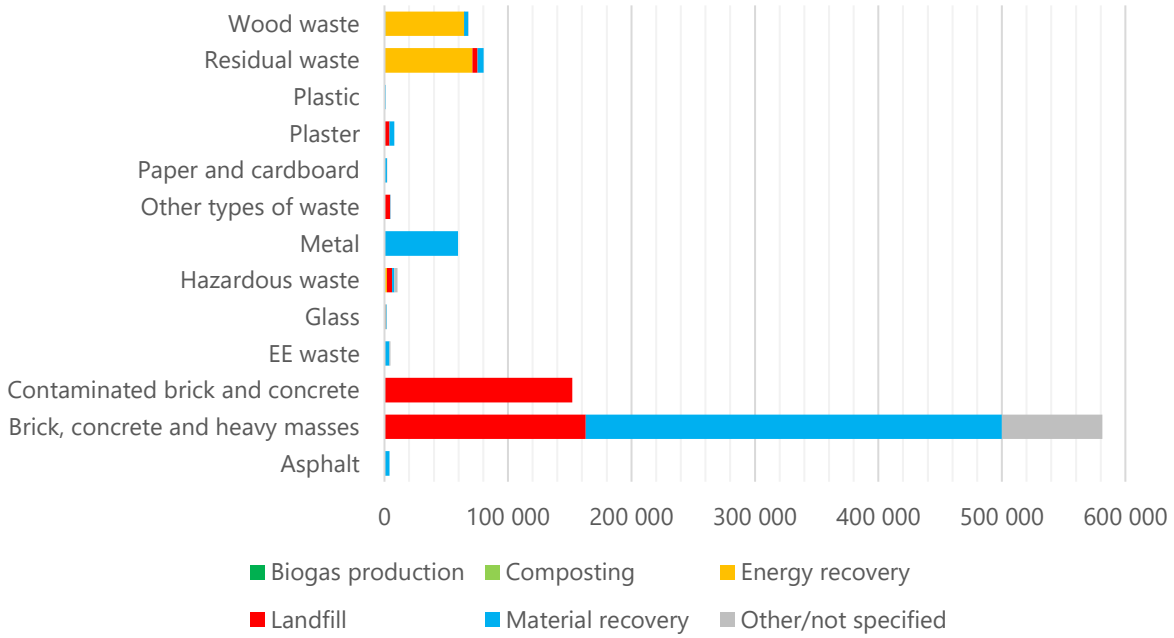


*Figure 9: Construction and demolition waste in Norway in 2020, for **demolition** projects, divided into different waste types, tonnes*

As shown below in Figure 0, the sorting level is a higher (92 %) compared to the total amount of C&D waste (86 %). The amount of waste being material recycled is approximately the same; 43 % compared to 44 %.

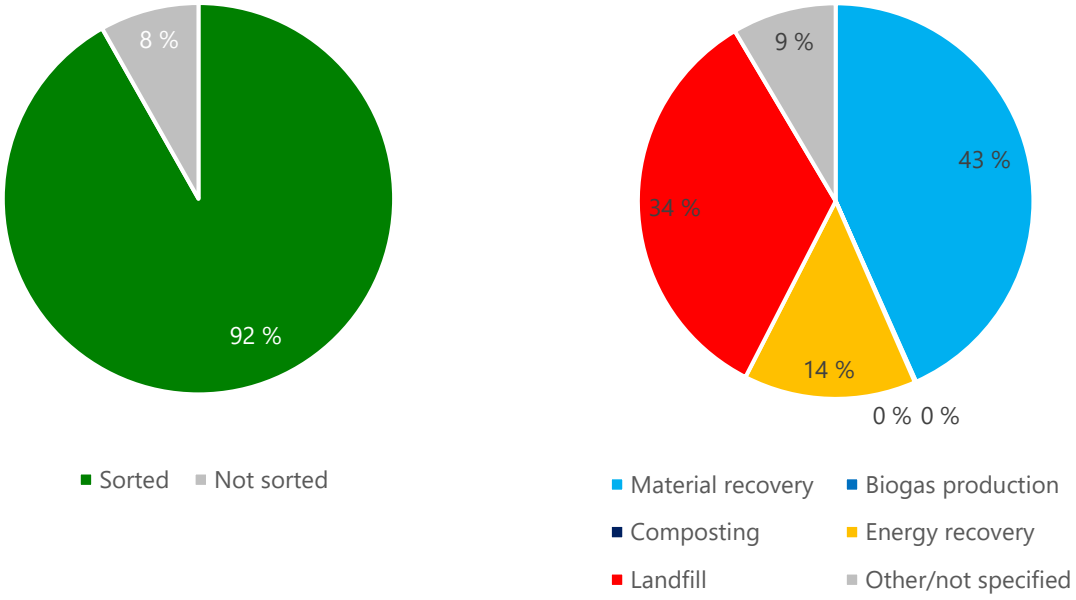


*Figure 10: The circle diagrams show C&D waste from **demolition** projects from building and construction projects in 2020, excluding hazardous waste. The circle diagram to the left shows sorted and non-sorted waste, whereas the circle diagram to the right shows the distribution of treatment methods of the waste*

9.2 C&D waste statistics, Denmark

9.2.1 The waste hierarchy

The EU Waste Directive states that by 2020 at least 70 % of the non-hazardous C&D waste should be material recovered. The Danish material recovery rate has for many years been well above the 70 %. A smaller part of the C&D is currently being utilized at the recycling level of the waste hierarchy. According to the Danish Waste Statistics 36 % of the C&D were recycled ("real recycling") in 2019, while 52 % of the C&D waste was being utilized at the lower level of recovery (backfilling and incineration).[24]

9.2.2 Waste statistics

9.2.2.1 Amounts

The table below shows the officially registered amounts for the various fractions of C&D waste for the years 2015 to 2019 as reported in the most recently published waste statistics by the Danish Environmental Protection Agency (EPA)[25]. The statistics are based on the use of the European Waste Code (EWC) and reported by waste handling operators. As shown, the total amount of C&D waste in 2019 was 5.023.000 tons, and the five major fractions were 1) concrete (1.318.000 tons), 2) Asphalt and tar containing waste (1.169.000 tons), 3) Mixed or separated fractions of concrete, bricks, tiles & ceramics (568.000 tons), 4) Mixed C&D waste (483.000 tons) and 5) Iron and steel (347.000 tons).

[24] Miljøministeriet 2021, page 152: https://mim.dk/media/222902/handlingsplan-for-cirkulaer-oekonomi_0607211338.pdf
[25] Miljøstyrelsen (2020), https://www2.mst.dk/Udgiv/publikationer/2020/12/978-87-7038-249-6.pdf

Table 1. Waste produced in the Danish building and construction sector (soil excluded). Source: Miljøstyrelsen 2020, page 41. Translation by NIRAS.

Construction & demolition waste	Ton (1.000)				
	2015	2016	2017	2018	2019
Concrete	1.057	1.071	1.127	1.197	1.318
Bricks	169	215	215	227	212
Roof tiles and ceramics	75	82	112	108	87
Mixed or seperated fractions of concrete, bricks, tiles & ceramics	441	442	496	589	568
Wood	104	131	159	156	153
Glass	15	22	20	28	31
Plastics	5	5	5	5	8
Asphalt and coal tar containing waste	885	983	855	1.233	1.169
Aluminum, copper, bronze and brass	15	19	21	22	23
Iron and steel	256	297	316	333	347
Lead, zinc, tin, mixed and other metal	32	35	43	45	58
Cables	6	8	7	6	9
Ballast from railway tracks	169	67	73	183	25
Isolation materials	13	16	21	20	21
Asbestos-containing building materials	82	80	87	88	96
Gypsum-based building materials contaminated with hazardous substances	56	64	77	77	74
C&D waste containing PCB	6	9	11	16	8
Mixed C&D waste	445	470	444	475	483
Daily waste and waste similar to daily waste	37	38	45	44	43
Dumping material ("Klapmateriale")	0	27	15	46	11
Other waste from building and construction activities	242	247	194	244	279
Total	4.110	4.328	4.344	5.142	5.023

However, it is broadly acknowledged that the official waste statistics are rather imprecise and that actual amounts of C&D waste are much higher due to the fact that much waste is not correctly weighed nor registered. Recent studies by NIRAS indicate that the actual amount of concrete and brick waste are much higher than the official numbers[26].

According to the official statistics, waste from concrete, bricks, roof tiles and ceramics, and mix of separated waste fractions of concrete, bricks, tiles and ceramics amounted to 2.2 million tons in 2019. NIRAS made a survey among the major concrete crushers on the Danish market and they reported to crushed 5,7 million tons of those fractions pr. year. The significant difference between the two figures can either be due to the fact that some of the bricks and concrete are not classified as waste (and thus do not have to be reported), or that the reporting does not take place.[27]

[26]NIRAS m. fl. 04.2021: Prognose for sekundære råstoffer – pilotprosjekt Høye-Taastrup kommuner og Roskilde kommune
NIRAS (2022), https://rn.viewer.dkplan.niras.dk/media/330587/kortlaegning-af-sekundaere-materialer-i-region-nordjylland.pdf
[27] NIRAS (2022), side 5. https://rn.viewer.dkplan.niras.dk/media/330587/kortlaegning-af-sekundaere-materialer-i-region-nordjylland.pdf

9.2.2.2 *Recovery and recycling rates*

According to the Danish Environmental Protection Agency's waste statistics, 36 % of the C&D waste is being recycled, while 52 % is recovered, including backfilling of concrete waste, 7 % incinerated with energy recovery and 5 % landfilled. Mixed C&D waste is sent to sorting which results in a higher overall recycling rate for C&D waste.

Table 2. C&D waste (soil excluded) divided on types of treatment/utilization. Source: Miljøstyrelsen 2020, page 142. Translation by NIRAS.

Construction & demolition waste	2018		2019	
	Ton (1.000)	Procent	Ton (1.000)	Procent
Recycling	1.856	36 %	1.787	36 %
Other final material recovery	2.675	52 %	2.594	52 %
Incineration	344	7 %	373	7 %
Deposit	267	5 %	269	5 %
Total	5.142	100 %	5.023	100 %

Before 2018 there was no distinction between "recycling" and "(other) recovery" in the waste statistics as both types of utilization were categorized as "recycling"[28], thus resulting in higher recycling rates. Note: The use of the different terms like "other recovery" and "final material recovery" clearly indicate the challenges in comparing statistics between countries.

9.3 C&D waste statistics, EU member states

Construction and demolition waste is the largest waste stream in the EU in terms of mass (374 million tons in the EU-28, in 2016, excluding excavated soil). Data on C&D waste generation, although not credible, shows that the total volumes have been relatively stable in recent years at the European level but that large variations in per capita generation exist across countries.

Driven by the material recovery target of 70 % by 2020 (set by the 2008 Waste Framework Directive and defined as including preparation for re-use, recycling and other material recovery operations such as backfilling), countries report increasingly high material recovery rates. Most of the reports from EEA-countries exceeded the 2020 target in 2016. Although this may suggest that the construction sector is highly circular, a closer scrutiny of the waste management practices reveals that C&D waste recovery is largely based on backfilling operations and low-grade recovery, such as using recycled aggregates in road sub-bases (European Environment Agency, 2021).

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[28] Miljøstyrelsen 2020, page 142

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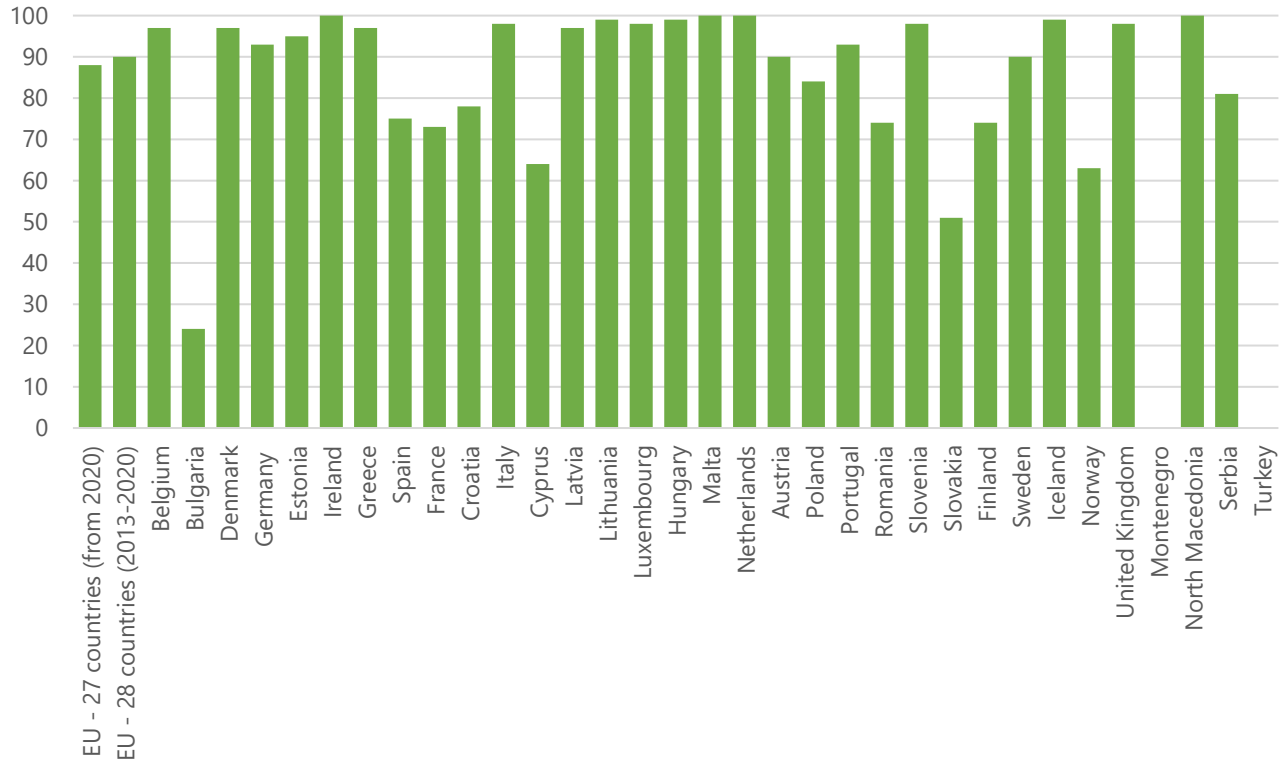

Figure 31: Recovery rate of construction and demolition waste [CEI_WM040] last updated 04.01.2022. The indicator is the ratio of construction and demolition waste which is prepared for re-use, recycled or subject to material recovery, including through backfilling operations, divided by the construction and demolition waste treated as defined in Regulation (EC) No 2150/2002 on waste statistics. .

11 shows a (material)recovery rate of 63 % for Norway. According to Norwegian statistics, the material recovery rate for C&D waste was 44 % in 2020. The Eurostat statistics is based on the input from Norway, sent either by Statistics Norway (SSB) or Norwegian Environmental Agency (Miljødirektoratet). This shared responsibility could lead to differences in use of terms and data. However, NIRAS has not been able to identify why the differences in material recovery reported by SSB and Eurostat occurs.

The European Commission has created a web page with information on policy initiatives, regulations and country fact-sheets on C&D waste management in all member states. The overviews consist of data from before 2012. The EU page could be found here.

10. Possible explanation for a level of 44 % material recovery in Norway

As referred to in chapter 5.1., the Waste Framework Directive requires that "*by 2020, the preparing for **re-use, recycling and other material recovery, including backfilling operations** using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occur-ring material defined in category 17 05 04 in the list of waste shall be increased to a **minimum of 70 % by weight***". In this chapter, NIRAS has tried to identify possible explanations for why Norway don't fulfil this requirement in the WFD.

In the European Environment Agency note of 16.01.2020[29], the main conclusion is:

> *EU countries are on track to fulfil the 70 % recovery target of 2020, with most countries already exceeding the target in 2016. The high recovery rates of C&D waste in Europe are mostly achieved by using recovered waste for practices such as backfilling and low-grade recovery applications, reducing the potential to move towards truly circular waste management.*

10.1 The reliability and comparability of statistics

The official Norwegian statistics from 2020 report a level of 44 % material recovery as described in chapter 9.1.1.

In EU statistics collected by Eurostat, Norway has a recovery rate of 63 %. The EU Recovery rate of construction and demolition waste is the amount of construction and demolition waste which has been prepared for re-use, recycled or subject to material recovery, including through backfilling operations, divided by the construction and demolition waste treated as defined in Regulation (EC) No 2150/2002 on waste statistics. The EU recovery rate is similar to the definition in the WFD definition of material recovery.

The Danish statistics have the same confusion, using national interpretations of the different terms used both nationally and by the EU system.

The SSB statistics are based on the reports on waste generation and treatment sent from construction/renovation/demolition project to Norwegian municipalities and further to SSB. Based on key figures, the total amount, split between construction/renovation/demolition and different waste categories are done. Danish statistics are based on reports from waste handlers. It is not split on construction/renovation/demolition.

The FIR – Fédération Internationale du Recyclage recommended to not use EU statistics for comparison, only to check out trends[30].

NIRAS is aware of the weakness of all statistics and the criticism of the C&D waste statistics has been put forward by stakeholders. However, a consistent use of terms in accordance with the WFD definitions should be required.

NIRAS is also aware of differences because of different legislative requirements for the collection and reporting of waste data. SSB's collection of data is based on the Regulation on waste statistics, which requires EEA member states to set up necessary systems for data collection and reporting. The SSB C&D statistics are based on and financed as a result of this regulation. The WFD also requires reporting from member states. However - this reporting is separate from the Regulation on waste statistics and is not done by SSB. The responsible authority for reporting statistics according to the WFD requirements is the Norwegian Environment Agency (Miljødirektoratet). The reporting is based on SSB statistics, but without any data collected specifically for reporting on the WFD requirements. The divided reporting

[29] European Environment Agency- 16.01.2020 Construction and demolition waste: challenges and opportunities in a circular economy
[30] Geert Cuperus, FIR – Fédération Internationale du Recyclage, personal message, Teams meeting 22.06.2022

responsibility between SSB and the Environment agency leads to suboptimal data collection and reporting, including for C&D waste. All European level data reporting should be regulated through the Regulation on waste statistics to ensure uniform collection and reporting of national statics.

10.2 C&D waste composition is different from average EU

Given the weakness of statistics put forward in 5.1, the composition of Norwegian C&D waste differs from the Danish composition and possible also from the average EU composition.

10.2.1 Wood

One of the main differences is the amount of wood waste. In 2020, wood waste accounts for 12.5% of the total amount of Norwegian C&D waste. In Denmark, in 2019 wood waste is 3 % of the total amount of C&D waste.

At the same time, only 6 % of the Norwegian wood waste is sent to material recovery. Although there is a growing market for both reuse and recycling of wood waste, a rough market assumption could be that 60 % of the wood waste may be suitable for recycling operations[31]. Hence, the amount of wood waste will make it more difficult to reach the overall material recovery target in the WFD.

Wood waste has also a well-functioning market for energy recovery, both in industry and in district heating systems in Norway and Sweden. The market price is variable, but with an overall trend for a positive value. This market as bioenergy is also a strong barrier for reuse or recycling of wood waste in Norway.

The amount of wood waste cause the same challenge to reach European targets set up for municipal waste and packaging waste.

10.2.2 Heavy fractions

Compared with Denmark, the composition of some heavy C&D waste has considerable differences in the statistics. In Norway, Asphalt is 14 % of total amount, in Denmark 23 %. Bricks, concrete etc. is 41 % in Norway, 44 % in Denmark. Metal is 1 % in Norway, 7 % in Denmark. Asphalt, concrete and metals are all sent to material recovery in Denmark, For concrete, the ration for material recovery in Norway is 58 %.

As described in chapter 9, statistics are not comparable. However, the high volume of fractions like concrete, metals and asphalt all sent to material recovery in Denmark, makes it easier to reach the target of 70 % material recovery. We have not tried to set figures to this effect.

10.3 Regulation on use of concrete for material recovery, including backfilling

Concrete is a large fraction related to demolition waste from building and construction projects. Together with brick waste, concrete makes up approximately 41 % of the waste disposed of at Norwegian landfills (Statistics Norway, 2020). The report "Materialstrømsanalyse byggavfall Betong, gips og vindusglass"[32] use statistics for concrete waste before 2014. In the report, most concrete is used as backfilling in temporary roads, smaller roads, filling purposes and coverage outside and inside landfills. Concrete is rarely used in production of new concrete, although this is technically done and also in common use in other countries. There is an increasing interest for using concrete in production of new concrete in Norway as well[33].

[31] Geminor, waste handling company - Personal message

[32] Materialstrømsanalyse byggavfall Betong, gips og vindusglass – Rapport nr OR.03.16 - SINTEF/Østoldforskning 2016

[33] https://www.tu.no/artikler/25-prosent-av-denne-soylen-bestar-av-brukt-betong-styrken-er-upaklagelig-br/522325?key=XXAB2MkY

Different hazardous components like PCBs, phthalates, brominated flame retardants and chromium are found in or on concrete, in materials like paint, cast on, plaster etc. Materials, with hazardous components, used on concrete can be removed and separated before demolition, ending up with one fraction for recycling and one for landfill/incineration.

Chromium is naturally present in cement materials as the raw material used is limestone, different fuels are used in clinker production and cement and concrete contain different additives. Chromium could be released as Cr(III) or Cr(VI) depending on different environmental factors. Cr(VI) is hazardous for both the environment and human health and thus may represent an environmental challenge. (Eckbo, et al. 2018)

Cr(VI) is, and has been, one of the reasons for the lack of material recovery (backfilling) of concrete in Norway. In 2016 Norwegian regulators introduced a new upper limit value, 2 mg/kg Cr(VI), criteria for recycling of concrete waste. The new limit value probably made a new barrier for backfilling of concrete waste. From 2016-2017 the amount of concrete waste that went to landfill increased from 529.000 tons in 2016 to 791.000 tons and the recycling rate went down from 63% in 2016 to 37% in 2017. In 2018-2020 the recycling rate for concrete waste lays between 58%-60%. The limit value for Cr(VI) was raised to 8 mg/kg in 2020.

In 2020, as part of a study[34] to assess the leaching of Cr(VI) from concrete, NGI and SINTEF presented limit values for Cr and Cr(VI) in neighboring countries t Norway. There is no harmonized approach to Cr in concrete within the Nordic region.

Swedish guidelines says that Cr(VI) content should not exceed 1 % of the total Cr in concrete masses. Total Cr has an upper limit for recycling of 40 mg/kg. The limits are only guidelines, applying to shattered concrete masses – not monolithic constructions.

In Finland, the Government Decree on the Recovery of Certain Wastes in Earth Construction (843/2017) has limit values for allowable total Cr leached from concrete and masonry masses. Leaching criteria are given as L/S 10 and vary according to type of material covering the concrete.

In Denmark, the municipalities are responsible for the classification of construction waste as non-contaminated, contaminated or hazardous waste based on information from the builder. Non-contaminated wastes are classified using an upper limit value of 20 mg/kg Cr(IV). For contaminated wastes, the municipalities may approve certain types of handling as material recovery following an assessment[35].

The conflict between re-use and the risk of leaching of hazardous substances from backfilling or other recovery methods is well known in other EEA member states. However, the balance between no leakage of hazardous substances and the wish to recycle material resources seems in the case of concrete, to end with the need for the resource to be used (example the Netherlands)[36].

In 2020 the regulation for concrete - and brick waste was updated with new limit values for different hazardous components in the Norwegian waste regulation. The effect of this change may be visible in the 2021 and 2022 data.

[34] Utlekking av heksavalent krom fra betong, Cathrine Eckbo, NGI, Byggavfallskonferansen 2020
[35] Forvaltningsgrundlag for bygge- og anlægsaffald, Sjællandsnetværlet for Bygge- og Anlægsaffald, 2020
[36] Interview BRBS Recycling: Peter Broere and International Recycling Federation: Geert Cuperus

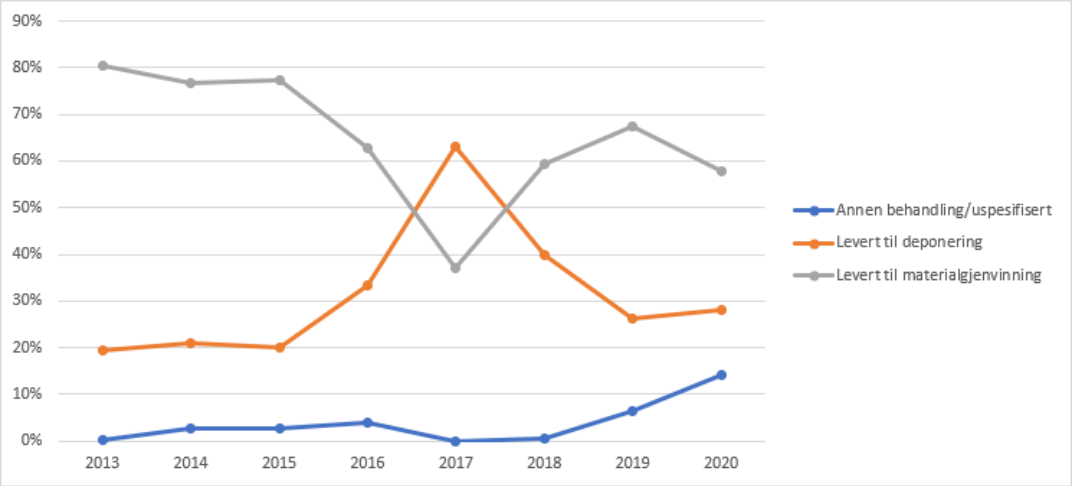

Figure 42. Treatment of concrete and bricks in Norway

10.4 Market for secondary products – bricks, concrete

The market for the use of bricks and concrete waste for backfilling purposes is different in Norway where alternative masses of primary stone/masses from construction are available in large quanta. The demand for secondary bricks/concrete is hindered by:

- Transport costs - generally long distances between construction sites
- Quality requirements
- Fulfilling standards set by large operators for road and railway construction
- A scepsis towards using waste masses

This situation is in opposite in Denmark where brick/concrete have a positive value and are demanded due to lack of alternatives. This is the same in the Netherlands.

10.5 Lack of recycling requirements in Norwegian legislation

In Denmark and The Netherlands, requirements in legislation for construction and demolition is followed by requirements for the waste treatment laid down in the waste regulation. According to FIR – Fédération Internationale du Recyclage, this is the case in most EU member states. The requirements for source separation of waste at construction sites put forward in The Regulation on technical requirements for building works are in Norwegian regulation, followed by requirement for the waste handling in itself. This leads to a market lead treatment of source separated waste where waste will be sent to the cheapest treatment. In general, incineration and landfilling have lover costs than material recovery. The Norwegian requirements in the Regulations on technical requirements for construction works should be followed by requirements for material recovery in the waste regulations. This is discussed further later in the report.

11. Effects of new EU regulation on C&D waste treatment

As described in chapter 5, EU is launching a set of regulations that will influence the generation, source separation and handling of C&D waste. The overall political ambitions are set in the "Green Deal" which is part of the EU Commission working program for 2020-2025. The Circular Economy Action Plan is a part of this political program. The vision is to move towards a climate-neutral continent among others clearly underline the high ambitions and will to transform Europe towards a more sustainable and competitive future.

It is difficult to quantify the effects of the different initiatives. Most of the initiatives are not put into new legislation yet. Hence, only the ambitions are known. Secondly, the effects are not as far as we know, quantified in the EU legislation or policy investigation processes. As a consequence, NIRAS has indicated the effects by setting positive or negative effects. However, we have used the existing C&D statistics for Norway and looked into some possible scenarios as an example to test out the effects of different regulatory initiatives. These results should however be used by caution.

11.1 Initiatives for waste prevention – effects on C&D waste generation

11.1.1 Renovation Wave and Directive on the energy performance of buildings

"A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives" is the EU strategy to boost renovation in the EU. The Commission proposes the development of standardized, sustainable industrial solutions and the reuse of waste materials. It will develop a 2050 roadmap for reducing whole life-cycle carbon emissions in buildings, including through the use of biobased products, and review material recovery targets. The Directive on the energy performance of buildings highlights renovation instead of demolition – this will give incentives for both member states and the building sector to both speed up renovation and to avoid demolition.

The results of the initiatives could be:

- A shift from demolition to renovation.
    - Preserving load-bearing structures reducing concrete waste and possible wood and metals
    - If the renovation is enlarged to more than load-bearing structures through mapping of possible reuse of other building materials this could lead to reduce all sorts of waste through more reuse of existing materials
    - An increase of all sorts of waste from renovation
    - A general decrease of all types of waste from demolition
- A shift from construction to renovation
    - Increase in generation of bricks/concrete
    - Reduction in generation of asphalt (this is uncertain)

Renovation will reduce the overall waste generation both from demolition and construction.

Summary of possible consequences:

Table 3. Possible consequences on prevention and overall material recovery rate.

Waste fraction	Effect on prevention	Effect on overall material recovery rate in Norway
Bricks and concrete	Positive	Positive
Polluted bricks and concrete	Positive	Positive
Wood	Uncertain	Uncertain
Metals	Positive	Negative
Other waste fractions	Positive	Positive

For wood waste, the consequences are difficult to foresee. Wood waste is a relatively small fraction in demolition. And about the same in construction and renovation.

An important notion is that renovation as it is put forward in the Renovation Wave, will contribute to a better resource management and energy savings and a better housing situation. Material recovery is only one of many indicators to achieve the political visions presented in the strategy.

11.1.2 Ecodesign and Construction Products Regulation

The EU has launched a Strategy for sustainable products. Included is a proposal for an updated sustainable products initiative. The strategy will include a set of different products, including high impact intermediary products such as steel and cement.

The launch of the Ecodesign proposal was coordinated with the Proposal for a regulation laying down harmonized conditions for the marketing of construction products. The regulation is linked to the Renovation Wave referred to in chapter 5.6 and the Circular Economy Action Plan. The proposal has several initiatives like:

- Surplus construction products should be kept by the ownership of the manufacturer and to regain, directly or via their importers and distributors, ownership of products that, after delivery onto a construction site or to the user, have not been used and are in a state equivalent to the one in which they were placed on the market.
- Manufacturers should be obliged to reach a fair level of environmental sustainability, both for their products and their manufacturing
- Manufacturers should ensure that products can be used for a very long time, requiring adequate design, use of reliable parts, reparability of products, availability of information on repair and access to replacement parts
- Manufacturers should favor re-use, remanufacturing and recycling of their products, and in addition, use of recycled materials in their production

The regulations will have effect on waste generation in construction and renovation. We anticipate that these effects could be:

- Increase in prefabricated production, especially for wood construction, plaster products, load bearing structures,
- Take back systems for products not used at the construction sites, this could be all sorts of products that other vices would be discarded as waste. Examples are insulation materials, paint, carpets or other floor materials, indoor windows, doors, sanitary products.
- Development of reusable packaging which will reduce the usage of plastics and carboard, as well as potentially lowering total need for packaging
- Reparable products and products with longer lifespan. This could affect all product types and reduce waste generation in future renovation projects. Examples are sanitary products, indoor walls, floor materials, kitchen installation, ventilation products, lightening products, etc.

NIRAS believes that reduced amounts of brick and concrete waste will trigger increased material recovery rate, as one of the barriers for material recovery of this fraction is low demand for use in infrastructure projects. Hence, reduced waste amounts should result in demand for a higher share of concrete waste for backfilling purposes (although the material recovery rate will still be hampered by challenges related to possible leaching of chromium 6, etc.).

With regard to plaster, there exist two recycling facilities in the Oslofjord-region. Costs related to transport is a barrier, hampering recycling, as landfilling may the most economically desirable option for plaster waste produced at building sites far away from these facilities. However, plaster waste from building sites within shorter distance to these facilities will be transported to recycling, regardless of the amounts produced. For plaster waste which is landfilled as of today because of e.g. high transportation costs, waste prevention obtained by e.g. use of prefabricated construction products and less surplus materials at building sites will lead to less waste being landfilled and a total increase in material recovery rates, both at aggregated level and at building site.

For wood waste, material recovery is generally low, and waste prevention will have a positive effect on the material recovery rate.

Hence, NIRAS put forward that there are reasons to believe that the above-mentioned waste prevention measures will also have a positive effect on the material recovery rate for construction waste. For metals and paper/cardboard waste prevention will result in lower material recovery rates, since these materials are more or less always recycled.
Summary of possible consequences:

Table 4. Possible consequences on prevention and overall material recovery rate.

Waste fraction	Effect on prevention	Effect on overall material recovery rate in Norway
Bricks and concrete	Positive	Positive
Polluted bricks and concrete	-	-
Wood	Positive	Positive
Metals	Positive	Negative
Plaster	Positive	Positive
Plastics	Positive	Positive
Paper and carboard	Positive	Negative
Other waste fractions	Positive	-

11.2 EU initiatives for source separation and material recovery

The Green Deal and the Circular Economy Action Plan shift the focus from environmental protection and waste management to design, production and consumption part of the value circle. But the waste legislation is still important to achieve a better resource management and the Commission has proposed or will propose changes in different waste directives.

11.2.1 Waste Framework Directive (WFD)

The overall target for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials is set to a minimum of 70 % by weight. By 31 December 2024, the Commission shall consider the setting of preparing for re-use and recycling targets for construction and demolition waste and its material-specific fractions. As far as NIRAS is informed, no communication is put forward by the Commission in this regard.

A shift from targets on material recovery to targets on re-use and recycling for specific waste streams will lead to a step up in the waste hierarchy. Targets could be set for the large C&D fractions like wood, bricks and concrete, metals and plaster. But could also be introduced for fractions where (the same) targets could be set for packaging or other municipal waste fractions like plastics, paper and carboard, electronic– and electrical equipment (WEEE), textiles, etc.

If the Commission sets targets for the recycling of the waste streams mentioned above, the effects could be:

- A shift from energy production to recycling of wood waste. As mentioned in chapter 10.2.1, about 60 % of the wood waste may have the necessary quality required as input to industrial production.
- Targets for recycling of concrete could lead to an increase in the use of used concrete as aggregates for production of new concrete. As a result, concrete waste to landfilling or even backfilling may be reduced.
- Increased source separation at construction sites to reduce the amount of residual waste. This could be significant effects for wood, plaster and plastics, although the effect for recycling will be positive for all fractions.

- Summary of possible consequences:

Table 5. Possible consequences on prevention and overall material recovery rate.

Waste fraction	Effect on prevention	Effect on overall material recovery rate in Norway
Bricks and concrete	-	Positive
Polluted bricks and concrete	-	Positive – ref Denmark
Wood	-	Positive
Metals	-	Positive
Plaster	-	Positive
Plastics	-	Positive
Paper and carboard	-	Positive
Other waste fractions	-	Positive

11.2.2 Landfill Directive

To support the EU's transition to the circular economy, the Landfill Directive will introduce restrictions on landfilling of all waste that is suitable for recycling or other material or energy recovery from 2030. This will lead to reduced possibilities of landfilling waste that could be recycled. Examples of waste going to landfill today (at least in Norway) are bricks and concrete and plaster.

Table 6. Possible consequences on prevention and overall material recovery rate.

Waste fraction	Effect on prevention	Effect on overall material recovery rate in Norway
Bricks and concrete	-	Positive
Polluted bricks and concrete	-	Positive – ref Denmark
Wood	-	-
Metals	-	-
Plaster	-	Positive
Plastics	-	-
Paper and carboard	-	-
Other waste fractions	-	-

11.3 Tentative effect on waste generation and material recovery rate if a set of initiatives are implemented

As far as NIRAS is aware of, there is no available data which could be used to carry out an analysis of the effects on C&D waste generation or the material recovery rate based on the assumed effects described in chapter 11.1 and 11.2. However, in understanding with the reference group of the project, a fictitious scenario test is carried out based on:

- SSB C&D statistics
- NIRAS knowledge of future legislation and policy initiatives
- Interviews with Norwegian stakeholders and NIRAS knowledge of effects of legislation and initiatives.

The results should only be seen as indications of possible effects - not scientific proof.

There is no indication that new regulations or political initiatives to reduce the generation of C&D waste, will influence the possibility for Norway to reach the 70 % material recovery target. This is also the conclusion in the following examples.

Assumptions:

- The SSB statistics show actual sorted waste streams. As an example, 109 967 tons of wood waste is generated from construction in 2020. All of this is handled separated of which 6 % is sent to material recovery. The statistics are however not based on report from waste holders reporting where the different waste streams have been delivered. In the three scenarios, this is however an assumption in our example.
- The Eco-design Directive and the Construction Products Regulation will probably lead to a change in the use of prefabricated products, take back systems for not used products at construction site, take back systems for packaging etc. We believe this will reduce the waste generation both for construction and renovation. Together with other measure taken at the construction site, waste generation could be reduced. In interviews with benchmark stakeholders, the following prevention results have been mentioned:
    - Wood waste: reduction on 20 - 30 % for construction. We have chosen 25.
    - Overall waste generation reduced with 17-30 % - ambition on 50 % reduction in 2030 (starting year average 2015-2019)
    - Measures to reduce packaging – but no targets or results mentioned
    - Focus on plaster – prefab has reduced waste from plaster
- Several benchmark stakeholders are putting forward that 85-90 % source separation is possible to achieve in construction. We have not been able to identify the average sorting percentage in construction projects, but if the average is the TEK 17 requirement on 60 % as it was in 2020, a raise to 85 % will reduce the residual waste with 30 %. However, according to the SSB statistics, the residual waste is only 17 % of the total waste streams, indication a separation rate on 83 % for all C&D waste in Norway. This is, based on NIRAS own knowledge and input from stakeholders, not the case.
- The introduction of ban on waste suitable for material recovery will lead to reduced landfill of plaster, bricks and concrete and also polluted bricks and landfill. This factor is uncertain, but in our example leads to an increase in material recovery of 50 % for these fractions.
- An increase in renovation will reduce the overall waste production both in construction and demolition. We have not tried to calculate the effects in separate analyse or how this would affect on the other assumptions.
- The only variable changed is the impact on waste generation by different initiatives. A deeper analyse should have checked for historical data and set up a growth trend towards 2030, as one example, However, this has not been possible to do within the limits of this project.

Summary of all assumption for a scenario analyse for construction waste:

- Wood waste reduction on 25 %
- Overall waste reduction on 30 % for all other waste fractions
- An increase in material recovery for bricks, concrete and plaster on 50 %
- A decrease in residual waste on 30 % by better source separation. This leads to an increase in paper/carboard, glass, plastics, metals, plaster, WEEE and wood waste.

With these assumptions, the overall material recovery rate for C&D waste from construction will increase from 52 to 59 %.

Table 7. Scenario showing effects of EU policy initiatives

	2020	Test scenario	Material recovery rate
Construction waste in all	646742	484230	
Wood waste	109967	85868	6 %
Paper and carboard	13915	13133	99 %
Plastics	6808	8158	48 %
Glass	3796	6050	37 %
Metals	24058	20233	100 %
Plaster	45894	35519	74 %
WEEE	1416	6646	75 %
Hazardous waste	4783	3348	0 %
Bricks and concrete	113848	79694	87 %
Polluted bricks and concrete	9932	6952	50 %
Asphalt	190171	133120	100 %
Residual waste	113096	79167	6 %
Other waste	9058	6341	6 %
Material recovery rate	52 %	59 %	

The scenario shown in table 11.1 indicate that effect of EU initiatives will lead to a reduction in overall waste generation of 25 % and an increase in the material recovery rate from 52 % to 59 %.

However, this scenario should only be used as an example and not as evidence for developing regulations or other political initiatives.

12. Drivers and barriers for prevention, reuse and recycling of C&D waste

Circular construction has received growing attention in recent years due to the potential for utilizing resources and materials at a higher level of the waste hierarchy than today. Reducing the construction sector's carbon footprint is crucial, if the ambitious climate reduction goal is to be realized. Circular construction is one of the means of action in order to do so. However, the construction industry has certain characteristics that impact the opportunities and challenges in relation to recycling and circular economy. The industry is characterized by:

- A complex value chain with many actors
- Large homogeneous fractions of concrete, brick, asphalt, wood, metal and glass which are sorted/separated at source (construction sites), as well as a number of heterogeneous fractions (including composite materials)
- Very long product lives, and slow phasing out of banned hazardous substances (legacy substances)
- Slow innovation processes
- High risk aversion and strong focus on durability

The long lifecycle of buildings result in slow material flows, which means that harmful chemical substances used in constructions in the past, will remain in the waste stream for years to come. A study (Skadelige kemikalier som barriere for den cirkulære Økonomi Del 2) conducted by NIRAS for Danish EPA in 2019[37] concluded that there are no simple or quick solutions to ensure that harmful chemical substances do not hamper the circular economy. In order to prevent harmful chemical substances from hampering the circular economy, one needs to address both the production and the waste sides of the value chain. On the product side, there is a need for initiatives that can support circular product development via substitution, design, material selection and suitable production processes. On the waste side, there is a need for measures to support cleaner fractions and create security for the quality of the secondary raw materials. This presupposes a close dialogue and new forms of cooperation between the actors in the value chain. In addition, it requires knowledge and transparency about the harmful chemical substances that are included in products, raw materials and waste, as well as measures that can contribute to distributing risks, costs and gains in the value chain in a way that gives the actors the right incentive to act.

12.1.1 Barriers for preventing and recycling R&D waste

The main barriers to recycling of C&D waste identified in the study are shown in the figure and explained below.

[37] Miljøstyrelsen (2019a): https://www2.mst.dk/Udgiv/publikationer/2019/12/978-87-7038-136-9.pdf

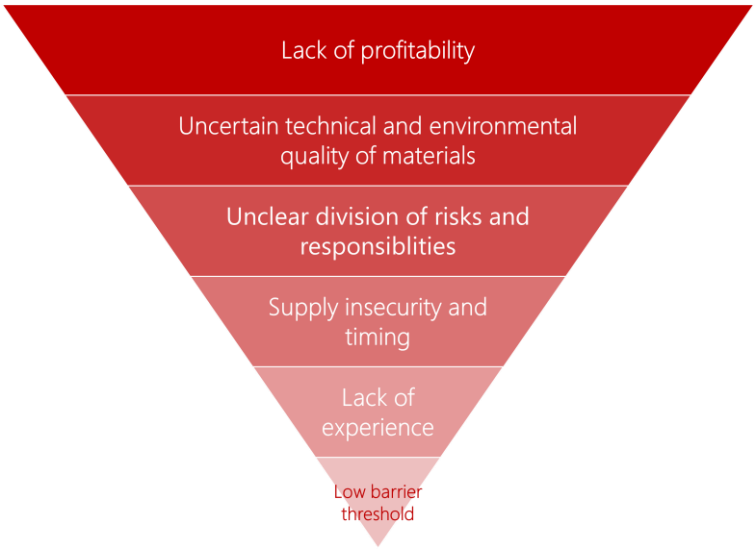

Figure 53: Barriers to recycling of R&D waste. Source: NIRAS based on Miljøstyrelsen (2019a).

- Lack of economic profitability, which is for instance caused by immature markets, lack of supply/demand or insufficient price difference between primary and secondary raw materials to finance investment in new production equipment.
- Uncertainty about the technical and environmental quality/performance of recycled materials. It is difficult to trace and document the potential content of hazardous substances in waste fractions, and standards related to the technical quality still needs to be developed for many recycled materials/products.
- Unclear divisions of risks and responsibilities. Often the builder needs to take on extra responsibility when using recycled materials because they are not certified and controlled in the same manner as new materials.
- Supply insecurity. Uncertainty about whether there will be sufficiently large and uniform fractions on the market at the time needed.
- Lack of experience and the need for new collaborations because the circular economy requires new transversal collaborations, supplier relationships and roles.
- Low barrier threshold and high-risk aversion in many companies means that even minor challenges can be a stumbling block for circular initiatives.

The findings in the Danish study was also confirmed in interviews with Norwegian stakeholders in June-September 2022 as a part of the work of this project.

In 2017 NIRAS conducted another study for the Danish EPA with a special focus on waste prevention and recycling in construction, renovation and demolition[38]. This study also identified a range of barriers and potentials and related them to the different phases of construction and demolition:

Preparation for demolition

- Lack of demand from developers that waste must be recycled means that contractors rarely focus on recycling unless there is a clear economic value in doing so, which is seldom the case
- Tight deadlines for demolition mean that there is rarely sufficient time to properly plan demolition in a way that would facilitate better recycling, nor to identify potential market opportunities for the material.
- Public developers (procurers) could help drive this process by developing new tendering forms that demand closer collaboration between actors, while improved economic incentives for resource mapping would also help.

[38] Miljøstyrelsen (2017): https://www2.mst.dk/Udgiv/publikationer/2017/02/978-87-93529-66-3.pdf

- Mandatory resource mapping prior to demolition would help push waste material up the waste hierarchy and should be undertaken by actors that do not have an economic interest in the handling of the waste.
- A lack of knowledge within the sector of the legislation and legal requirements during preparation for demolition is also seen as a barrier, especially among the small companies in the sector.
- Municipalities and major developers can – and have started to – play a central role in building knowledge by making stronger demands for resource mapping for municipal building projects than are legally necessary, while industry associations can help and guide members toward better practices.

Planning phase of construction

- Time constraints sometimes lead to increased waste of new materials.
- Materials are regularly over-ordered to ensure adequate supplies on site
- Leftover material and products are often simply discarded.
- Designs also often use higher specification materials/products than necessary for the use-case. More thorough design and process planning can help reduce this waste, as can product return systems from suppliers.
- Materials can be damaged on-site or during delivery but planning of logistics and storage can help reduce this.
- Use of Prefabricated elements may reduce waste generation, since there are no cut-offs at the building site, although the use of prefabricated elements may be more difficult in for renovation projects.
- The economic risk of using recycled materials (time-limited warranties for example) is currently held by the developer. Distributing this risk between actors, or other forms of insurance, could help drive higher use of recycled materials in new buildings.
- Certification schemes like DGNB, BREEAM and LEED provide some incentive to reduce waste and increase recycling during construction, and utilise recycled material in buildings.
- Stronger regulation of resource use in construction is seen as a way of forcing developers to think about resource planning and of making certification schemes more attractive.
- Increased knowledge of the possibilities of using recycled materials by architects and developers is seen as key to constructing resource efficient buildings.

Management of material on a construction site

- Management of material on a construction site is typically the responsibility of the contractor running the site, and the contractor rarely has any incentive to make the best possible use of waste materials.
- Materials from demolition are typically the property of the demolition contractor, which holds both the legal responsibility for proper waste management and the economic benefits from sale of these materials.
- Developers are rarely involved in the management of waste materials. But some developers have begun to take on a new responsibility in this direction. There is often little economic incentive for the contractor to sort waste beyond legal requirements. Improving the economic incentive to produce better and cleaner waste fractions is seen as key to improving waste handling during demolition. A requirement for selective demolition is expected to reduce this barrier.
- Existing regulation in Denmark seems to be among the most progressive in Europe in this area, but there is a lack of inspection to ensure that regulation is actually followed.
- Technical challenges also limit the production of clean and easily recyclable waste fractions from construction and demolition, which is further complicated by the need to keep waste from each demolition project separate to facilitate traceability of the recycled product.

The market for recycled raw materials

- The market for materials recovered from construction and demolition processes functions reasonably well for crushed concrete and bricks and tiles, which are most commonly used as filling material or as a base layer for road and civil engineering works.

- There is, however, only a modest market for reuse or recycling of material for other uses, and it typically operates privately and below market prices for new products. However, in recent years there has been an increase in digital and physical marketplaces for reusable items. Likewise, many municipal recycle centers have added a section where they sell reusable items.
- Demolition contractors highlight that demand for materials (beyond filling and base layer uses) is limited, and the short planning and demolition timeframe does not allow the identification of potential buyers for other, potentially higher value, products.
- Price plays a crucial role as well: virgin concrete is currently less expensive than recycled concrete and recycling of wood is more expensive than incineration.
- Identifying potential uses outside of the construction sector could help expand the market and drive demand, while temporary economic support could help mature the market.
- Uncertainty about the quality of the recycled material also acts as a barrier to further utilisation, something which certification and CE labelling could help alleviate.
- Overly strict limit-values for problematic substances in recycled materials is also seen as a significant barrier and means that many materials cannot currently be recycled. Differentiating the acceptable content of problematic substances by use-case could release more material for recycling.
- Technical demands of construction materials and products also limit the possibilities for reuse, with modern insulation demands for doors and windows, for example, often precluding their reuse in new buildings.
- CE labelling can also pose problems for reuse of building products, and although it is currently uncertain to what degree reused products should bear a CE label in Denmark. Clear guidance on this subject could help alleviate confusion on the part of developers and contractors.

13. Recommendations for policy initiatives for better C&D waste management

The C&D network raised the following main questions:

1. Will requirements for waste prevention reduce the amount of C&D waste and as a consequence influence on the source separation and recycling rate of C&D waste?
2. Is it possible to introduce requirements for waste prevention in the WFD and how should these requirements be written into the directive?
3. What will be the consequences of different options for introduce waste prevention requirements in the WFD?

The research carried out in this report has tried to identify the relation between waste prevention and the legal requirements in the Norwegian, Danish and EU regulation for handling of C&D waste at the construction site. At the same time, the network is aware of the EU process of the revision of the Waste Framework Directive (WFD) and other regulations that will influence on the framework for handling of C&D waste in the years to come.

The research has identified drivers and barriers for waste prevention, reuse and material recovery in the building sector. As an overall conclusion, there is no general conflict between policy initiatives for waste prevention and the requirements for the onsite source separation of C&D waste and targets for material recovery.

To obtain better resource management in the Construction sector require a set of policy initiatives, regulations and use of economic instruments. NIRAS would recommend to avoid a separate look into one regulation as the only tool, in this case only to look into the WFD regulation. As an example, NIRAS will put forward that the WFD is not the optimal regulation to obtain waste prevention in the construction industry or preparation for reuse for construction waste.

The barriers and drivers identified and put forward by stakeholders, demonstrate the need for a value circle perspective into the future policy initiatives and regulations of the construction sector. The overall ambition is clearly put forward in the EU policy initiatives. It is important for all stakeholders to make sure that the different measures like regulation, financial support and research and development programs are reflecting the overall ambitions and will be put in force in a way that support each other.

The shift towards a Circular Economy will need policy initiatives and regulation all around the value circle for the construction sector. It is of high importance that these initiatives and regulations recognise the different steps within the circle to make sure that all discissions taken at on step don't create a barrier to another step. For the construction sector, this could be complicated due to the long life of buildings and that several industries and governmental institutions are involved and have influence on the value circle.

13.1 Waste Framework Direction (WFD)

13.1.1 Targets for waste prevention

The WFD Article 9 Prevention of waste has several paragraphs encouraging Member States to prevent waste generation. However, the WFD is mainly established to regulate the handling of waste. Most actions to prevent waste will be carried out by other actors than the ones responsible for the waste management. NIRAS recommend that requirements for waste prevention is moved from the WFD regulation into product regulations like the Eco design regulation, Packaging and packaging waste directive and the Construction Product Regulation. This policy option is already noticed by the European Commission.

As a consequence, NIRAS' proposal for waste prevention regulations is put forward in other regulation referred later in this chapter.

13.1.2 Develop requirements for separate collection

The WFD has developed requirements for separate collection of food, plastics, paper, glass, metals and textiles of municipal waste. This could be enlarged to C&D waste where other fractions as wood, concrete and bricks, plaster, asphalt could be introduced.

13.1.3 Develop targets for recycling in the WFD for all waste, including C&D waste

The WFD includes a target on 70 % for reuse, recycling and other material recovery by 2020. The Commission could consider the setting of preparing for re-use and recycling targets for construction and demolition waste and its material-specific fractions. These targets could follow the same structure as introduced for packaging waste in the "Packaging and packaging waste directive". Setting targets for C&D waste could be relevant for paper and carboard, plastics, wood, glass, metals, concrete and plaster.

As an overall recommendation, NIRAS recommend to develop the same type of regulations for C&D waste as for municipal waste. All regulations and targets introduced in WFD for MWE should be applied for C&D waste as well. Material specific targets would lead to a discussion on the right level of reuse, recycling or backfilling for different waste streams and set criteria for when incineration or landfill would be the best option for waste treatment.

13.1.4 Introduce a ban on landfilling and incineration of source separated C&D waste

The WFD has already introduced in Article 10 (4) that: "*Member States shall take measures to ensure that waste that has been separately collected for preparing for re-use and recycling pursuant to Article 11(1) and Article 22 is not incinerated, with the exception of waste resulting from subsequent treatment operations of the separately collected waste for which incineration delivers the best environmental outcome in accordance with Article 4.*" To support this article, a ban on landfilling could be introduced in the landfilling directive.

The WFD could also clarify how Member States should introduce the waste handler as responsible for not sending source separated waste to landfill as it done in the Danish legislation by defining waste handling as : "*Collection, transport, recovery and disposal of waste, including supervision in connection with this and after-treatment of disposal facilities as well as the activities of dealers and brokers.*" Waste-producing companies must ensure that significant parts of their source-sorted commercial waste, which is suitable for material recovery, is prepared for reuse, recycled or used for other material recovery.

13.1.5 The use of Extended Producer Responsibility (EPR)

EPR are regulated and introduced for several waste streams in WFD. The EPR instrument could be introduced as a tool for building and construction products to stimulate suppliers of specific products to establish take back systems or to set up financial systems to reduce the gap between landfill/incineration and reuse/recycling of products or materials. This driver is proposed by certain stakeholders which were interviewed for this report. Take back systems for construction products are mentioned in the revision of the WFD, but EPR is not pointed out as tool for these take back requirements. NIRAS has not identified specific construction products or materials where EPR could be introduced.

13.2 Landfilling directive

By 31 December 2024, the Commission shall review the 2035 10% target with a view to introducing restrictions to the landfilling of non-hazardous waste other than municipal waste. This could include C&D waste.

In article 5, 3 (f), the directive has implemented a ban on source separated waste: "*waste that has been separately collected for preparing for re-use and recycling pursuant to Article 11(1) of Directive 2008/98/EC and Article 22 of that*

Directive, with the exception of waste resulting from subsequent treatment operations of the separately collected waste for which landfilling delivers the best environmental outcome in accordance with Article 4 of that Directive".

This is supported by 3a. stating that: "*Member States shall endeavour to ensure that as of 2030, all waste suitable for recycling or other recovery, in particular in municipal waste, shall not be accepted in a landfill with the exception of waste for which landfilling delivers the best environmental outcome in accordance with Article 4 of Directive 2008/98/EC.*"

A ban on landfill is mentioned as a driver to compensate for the low price on landfilling which gives a more difficult competition for recycling and reuse. The Norwegian EPA has 01.07.2022 sent a proposal for a revised Chapter 9 in the Waste regulation where a ban on source separated waste prepared for reuse or recycling is proposed[39]. However, as far as NIRAS understand the proposal, the ban is limited to separately collected waste C&D waste. To avoid that waste suited for material recovery is not sent to landfill, two alternatives could be implemented:

- introduce landfill ban on C&D waste which are suited for recycling, not only the separated collected waste.
- Raise the source separation rate from todays 70 % to at 85 % to force source separation on waste suitable for material recovery

In the Landfill Directive, Article 5, 5 "*Member States shall take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10 % or less of the total amount of municipal waste generated (by weight).*" This paragraph could include C&D waste as well as municipal waste.

13.3 Eco Design Directive, Construction Products Regulation (CPR) and Directive on the Energy Performance of Buildings

The proposal for revised Eco Design Directive was published on 30.03.2022. The proposal for a new Eco-design regulation demonstrate the ambition of the Commission to use product regulations as a tool to reach environmental goals. The proposal was launched at the same time as the proposal for a revised Construction Products Regulation. The two proposals are linked to each other and will influence on the construction sector.

Requirements for products to be repairable, designed for reuse and recyclability, to contain recyclable materials, etc. will influence on construction products and the generation and handling of C&D waste. The same will requirements for take back system of not used C&D products (e.g. surplus construction products at construction sites).

A shift towards regulation on products and performance will be important to achieve a more sustainable construction sector, to reduce climate footprints and a more resource efficient sector. As shown in chapter 11, the overall effect on waste generation and recycling and other material recovery will be positive. As mentioned over, it's extremely important for all stakeholders to make sure that the different regulations are reflecting the overall ambitions and will be put in force in a way that support each other.

13.4 Renovation Wave

The political initiative Renovation Wave for Europe could influence the prevention and handling of C&D waste in Norway, if the initiative is followed by a similar Norwegian political initiative. If renovation replace demolition and new construction, this will change the generation of C&D waste and how the waste is treated.

[39] Anbefaler endringer i deponiregelverket - Miljødirektoratet (miljodirektoratet.no)

Limiting demolition has traditionally mostly been linked to preserve historical buildings or buildings of cultural heritage. An increased recognition of the environmental footprint in existing buildings could be followed by more restriction on demolition, supporting renovation as an alternative. To introduce a general stop in demolition could lead to a shift in the look on existing buildings and lead to develop a better knowledge and methods for renovation.

13.5 Economic instruments

To support the transition towards a circular economy and the different initiatives mentioned above, the Commission is also preparing a set of economic instruments. Due to the limitations of this project, NIRAS has not been able to look into the EU instruments, nor Norwegian counter parts. Some examples of EU instruments are given below:

- Sustainable finance Taxonomy – regulation - https://ec.europa.eu/info/law/sustainable-finance-taxonomy-regulation-eu-2020-852_en
- Funding for research and development (Horizon Europe, https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/horizon-europe_en
- European structural and investment funds - https://ec.europa.eu/info/funding-tenders/funding-opportunities/funding-programmes/overview-funding-programmes/european-structural-and-investment-funds_en
- Strengthened use of environmental and/or quality requirements within public procurement

13.6 Better statistics for C&D waste

The uncertainties in Norwegian, Danish and European statistics demonstrate that C&D statistics has several limitations and cannot easily be used for comparison between EU member states. As put forward by EEA, most recycling of concrete and bricks seems to be backfilling and a downcycling of resources. As important to reach an overall material recovery target on 70 %, a move up the waste hierarchy of several waste fraction should be possible. This will require a development of methods and report from member states on C&D waste to help to achieve a better knowledge and understanding of the value chain for C&D waste.

NIRAS recommend that consistent use of terms in accordance with the WFD definitions should be required. All reporting of data on European level should be regulated in the Regulation on waste statistics, to ensure uniform collection and reporting of national statistics.

In Norway, SSB should be given both mandate and resources to further develop the system for reporting and processing of C&D waste data. The split responsibility between SSB and Norwegian EPA leads to an suboptimal use of resources and a less accurate statistics than needed.

13.7 Norwegian legislation

In chapter 13, NIRAS has discussed possible initiatives on EU level. All initiatives could be taken into Norwegian legislation as well. For most initiatives, there is a possibility for Norway to start developing framework on better C&D resource and waste management parallel with the EU development.

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European Commission – 20.03.2022: Proposal for a Regulation establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC

European Commission – 15.12.2021: Proposal for a Directive on the energy performance of buildings (recast)

European Commission – 30.03.2022: Proposal for a regulation laying down harmonised conditions for the market-ing of construction products, amending Regulation (EU) 2019/1020 and repealing Regulation (EU) 305/2011

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