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REPORT 2026:27

Regulation on life-cycle GWP and limit values for the climate impact of buildings

in accordance with the EPBD

Part 2 Annexes

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Contents

Annex 1 – Description of the current situation

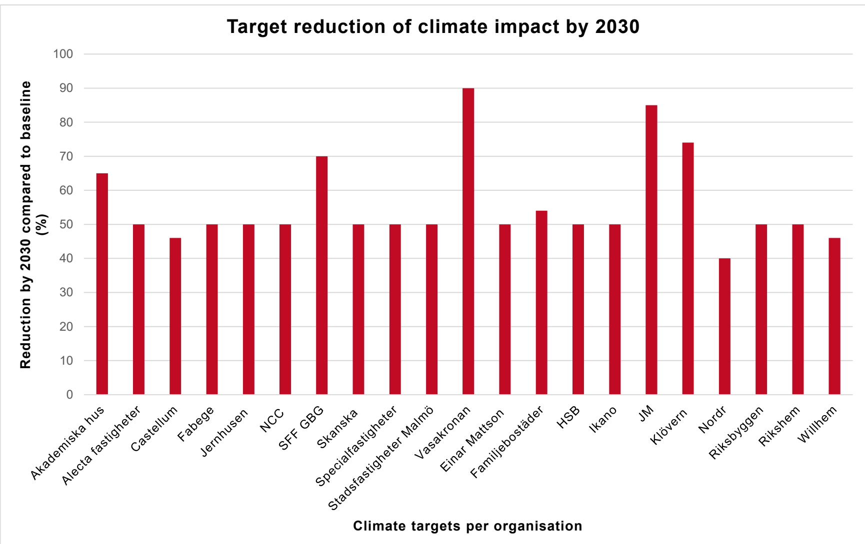
This section provides a description and analysis of the industry's work on climate impact and how this has progressed in recent years, as well as what we can expect by 2030. This section covers three different areas:

- Requirements and targets for reducing the climate impact of construction projects between 2020 and 2030
- Shifting climate impact of materials and energy between 2020 and 2030
- Cost effect of reduced climate impact.

Requirements and targets for reducing the climate impact of construction projects between 2020 and 2030

Large parts of what is currently being built and especially what will be built between now and 2030 are subject to some type of climate requirements set by the organisation, either at the developer or contractor, or both. This means that a shift in the level of climate impact for typical construction will occur between 2020 and 2030. Many municipalities also impose requirements on climate performance in their land allocations, for example Gothenburg, Malmö, and Uppsala. Stockholm is also looking into similar requirements. These municipalities account for a large proportion of all new construction in Sweden.

Figure 1. Presentation of a number of real estate companies' climate targets for new construction, most of them expressed as reduction in climate impact per unit area.



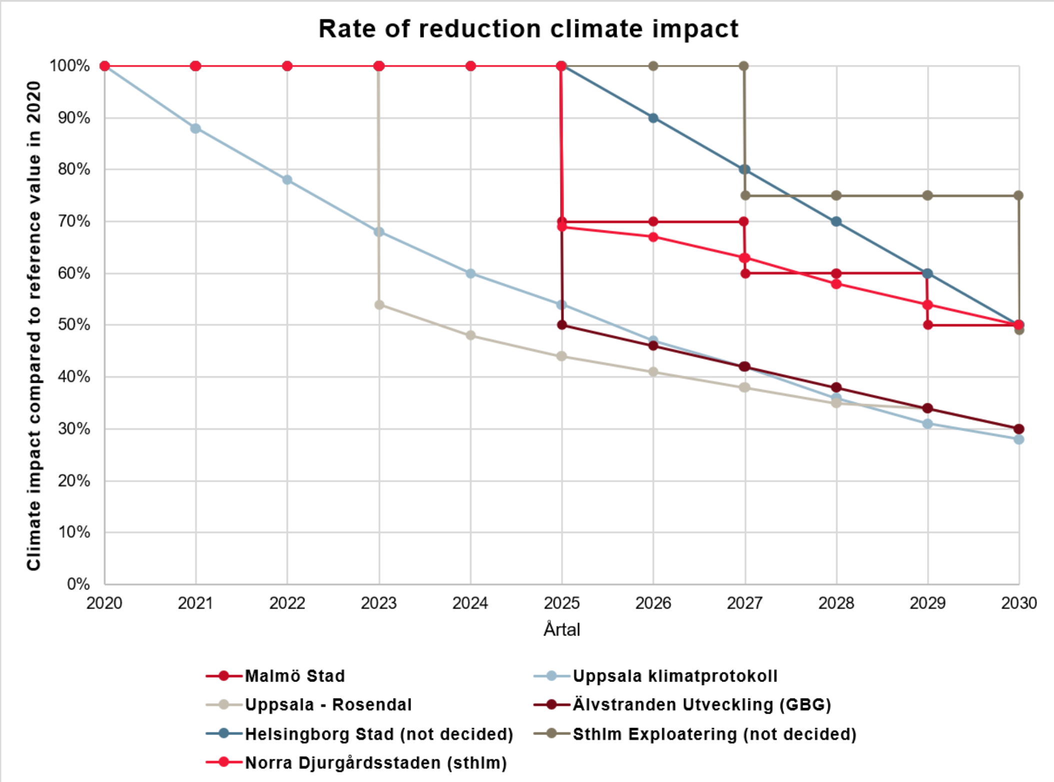
The figure is based on each organisation's website, April and May 2025. Source: KTH.

Figure 1 shows the targets set for reduced climate impact of new construction by a selection of organisations. Most targets are expressed as reduced climate impact for modules A1–A5 per square metre of gross floor area (GFA), i.e., formulated the same way as the proposed limit values. The scope of building elements varies. Please note that the reduction is made compared to a baseline, often specified as a particular year. The baseline, and the year thereof, varies between the different organisations. The baseline is usually the year 2020, or thereabouts.

Public Housing Sweden (Sveriges Allmännytta) has a climate initiative with a reduction target of ensuring that the climate impact of new construction does not exceed 140 kg CO_2-eq/m^2 GFA by 2035[1]. Compared with the median value from the 2020 reference value study for multi-dwelling blocks, this represents a reduction of approximately 60 per cent. Figure 2 shows land allocation requirements regarding the rate of reduction in climate impact for new construction in a selection of municipalities, compared with the 2020 reference values. Most municipalities have specific requirements for each building type, expressed in terms of maximum climate impact in kg CO_2-eq/m^2 GFA. The graphs summarise the figures as a percentage up to 2030. The level is given for the year of start of construction/building permit application.

[1] https://www.sverigesallmannytta.se/allmannyttans-klimatinitiativ/de-uppdaterade-klimatmalen/. (Retrieved on 16 April 2026).

Figure 2. Climate requirements for land allocations.



The reduction requirements are based on a reference value for 2020. Source: KTH.

A large proportion of all construction projects are carried out by an organisation that has signed the ‘Roadmap for fossil free competitiveness: the construction and civil engineering sector’, where organisations subscribe to a target of halving their climate impact between 2015 and 2030.

Climate impact of materials and energy for buildings between 2020 and 2030

The transition of the value chain: a review of conclusions from Boverket 2023:20

Boverket (2023) describes the expected climate impact trends in the construction industry, based on measures throughout the value chain (p. 79). This is described as follows:

> ‘Potential emission reductions have been studied for various sectors, including the construction sector, as part of the major ongoing research programme known as Mistra Carbon Exit. KTH Royal Institute of Technology has developed slightly adapted and updated scenarios of relevance to the initial level of the limit values in discussion with doctoral student Ida Karlsson at Chalmers University of Technology (see Annex 4). The most likely one of a number of scenarios for the climate impact of the construction sector has been selected. This scenario shows the reduction in climate impact of all

> new construction of buildings in Sweden for different years compared to the 2020 level. Two alternative scenarios have been drawn up for 2030.
>
> One in which CCS is assumed to have been introduced for cement, and one without CCS. Figure 8 shows the scenario without CCS (given that there are still uncertainties concerning its development), where the potential reduction is estimated at just below 50 per cent by 2030, compared to 2020 levels. This potential includes measures across the entire value chain, from the project design of buildings and the manufacture of construction products, to construction. Total construction emissions are the sum of emissions from building materials, and emissions from transport and construction equipment/material transport.

In order to ascertain whether these conclusions remain relevant, Karlsson[2] was contacted, who comments on the paragraph as follows: "The policy framework underpinning the studies has been strengthened over the past two years at EU level, particularly in relation to the energy transition and emissions trading. Although uncertainties remain, developments have moved in a direction that reinforces the conclusions."

Trends in the climate impact of concrete

There has been rapid progress in reducing the climate impact of concrete, primarily through the replacement of cement with alternative binders. This is largely due to the fact that the cement is replaced with other products with a lower climate impact. The proportion that can be replaced is determined partly by the properties of the concrete and partly by standards. As a rule of thumb, this method can reduce the climate impact of concrete by approximately 50 per cent, although concrete with an even lower climate impact has already been used in casting operations during 2025.

To achieve a greater reduction in the climate impact of a concrete product of the same quality, carbon capture and storage (CCS) is required. This is currently done in Norway (Brevik) and is planned for Sweden (Slite, Gotland). The aim is to start production in Slite around 2030, with products reaching the market approximately one year later.

As part of the study, an interview was conducted with Katarina Malaga[3], adjunct professor of sustainable construction, Research and Business Development Manager at RISE, and coordinator of the BETCRETE 3.0 [4] research project. The following paragraph is based on this interview.

As part of the research project, KPIs have been developed (Malaga et al., 2025). These figures show that the proportion of alternative binders in

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[2] Personal communication. Ida Karlsson, Chalmers, 6 May 2025.
[3] Personal communication, Katarina Malaga, 29 April 2025.
[4] Betcrete 3.0.

concrete used by the participating concrete suppliers[5] was approximately 20 per cent in 2024, resulting in a 10–15 per cent reduction in climate impact between 2020 and 2024. However, this KPI covers concrete used in both residential construction and infrastructure. Due to the current economic situation, the proportion of house-building projects has declined in recent years, meaning that concrete used for infrastructure accounts for a larger proportion of the KPI. According to Katarina Malaga, concrete used in infrastructure generally contains a lower proportion of alternative binders than concrete used in residential construction. Consequently, the proportion of alternative binders in residential construction projects should be higher than 20 per cent.

Based on the development between 2020 and 2025, current regulatory framework and the timeframe for the introduction of new binders, Katarina Malaga estimates that the change in climate impact will correspond to an approximately 25–30% reduction in the climate impact of structural concrete between 2020 and 2030.

At present (2025), the regulatory framework allows up to 65 per cent of Portland cement to be replaced with alternative binders, resulting in a reduction of climate impact of approximately 50 per cent. However, where the concrete structure is required to meet specific exposure classes, the regulatory framework contains provisions limiting the proportion of alternative binders that may be incorporated.

Under the current regulatory framework, all structures (houses) in Sweden should be able to use climate-improved concrete corresponding to at least Level 3, i.e., a 30 per cent reduction in climate impact. However, material supply constraints in different parts of the country may mean that concrete suppliers in rural areas are unable to supply climate-improved concrete at high levels. According to Katarina Malaga, however, Level 2, i.e., a 20 per cent reduction in climate impact, should currently be available for delivery throughout Sweden.

CCS cement – EvoZero – from Heidelberg Materials in Norway will be launched on the Swedish market in autumn 2025. However, it is not yet known what proportion of this production will be supplied to projects in Sweden. Katarina Malaga roughly estimates that around 10 per cent of the market will be able to be met by CCS cement from Norway. Heidelberg Materials also plans to install a CCS plant in Slite. It is expected to be completed and in production by 2030. This means that CCS cement will not constitute a significant share of the Swedish market by 2030, only later. Schwenk also plans to install a CCS plant in Akmene, Lithuania, where the majority of cement exported to Sweden is produced. This plant is also expected to be completed in 2030. By around 2032, CCS

[5] accounting for the majority of the concrete produced in Sweden.

cement could account for approximately 80 per cent of the Swedish cement market if both Heidelberg Materials and Schwenk implement their plants as planned. CCS cement is, however, estimated to be considerably more expensive than conventional cement (2,5 to 5 times). As cement production is covered by the EU ETS, however, pricing should be considered in relation to the cost of emission allowances.

According to Katarina Malaga, no significant change in the way buildings are designed with regard to using the right concrete in the right place and optimising structural designs is expected before 2030. Following the widespread introduction of CCS cement and rising prices for emission allowances, there is likely to be a significant shift in this area as a cost-saving measure.

An updated assessment of the climate impact of the well-studied multi-dwelling block *Blå Jungfrun* was carried out using semi-prefabricated construction with two types of external walls (Erlandsson et al., 2023). Two options were compared: one using concrete grades that could be adopted relatively easily without affecting the construction process, and another requiring certain measures to be implemented on the construction site. The first option had a climate impact of 227/215 kg CO_2-eq/m² GFA. The second had a climate impact of 218/202 kg CO_2-eq/m² GFA, i.e. a reduction in climate impact of between just over 35 per cent and just under 45 per cent compared with the reference value (median) for multi-dwelling blocks reported by Malmqvist et al. (2023).

Trends in the climate impact of steel

Within the limited scope[6] of this study, no statistics have been identified on the climate impact of steel used in Swedish buildings, either for the time to date or in the form of projections up to 2030. Neither the Swedish Institute of Steel Construction, Jernkontoret, nor EUROFER has access to such statistics.

It can, however, be noted that the majority of the steel used in Swedish buildings is imported, primarily from manufacturers in Europe. As a result, developments in the European steel industry may be regarded as a reasonably accurate reflection of trends in the use of steel in Swedish

[6] Web searches at EUROFER on 5 May 2025, personal communication, Karlsson, I, Chalmers, 22 April 2025, personal communication with Cecilia Mattsson, Jernkontoret, on 9 May 2025, email to the Swedish Institute of Steel Construction on 13 May 2025, personal communication with Dan Pada, Nordec, on 9 May 2025, Eurofer, 2024. European Steel in Figures 2024, https://www.eurofer.eu/assets/publications/brochures-booklets-and-factsheets/european-steel-in-figures-2024/EUROFER-2024-Version-June14.pdf. Retrieved 10 April 2026. The state of the European Steel Transition, WWF, Mars 2025, https://eeb.org/wp-content/uploads/2025/03/State-of-Steel-Report.pdf. Retrieved 10 April 2026.

buildings. The Swedish steel industry is primarily focused on steel grades other than those used in buildings[7].

Through EUROFER, the European steel industry has committed to reducing its climate impact by 30 per cent between 2018 and 2030 (equivalent to a 55 per cent reduction compared with 1990), while noting that this requires the right conditions.[8] One measure with substantial emission reduction potential is the transition to arc furnaces, which are powered by electricity rather than coal. These furnaces are primarily used to melt recycled steel scrap, which has a lower climate impact than virgin material. Today, just over 40 per cent of steel is produced in arc furnaces.

A number of major investments aimed at reducing climate impact have been completed, are under way or are planned for the period 2020–2030. This affects the largest manufacturers in Europe. These are shown on a map published by EUROFER[9]. However, no compilation is available showing the share of steel production covered by these investments. EUROFER presents the investments on a map and describes them as follows:

> "The above map shows examples of key low-CO2 projects that can help to achieve a substantial reduction of CO2 emissions in the EU steel industry. These projects (currently 60, but numbers grow by the month) will almost all start before 2030 and have the potential of reducing CO2 emissions by 81.5 million tons per year by 2030. This is equivalent to a cut of more than 1/3 of direct and indirect CO2 emissions of the European steel industry in just eight years from now, in line with the EU climate targets."

Dan Pada, Technical Manager at Nordec, considers it unlikely that this target will be achieved and notes that several of the planned projects have been postponed or put on hold. He estimates that the transition will result in a reduction of around 20 per cent in climate impact between 2020 and 2030[10]. He considers that there will be no shortage of steel scrap to increase the proportion of recycled raw material in steel products in the future.

One concern regarding the potential to scale up the use of scrap-based steel is the availability of steel scrap, and the reported recycling rates vary. For heavy structural applications, EUROFER states that the recycling rate is 93 per cent[11]. Other studies indicate that a significant proportion of the steel used in society is not recycled but is instead lost over

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[7] Personal communication with Cecilia Mattson, Jernkontoret, and others, on 9 May 2025.
[8] https://www.eurofer.eu/publications/position-papers/a-green-deal-on-steel-update. Retrieved 10 April 2026.
[9] https://www.eurofer.eu/issues/climate-and-energy/maps-of-key-low-carbon-steel-projects. Retrieved 10 April 2026.
[10] Personal communication with Dan Pada, Nordec, 9 May 2025.
[11] https://www.steelconstruction.info/Recycling_and_reuse. Retrieved 10 April 2026.

time through various mechanisms, such as landfilling, losses during waste disposal, and accumulation in so-called ‘obsolete stocks’ (for example, old buildings or products that are no longer in use but have not been recycled).

- According to a study by Pauliuk et al. (2017), up to 50 per cent of steel could be lost by 2100 through these mechanisms, depending on the region and product group.
- An earlier study by Bowyer et al. (2015) points out that recycling rates are often overestimated if all steel scrap, including scrap that is not recycled, is not taken into account.
- Despite the increasing availability of steel scrap in the future, challenges remain in actually returning all of this material to production (Schneider et al., 2020).

Overall, the research indicates that approximately half of all steel placed on the market is not recycled, which means that there is considerable potential to increase the amount of steel scrap available.

Alla Toktarova, Chalmers University of Technology[12], works on scenarios for emissions intensity in the EU and the UK. Her scenarios take into account, among other things, planned investments, the transition of the energy system, and the costs of electricity and emission allowances. The scenarios show a reduction in total emissions from steel production of between just under one quarter and just over one half between 2020 and 2030. Toktarova considers the transition of the electricity system to be the greatest source of uncertainty in the model. The model presents total emissions rather than emissions intensity (for example, kg CO_2-eq/tonne). As no major change in steel use is expected during the period, this shift can be assumed to apply to the intensity of the products as well[13].

Since 2020, there has been a change in the recommendations for how climate impact is calculated in an EPD. It is now recommended that, where electricity with a lower climate impact than the market mix is purchased, this should be reflected in the EPD calculation, resulting in a lower reported climate impact, particularly for iron produced in electric arc furnaces. This is therefore purely a methodological change in the calculation, resulting in a lower calculated climate impact. In other words, it will make it easier for building sector stakeholders to comply with a limit value, even though it does not result in any actual climate benefit (unless it contributes to increasing the share of renewable electricity).

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[12] Totarova, Alla, doctoral student at Chalmers, personal communication, 22 May 2025.
[13] EUROFER. https://www.eurofer.eu/. Retrieved 10 April 2026.

The Swedish Institute of Steel Construction[14] currently has no statistics or forecasts regarding developments in climate impact and the share of scrap-based products between 2020 and 2030 for steel products used in Swedish buildings. It also has no forecasts regarding the future availability of scrap-based steel. Hagman points out that recently published EPDs for structural steel with open sections show considerably lower climate impact than the values in Boverket's climate database. This is based on EPDs from the largest wholesalers on the Swedish market (Stena Stål, Tibnor and BE Group); see Tables 1 and 2.

The largest steel distributors in Sweden all have EPDs, and Table 1 below compares these with Boverket's generic values. There are also a number of manufacturers of steel structures whose products generally have a lower climate impact than those of the stakeholders listed below. No review has been carried out of other steel products used in buildings, such as steel roofing and steel studs. The review shows that, for structural hollow sections, climate impact is essentially unchanged compared with 2020, whereas the climate impact of reinforcement and other structural steel has decreased substantially between 2020 and the publication of the EPDs currently available[15].

Table 1. Comparison between the values in Boverket's climate database and the EPDs available today, in 2025.

Product type	**Steel distributor**	**Typical value Boverket's climate database[16], A1–A3 (kg CO2-eq/kg)**	**Examples of GWP-GHG from the EPD, 2025, A1–A3 (kg CO_2-eq/kg)**	**Change (%)**
Reinforcement	7 Steel (dominant stakeholder)	0.596	0.373[17]	37% lower
Structural hollow sections, often	Stena Stål	2.52	2.58[18]	Approx. 10% higher to 70% lower
	Tibnor		2.85/2.5/0.71[19]	

[14] Personal communication, 19 June 2025. Olle Hagman, Swedish Institute of Steel Construction.
[15] 2025-05-14.
[16] Boverket's climate database – navigate Values presented here are for the products used in the development of Reference values for different building types, i.e. primarily virgin raw material for structural steel. (Retrieved 10 April 2026)
[17] https://www.environdec.com/library/epd305 (Retrieved 10 April 2026).
[18] s-p-04604-structural-hollow-secti.-ons.pdf (Retrieved 10 April 2026).
[19] Sustainability | Tibnor.se (Retrieved 10 April 2026).

Product type	Steel distributor	Typical value Boverket's climate database[16], A1–A3 (kg CO2-eq/kg)	Examples of GWP-GHG from the EPD, 2025, A1–A3 (kg CO_2-eq/kg)	Change (%)
made from virgin raw material	BE Group		2.63[20]-2.95[21]	
Other structural steel, particularly beams	Stena Stål	2.52	0.524[22]	70-80% lower
	Tibnor		0.425[23]	
	BE Group		0.410[24]	

Source: KTH.

Table 2 below summarises this paragraph.

Table 2 Summary of changes in the climate impact of steel products used in the Swedish construction sector, based on the section above.

Source	Summary of the change in climate impact between 2020 and 2030	Comment
EUROFER, trade association	30% reduction	2018 targets
Pada, technical expert	20% reduction	Qualified estimate
Swedish Institute of Steel Construction	No percentage estimate. EPDs already show significantly lower climate impact for many product groups.	Basis for EPD values.
		There are no statistics on the quantities used for each product group.
Toktarova, Chalmers	Approx. 25–50% reduction.	Scenarios based on planned investments, the transition of the energy system, electricity and ETS costs.

Source: KTH.

[20] EPD_BE_Group_AB_Cold_formed_structural_hollow_sections_HUB-1322_2024-04-22.pdf (Retrieved 10 April 2026).
[21] EPD_BE_Group_AB_Hot_finished_structural_hollow_sections_HUB-1323_2024-04-22.pdf (Retrieved 10 April 2026).
[22] epd-document_epd-ies-0028446_001_en.pdf (Retrieved 10 April 2026).

[23] Beams-SE-EPD-HUB-3025-2025-03-10-1-.pdf (Retrieved 10 April 2026).
[24] BEGroup_Balk_EPD_HUB-3497.pdf (Retrieved 10 April 2026).

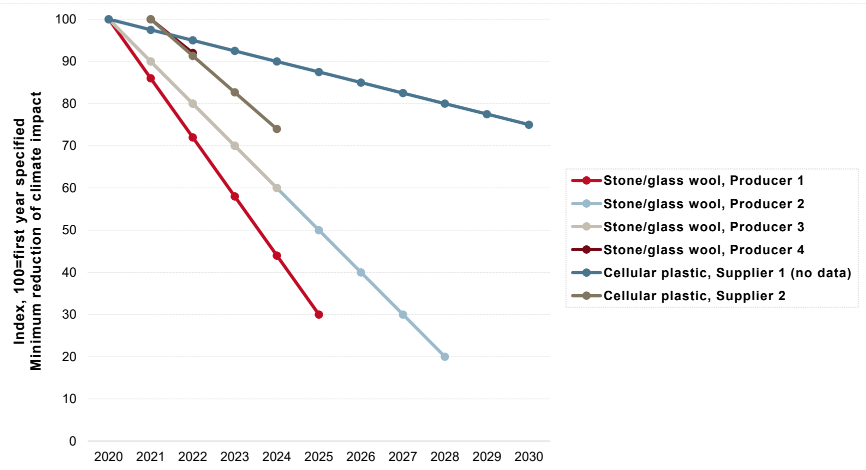
Trends in the climate impact of insulation and gypsum

In dialogue with Karlsson, she prepared a summary of implemented and planned measures for the period 2020–2030 for the largest suppliers of gypsum and insulation products to the Swedish market[25]. The summary shows that the three largest suppliers of gypsum all plan or have implemented measures resulting in a reduction in climate impact of at least 25 per cent: two between 2020 and today, and one by 2030.

The same type of review for the largest producers of insulation products, that is, implemented and planned investments, provides an indication of the climate impact of insulation products. There are measures that, within the scope of this work, have not been possible to quantify. This shall therefore be regarded as a minimum reduction from planned measures. Rock and glass wool are typically used for the insulation of roofs and walls and account for the largest share of the climate impact from insulation. Cellular plastic insulation is typically used beneath the foundation slab. The summary indicates a decrease as shown below and in Figure 3:

- Rock wool and glass wool: an annual reduction of between 8 and 14 per cent; a planned reduction of between 8 per cent (over one year) and 80 per cent (over eight years).
- Cellular plastic: annual reduction of between 3 and 9 per cent; planned reduction of between 25 per cent (over ten years; this includes measures that could not be quantified) and 26 per cent (over three years).

Figure 2. Expected climate impact reduction.



Expected reduction in the climate impact of manufacturers of insulation materials used in Sweden. Please note that the dashed lines merely illustrate the relationship between the two end points for each manufacturer; the transition takes place in stages. Source: KTH.

[25] Work material, Karlsson, Ida, Chalmers, 8 May 2025.

The shift of the energy system

For the remaining material types used in buildings, it is reasonable to assume that the overall development of the energy system across the EU Member States can be expected to be reflected in the development of greenhouse gas emissions from the production of these materials. This is because the majority of these products are imported. The EU Climate Action Progress Report 2024 (European Commission, 2024) shows how the emissions intensity of electricity generation in the EU decreased by 17 per cent from 1990 to 2020. The report also presents indicative developments up to 2030, but as these are based on management by objectives and to avoid overestimating the reduction in emissions, a lower rate of reduction than the report's indicative development is assumed. Instead, the same annual rate of reduction as that observed between 1990 and 2020 was adopted, corresponding to a total reduction of 17 per cent between 2020 and 2030. This level is consistent with the EU Prime 2020 scenarios proposed as climate improvement scenarios for the calculation of Modules B1.2–B5, B7, and C1–C4 in whole life-cycle calculations (Erlandsson et al., 2024; Görman et al., 2024).

Summary of material and energy shifts

By mapping the shift in the climate impact of the dominant materials currently used in the construction of buildings in Sweden between 2020 and 2030, it has been possible to estimate the extent of the shift in the climate impact of buildings that can be expected to have occurred, or to occur, between 2020 and 2030.

Table 3 summarises the assumptions made in the study, based on the review of developments in building materials presented in this section.

Table 3. Summary of assumptions regarding developments leading to reduced climate impact associated with building materials, 2020–2030. The assumptions have been made to avoid overestimating the reduction in climate impact during this period; i.e., they are conservative assumptions.

Type of action/Type of material	Assumptions regarding reductions between 2020 and 2030	Comment
Design choices and replacement of type of material	Not included in analysis	Not included in the analysis, but likely to offer a significant and cost-effective potential.
Optimisation, for example reduced quantities or optimisation of, for example, concrete grades	Not included in analysis	Not included in the analysis, but likely to offer a significant and cost-effective potential.
Concrete	30 % reduction	20% reduction between 2020 and 2024, probably somewhat underestimated. Estimated shift of 25–30% between 2020 and 2030.
Steel	20 % reduction	Conservative assumption of the development.

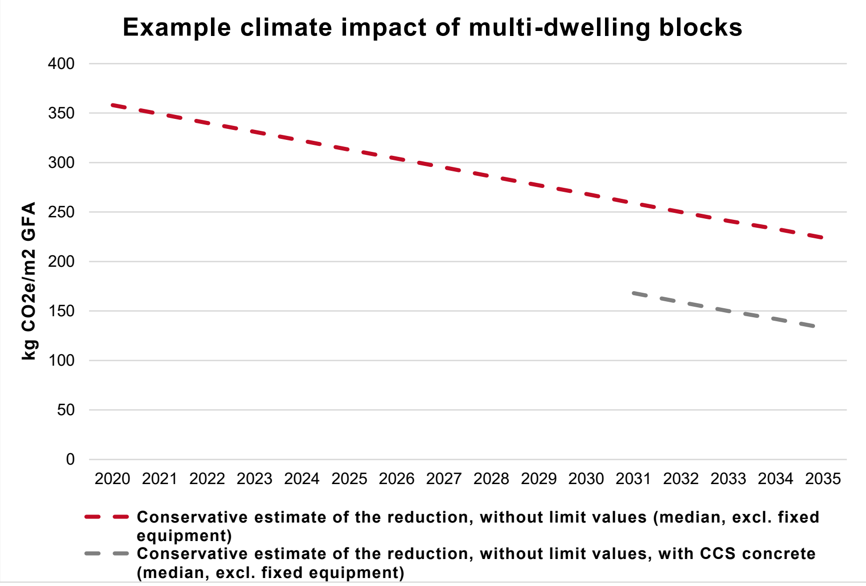
Type of action/Type of material	Assumptions regarding reductions between 2020 and 2030	Comment
Gypsum	25 % reduction	Conservative assumption of the development
Insulation	50 %	Conservative assumption of the development
Other material types, energy in Module A5, and default values for building-related fixed fittings, technical equipment and finishes (even where these are partly made up of the material listed above).	15 %	Assumed the rate of reduction in the European energy system as a conservative assumption, partly because many of these products are imported from other European countries and partly because their climate impact is often largely attributable to electricity use. Conservative assumption that the climate impact of electricity in Europe will continue to decrease at the same rate as between 1990 and 2020 (1.7% per year), rounded down here to 15% over ten years.

Source. KTH.

When these reduction levels are applied to the climate impact of the buildings included in the reference value study (Malmqvist et al., 2023), the climate impact is reduced by an average of 25 per cent, with very little variation between building types (24–26 per cent) or between individual buildings (21–28 per cent). In this study, a conservative assumption has therefore been made that the climate impact of buildings will be reduced by 25 per cent between 2020 and 2030. This is likely to be an underestimate, as work on material selection and material optimisation is already taking place and will continue during the design and construction of buildings, which has not been taken into account in this assumption.

This assumption may be applied until 2030. Developments between 2030 and 2035 will be heavily influenced by the possible introduction of CCS cement, with production in Slite. Figure 4 schematically illustrates this development for the construction of a multi-dwelling block at different points in time going forward.

Figure 3. Conservatively assumed development of the climate impact of materials and energy between 2020 and 2035, illustrated using the climate impact of the median multi-dwelling block from Malmqvist et al. (2023).



Source: KTH.

Parallel to the work of this study, Ida Karlsson[26], a researcher at Chalmers University of Technology focusing on the transition towards net-zero climate impact for buildings and infrastructure in Sweden, has studied the targets set by construction stakeholders. Her published research shows very substantial reductions as soon as by 2030, see Boverket (2023). Inspired by a question raised by the investigators in this work, she has also analysed the transition for different building materials in the same way as this study and reaches very similar conclusions. When the buildings included in the reference value study are calculated using the same methodology as above, i.e., assumptions regarding emission reductions for different types of materials, these estimates produce the same reduction, namely an average reduction of 25 per cent by 2030 (see Table 4).

Table 4. Assumptions regarding emission reductions from construction up to 2030 by Ida Karlsson, compared with the assumptions made in this study.

Type of action/Type of material	Karlsson's estimated average emission reduction at the national level, 2020–2030	Reduction between 2020 and 2030 assumed in this study
Design choices and replacement of type of material	Not included in analysis	Not included in analysis
Optimisation of, for example, reduced quantities or optimisation of, for example, concrete grades	Not included in analysis	Not included in analysis
Concrete	30 %	30 % reduction
Steel	30 %	20 % reduction

[26] Presentation and personal communication 23 June 2025, Ida Karlsson, Chalmers.

Type of action/Type of material	Karlsson's estimated average emission reduction at the national level, 2020–2030	Reduction between 2020 and 2030 assumed in this study
Gypsum	40 %	25 % reduction
Insulation	40 %	50 %
Other material types, energy in A5, and default values for building-related fixed fittings and technical equipement and finishes (even where these are partly made up of the material listed above).	Not included in analysis	15 %

Source: KTH.

Cost effect of reduced climate impact

The costs associated with introducing the life-cycle GWP requirements under the EPBD can be divided into costs that are *not* affected by the level of the limit value and costs that are affected by the level of the limit value (see Table 5).

The costs that vary according to the level of the limit value are primarily the costs of materials and climate optimisation measures, as well as any additional need for climate calculations. The following sections provide information on the three aspects affected by the level of the limit value, together with information on the current costs of projects with ambitious climate objectives.

Table 5. Costs affected and not affected, respectively, by the level of limit values.

Not affected by the level of the limit value	Affected by the level of the limit value
• Information management for completed buildings • Climate calculation for a finished building	• Material costs • Design for reduced climate impact • Any additional climate calculations

Source: KTH.

Boverket's Report 2023:30 included a socioeconomic impact assessment of the costs that could arise from introducing requirements for the calculation of an entire life cycle and limit values for maximum climate impact. No cost analysis was carried out of the cost implications of different limit value levels. The calculation also assumed that limit values would be introduced in 2025, three years after the introduction of the requirement for climate declarations and the requirement for an expanded calculation in 2027. Most of the stakeholders who responded that costs could increase pointed to costs associated with information management, climate calculations and design costs. This means that the stakeholders did not regard the cost of materials as a major cost item in this proposal.

No cost analysis was carried out for the proposals in the report on the assumption that they would instead be introduced in 2030. However, it is reasonable to assume that, after eight years under the climate declaration framework, the challenges associated with information flows and knowledge of climate impact would be considerably less than after three years, if not non-existent.

It is difficult to draw conclusions about any impact on material costs on the basis of the analysis carried out in Boverket's Report 2023:20. This is partly because different limit value levels are proposed and partly because the timing of their introduction differs.

Current costs of completed/ongoing projects with ambitious climate objectives

This section describes the current costs associated with projects with ambitious climate objectives. These costs should not be regarded as indicative of the costs in 2030, but they may serve as a likely, albeit substantially overestimated, upper limit for the costs associated with the climate performance achieved by the projects, as these additional costs are expected to decrease, if not disappear entirely.

Framtiden Byggutveckling in Gothenburg has developed *Kvarteret Omställningen*, with a timber frame and construction starting in 2023, subject to a requirement that the climate impact not exceed 200 kg CO_2-eq/m² GFA (system boundary in accordance with the proposal in Boverket's Report 2023:20), and *Kvarteret Återbruket*, with construction starting in 2024, subject to a requirement that 50 per cent of the building by weight consist of reused materials, which corresponds in principle to 200 kg CO_2-eq/m² GFA (same system boundary). The indicated additional cost attributable to these climate requirements is approximately 5 per cent for Kv. Omställningen and 6 per cent for Kv. Återbruket, respectively, for each construction contract[27].

In Uppsala, the multi-dwelling project *Takryttaren* is under construction, with an estimated climate impact of just under 200 kg CO_2eq/m² GFA (system boundary for building elements in accordance with the proposed limit values in Boverket's Report 2023:20)[28]. This project does not entail any additional costs compared with an Uppsalahem project without climate requirements[29].

Castellum has worked on a number of projects requiring reduction of climate impact. Maria Perzon, Group Sustainability Manager, comments as

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[27] Mattias Ström, Framtiden Byggutveckling, personal communication, 29 April 2025.
[28] Documentation: NCC's climate webinar, 9 April 2025. From Anna Sporre, NCC.
[29] Personal communication, Åsa Pallin, sustainability specialist, Uppsalahem. 16 May 2025.

follows: "Our experience from projects such as Effekten 13, Korsningen, and Amperen shows that it is entirely possible to achieve a 30–50 per cent lower climate impact without increasing costs."[30]. This statement refers to completed projects. Any additional costs associated with reduced climate impact are expected to decrease, or be eliminated altogether, by 2030.

Estimated costs of reducing climate impact in 2030, dialogue with industry stakeholders

Several contractors[31] consider that a 35 per cent reduction in climate impact compared with the 2020 reference values could be cost neutral by 2030, confirming the picture that emerged from the early industry dialogues conducted as part of this study. At the same time, some respondents consider it difficult to provide price estimates for 2030 owing to the uncertain global situation, including tariff wars. It should also be noted that awareness of the potential impact of the EU ETS on prices is generally low among those consulted, meaning that this aspect has probably not been fully taken into account in these considerations.

Cost impact of the EU ETS

The EU Emissions Trading Scheme was tightened in 2023[32]. Different forecasts exist regarding the cost impact of these changes, but costs are generally expected to increase. However, the range of this cost increase varies, see Table 6 for expected price levels according to two cost forecasts. An analysis of the cost impact of emissions allowances has been carried out for construction materials without climate improvements and one or more levels of materials with lower climate impact (Borgström et al., 2025).

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[30] Article SGBC. https://www.sgbc.se/nyheter/castellum-nollco2-ar-ett-viktigt-verktyg-i-var-klimatstrategi/. Retrieved 2 July 2025.

[31] Ludvig Dahlqvist, Sustainability Specialist, Technology and Sustainability, NCC, personal communication 22 April 2025; Johan Hammar, Sustainability Specialist, JM, personal communication 22 April 2025.

[32] https://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:32023L0959. Retrieved 10 April 2026.

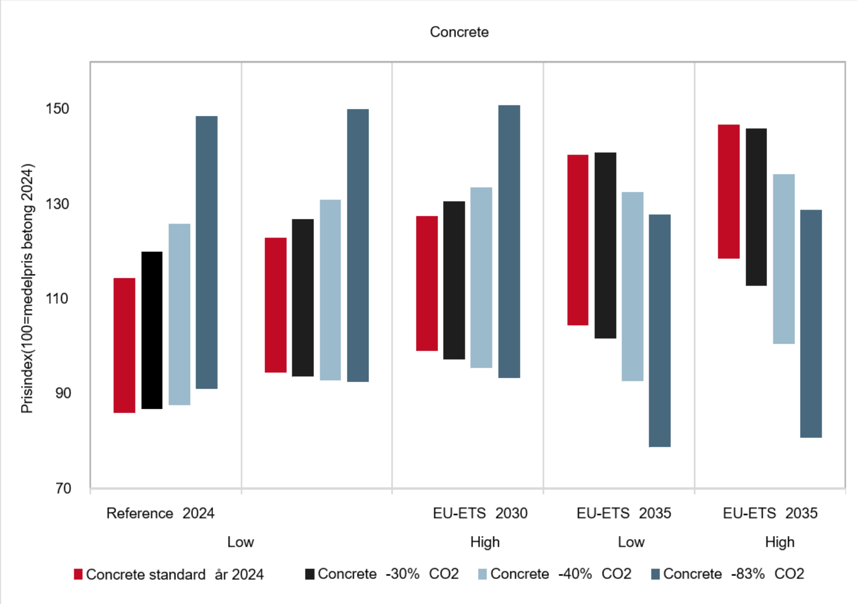
Table 6. Estimated future costs of emission allowances under the EU ETS.

Emissions allowance levels under EU ETS I and II (€/tonne CO_2)	**EU-ETS I 2030**	**EU-ETS I 2035**	**EU-ETS II 2030**	**EU-ETS II 2035**
European Commission (EU ETS low in the figure below)	€95	€100–140	€69	€140
Bloomberg NEF (EU ETS high in the figure below)	€145	€175	€149	€80

Estimates of future costs of emission allowances under the EU's original emissions trading system for power generation and emission-intensive industry (EU ETS I), and under the forthcoming emissions trading system for fuel use in road transport, machinery, buildings and small-scale industry (EU ETS II). Source: Klimatkrav för byggnader - på väg mot netto noll. [Climate requirements for buildings – moving towards net zero.] SBUF project no. 14381.

Although there is considerable uncertainty, there is a clear trend towards reduced additional costs between climate-improved materials, with reductions in climate impact of up to 50 per cent, compared to standard products by 2030. By 2035, the standard products have higher costs. Figure 5 includes one of the material groups analysed, concrete, as an example (Borgström et al., 2025).

Figure 4. Indicative cost development for concrete products with different climate impacts.



Indicative cost development for concrete products with different levels of climate impact, ranging from concrete products representing the 2024 standard (in accordance with Svensk Betong's guidance) to products with up to 83 per cent lower carbon dioxide emissions. The analysis is based on average prices for typical products and compares how these could be affected by potential emissions allowance levels under the EU ETS in 2030 and 2035, taking into account the phasing out of free allowances. Source: Figure from Borgström et al. (2025).

The trend for the other two materials analysed (reinforcement and structural steel) also indicates that the cost of materials with a medium level of climate impact reduction (33–67 per cent) will be lower than that of today's standard products by 2035, and that the cost differences will decrease by 2030. For these products, the analysis shows that there is still a price premium for products with a very high reduction in climate impact (80–90 per cent reduction).

A corresponding analysis has been carried out for transport fuels, comparing fossil diesel with HVO100. Under the lower emissions allowance price scenario, the price premium for HVO100 has almost, but not entirely, disappeared by 2030, whereas under the higher price scenario, the cost of HVO100 is significantly lower in both 2030 and 2035 (Borgström et al., 2025).

Cost of design for reduced climate impact and any additional climate calculations

There is relatively little information available on the additional effort required to design for reduced climate impact. In a pioneering project (*Takryttaren*, achieving approximately a 50 per cent reduction in climate impact), the contractor estimated the additional time required during the early design stages at approximately 100 hours[33]. It is likely that climate optimisation in pioneering projects today is more time-consuming than it will be in projects required to comply with a limit value in 2030, when data management is more automated, standard construction methods have been adapted to reflect the climate requirements, and the level of knowledge is higher. Accordingly, this time estimate can probably be regarded as an upper limit on the effort required to comply with the limit values.

The cost of any additional climate calculations carried out during the early stages is expected to be lower than the cost of preparing a climate declaration, as efficiency gains can be achieved when more than one calculation is carried out within the same building project, and the requirements for the level of detail and verification are less stringent. The cost of climate calculations depends to a large extent on the degree to which information flows are automated and the compatibility of information exchanged between different systems.

At present, completing a climate calculation takes between 1 and 100 hours, including the work involved in compiling the input data. The lower values apply to organisations, including the larger contractors, that have integrated the climate calculations into their other systems. Considerable efforts are currently being made to streamline and standardise these processes, and by 2030 it can be assumed that the effort required to carry out the calculations will have decreased significantly. Where multiple calculations are carried out within the same project, the time decreases significantly.

One work that will facilitate compliance, particularly for small and medium-sized enterprises, is the work being carried out by the building-material trade and other suppliers of construction products, where the quantities and products purchased for a project will be delivered in a standardised format, ready for import into the LCA software.

Cost of materials for reducing climate impact

Three factors influence the cost of materials in a building project that aims to reduce climate impact.

- **Choice of products**. This measure can either reduce or increase costs.
- **Optimisation of quantities**. This can be achieved by reviewing requirements (for example, whether the entire building must meet the same acoustic requirements), reviewing dimensions and minimising waste (often between 5 and 15 per cent of the quantities purchased today). This generally results in lower costs. It is not uncommon for

[33] Documentation: NCC's climate webinar, 9 April 2025. From Anna Sporre, NCC.

there to be an optimisation potential of 5–10 per cent of the quantities in a building. Note that this, until this becomes standard practice, requires slightly greater resources for design or investigation. In this context, it should also be noted that a number of other factors affect the cost of building materials, which has increased sharply in recent years. This creates a strong economic incentive to work more on optimising quantities.

- **Selection of climate-improved products** that otherwise have the same properties. At present, this results in somewhat higher costs, although whether this will still be the case in 2030 remains uncertain.

For projects with a moderate level of ambition in climate optimisation, material costs can often decrease as optimisation leads to lower costs. In projects with significantly higher climate ambitions than the rest of the industry, there is currently a price premium for products with lower climate impact, which is today only partly offset by the optimisation of quantities. The position in 2030 is highly uncertain, but it is likely that the EU ETS will reduce these differences or, in some cases, eliminate them altogether by 2030. By 2035, price developments are expected to shift further in favour of products with lower climate impact, possibly with the exception of those achieving the highest reductions in climate impact (in the order of an 80 per cent reduction).

Summary of the costs of reducing climate impact

Many of the costs identified by stakeholders are associated with the climate impact declaration itself (see Table 7).

Table 1. Repetition of the categories of costs associated with the introduction of limit values and requirements for the disclosure of life-cycle GWP.

Not affected by the level of the limit value	Affected by the level of the limit value
Information management Climate calculations	Material costs Design for reduced climate impact Any additional climate calculations

Source: KTH.

The remaining costs, which are affected by the level of the limit value, can be summarised as follows:

- Material costs. Probably the most significant impact.
  - Cost per unit. The EU Emissions Trading System is likely to eliminate the price premium for materials with lower climate impact (with the exception of pioneering products, achieving reductions in climate impact of around 80 per cent) by 2030, and no later than by 2035.
  - Quantity to be purchased. The potential for optimising quantities is likely considerable, both through reducing waste and by

reducing the quantities required for the building itself. Projects already working in this way often achieve reductions of between 5 and 10 per cent.

- Design for reduced climate impact
    - Can, to some extent, be regarded as a transition cost. Likely to require an effort when the limit values are introduced, which can be expected to be somewhat greater in the case of higher reduction requirements. This effort can be expected to decrease as new solutions with lower climate impact become standard practice.
- Any additional climate calculations
    - To ensure that a certain level of climate performance (a limit value) is achieved, either experience from previous projects or climate calculations carried out during the course of the project are required. The more ambitious the climate objectives, the more work this is likely to entail. Through the same measures that reduce the administrative burden associated with climate declarations (efficient, automated and interconnected information flows), this impact can be expected to decrease progressively. The earlier the requirements for the disclosure of life-cycle GWP are introduced, the smaller this item is likely to be when the limit values are introduced, owing to the longer transition period.

Annex 2 – Review of classification of building types

Table 2. Review of classification of building types

Building type in Boverket 2023:20	Consultation responses to Boverket 2023:20, and other input relating to increased knowledge	Proposed categorisation in the energy performance requirements	Building categories in the Nordic countries
Single-family houses	Smaller single-family houses have more difficulty meeting a limit value. Single-family houses with bricks or render have greater difficulty complying with the limit values.	One-and two-dwelling buildings: Net heated area <90	*Finland* Limit values are proposed for terraced houses, but not for single-family or two-family houses. *Denmark* Single-family houses, terraced houses, micro-houses (tiny houses), and holiday homes, both above and below 150 m².
		One-and two-dwelling buildings: 90 ≤ Net heated area <130	
		One-and two-dwelling buildings: 130 ≤ Net heated area	
Multi-dwelling blocks		Multi-dwelling blocks	*Finland* Multi-storey residential buildings *Denmark* Apartment buildings
Office buildings		Offices	*Finland* Office buildings and health centres *Denmark* Office buildings
Education facilities	Consultation responses indicating that the reference value for preschool buildings is consistently lower than the respondents' own calculations.	Education	*Finland* Educational buildings and daycare centres *Denmark* Institutions
Special housing		Other energy-consuming buildings and Accommodation and restaurants	*Finland* Accommodation buildings, hotels, boarding houses, sheltered housing, residential homes for the elderly and care facilities *Denmark* Other buildings

Building type in Boverket 2023:20	Consultation responses to Boverket 2023:20, and other input relating to increased knowledge	Proposed categorisation in the energy performance requirements	Building categories in the Nordic countries
Group 2, Other buildings		Trade and culture	*Finland* Commercial buildings, department stores, shopping centres, retail buildings, shopping arcades, theatres, opera houses, concert and congress halls, cinemas, libraries, archives, museums, art galleries and exhibition halls *Denmark* Other buildings
Group 2, Other buildings		Hospitals	*Finland* Hospitals *Denmark* Hospitals excluded
Group 2, Other buildings	Industrial buildings for logistics and trade were intended to be included in the reference value study, but could not be included due to insufficient data. The climate impact of industrial buildings for logistics and trade is significantly lower than the proposed limit value for 'Other buildings' in Boverket 2023:20.	Sports	*Finland* Warehouses, traffic buildings, swimming pools and ice rinks with a net heated area exceeding 1,000 square metres, Sports halls *Denmark* Other buildings
		Other energy-consuming buildings	*Finland* Warehouses, traffic buildings, swimming pools and ice rinks with a net heated area exceeding 1,000 square metres *Denmark* Other buildings

Source: KTH.

Annex 3 – Review and update of reference values

Introduction

The proposed limit values in Boverket's Report 2023:20 were based on the reference values that Boverket developed for different building types, initially in 2021 and subsequently updated on two occasions[34] following the emergence of new knowledge. Knowledge has also increased for other building types. One example is special housing, which was added as a new building type in Boverket's Report 2023:20. As the development of climate calculations for buildings has progressed very rapidly in recent years, this study has provided an opportunity to review and supplement the knowledge base on reference values for different building types. This annex presents this review and the updated reference values in greater detail, corresponding to the classification of building types proposed in Section 6.2. In addition, it describes the work undertaken to develop proposed reference values to serve as the basis for limit values for buildings with specific climate-driving conditions, which is new for this study.

Although Boverket's Climate Declaration Register already contains a reasonably large number of declarations, the assessment has been that the quality of the declarations submitted to date has been limited. Consequently, the updated reference values have not been developed on the basis of those data.

Summary of the updated reference values serving as starting points for the limit values

Table 9 summarises the reference values that are to serve as the baseline values for establishing the limit values in accordance with the methodology proposed in Chapter 6.3 of the report. The table also describes the proposed methodology for establishing the 2030 limit value level in the same section. Please note that the climate impact of fixed equipment has been deducted from the values shown in the table, which means that they differ from the levels found in Malmqvist et al. (2023) and Boverket (2023). The following sections provide a more detailed account of how the updated reference values in the table have been developed.

[34] The latest version is: Malmqvist, T., Borgström, S., Brismark, J. and Erlandsson, M., *Referensvärden för klimatpåverkan vid uppförande av byggnader* [Reference Values for the Climate Impact of Building Construction], Version 3, 2023. https://kth.diva-portal.org/smash/get/diva2:1812831/FULLTEXT01.pdf. Retrieved 10 April 2025.

Table 3. Updated reference values for the proposed classification of building types set out in Section 6.2, serving as the basis for establishing differentiated 2030 limit values for the various building types described in Section 6.3.

Building types	Reference value (kg CO_2eq/m² GFA)	Basis for the reference value
Group 1		
Single-family houses larger than 130 m² net heated area	171	The reference value study: single-family houses (75th percentile).
Single-family houses smaller than 130 m² net heated area	196	The reference value study: single-family houses (75th percentile) + supplement 25 kg CO_2eq/m² GFA.
Multi-dwelling blocks	358	The reference value study, multi-dwelling blocks, median.
Office buildings	383	The reference value study, office buildings, median.
Primary care buildings	383	Assumption that the reference value is the same as for office buildings.
Preschool buildings	384	Updated reference values in this study, median.
School and university buildings (excluding (laboratory activities)	382	Updated reference value in this study for school buildings, median.
Special housing	364	According to Boverket 2023:20, median.
Accommodation buildings	364	Assumption that the reference value is the same as for special housing.
Industrial buildings for logistics and trade exceeding 1,000 m² GFA	291	New reference value in this study: the median.
Group 2 – Other building types, excluding buildings in Group 3	449	Other buildings: to be dealt with in accordance with Boverket 2023:30. Highest 75th percentile among the building types in Group 1.
Group 3 Buildings with specific, climate-driving conditions		New reference values in this study, based on a few calculations and qualitative reasoning.

Building types	**Reference value (kg CO_2eq/m² GFA)**	**Basis for the reference value**
Buildings subject to planning provisions that significantly increase climate impact	A supplement of 30 to the reference value for the building type, in Group 1 or 2.	Supplement based on the mean value from façades in the reference value study
Buildings with critical socie-tal functions and high secu-rity requirements	625	A new figure in this study, based on a climate calculation of a building with very high safety requirements.
Swimming pools	700	New value in this study, based on three climate calculations, including very conservative values for fixed fittingsand technical equipment (mean),
Buildings with exceptionally high ceiling heights and long spans	775	New value in this study, based on a climate calculation for an arena un-der a non-climate-improved sce-nario.
Buildings constructed on deck structures or predomi-nantly below ground	A supplement of 100 to the reference value for the building type in Group 1 or 2.	Supplement based on a qualified, conservative estimate.
Shelters	800–1100	New value in this study, based on a climate calculation and sensitivity analysis.

Source: KTH.

Preschool, school and university buildings

One of the consultation responses to Boverket’s Report 2023:20 pointed out that the published reference values for preschool buildings are signifi-cantly lower than the respondent’s own calculations. As several of the da-tasets used in the reference value study originated from this stakeholder, a further investigation was carried out in which climate impact data for ad-ditional preschools was collected. The organisations in the major metro-politan areas responsible for the construction of preschools were asked about completed calculations. Climate calculations for ten preschools that were not included in the reference value study (Malmqvist et al., 2023) were obtained. In addition, updated calculations were obtained for six of the 14 preschools included in the reference value study. As part of this work, two additional calculations for schools were also obtained. Table 10 summarises the calculation base relating to preschool and school buildings.

Table 4. Description of the data underlying the previous and updated versions of the reference values for the climate impact of preschool and school buildings.

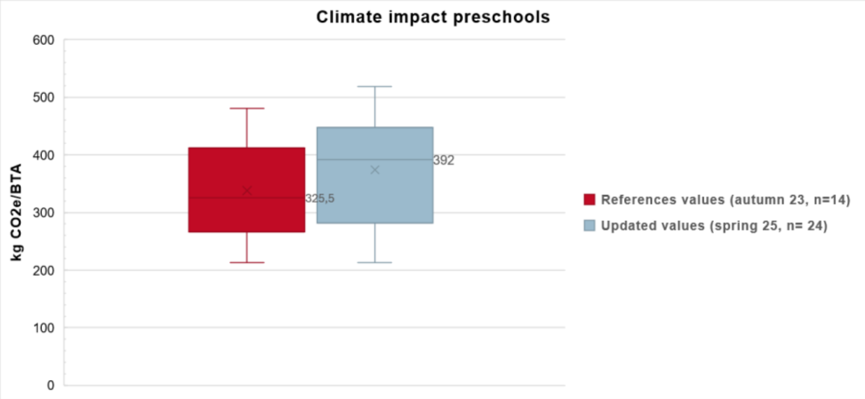
Climate impact	Quantity	Source of climate impact
Original climate impact values for preschools in the reference value study (Malmqvist et al., 2023).	8	Calculation carried out as part of the reference value study.
Updated climate impact values for preschools included in the reference value study.	6	Climate impact value obtained.
New values for climate impact of preschools.	10	Climate impact value obtained.
Original climate impact values for schools in the reference value study.	9	Calculation carried out as part of the reference value study.
New values for climate impact of schools.	2	Climate impact value obtained.

Source: KTH

A comparison was made between the previous dataset (the published values from the reference value study) and the new dataset for preschool buildings (see Figure 6). The median value for the previous dataset was 326 kg CO_2eq/m² GFA, while the median value for the new dataset is 391 kg CO_2eq/m² GFA.

The updated calculations for the buildings included in the reference value study showed an increase in climate impact of between 4 and 7 per cent, with the exception of one calculation, which showed a 17 per cent lower climate impact. This calculation relates to a pilot project in which considerable efforts were made to reduce climate impact and is therefore not considered to be as representative of current construction in Sweden. This building does not affect the reference value, which is based on the median.

Figure 5. Climate impact of preschool buildings, proposed system boundary for the 2030 limit value (building element 2–8). Comparison between the reference value study and the updated dataset (spring 2025).



Source: KTH.

As a result of the revised median value for preschool buildings, the median values for schools and preschools were very similar. It was thus considered whether to merge schools and preschools into a single category, education facilities. Accordingly, updated reference values were developed for schools and preschools, as well as a common reference value for education facilities. The resulting reference values are presented in Table 11.

Table 5. Updated median values and 75th percentile values for preschools and schools and all education facilities.

	Education facilities	Preschools	Schools
Median	391	391	384
75th percentile	445	449	419
Number of buildings included in the calculation (n=X)	35	24	11

Source: KTH.

Industrial buildings for logistics and trade

When the reference value study was carried out, the objective was to develop reference values for industrial buildings for logistics and trade, as this is a relatively common building type in construction in Sweden today. However, it was not possible to obtain a sufficient number of robust calculation bases to develop reference values. During the present investigation, additional completed calculations have, however, been obtained.

These calculations show substantial differences between different types of industrial buildings for logistics and trade, and there is no uniform definition of what constitutes an industrial building for logistics and trade. The limited number of calculations available for sports halls, for example, show significantly higher climate impact than warehouses. Consequently, this work has been limited to examining the possibility of developing a reference value for warehouse and commercial buildings, considered equivalent in terms of design. In addition, a delimitation in size, a minimum of 1,000 m^2 GFA, has been chosen to ensure that no delimitation issues arise for smaller warehouse and commercial buildings, which often have a different structure.

These show that the climate impact of industrial buildings for logistics and trade is significantly lower than the proposed reference value and limit value for Group 2, ‘other buildings’, in Boverket (2023). It was therefore considered a priority to develop reference values for this building type.

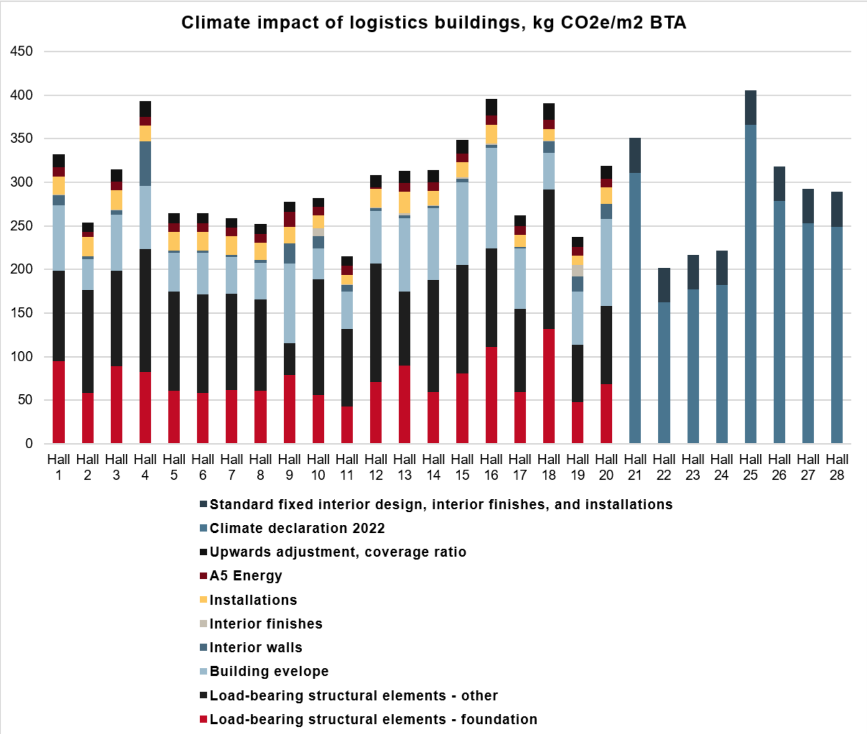
There is no building type in either Boverket’s Purpose Catalogue or the energy performance requirements that corresponds to the concept of industrial buildings for logistics and trade. Going forward, industrial buildings for logistics and trade are defined as “industrial buildings, for example for logistics, warehousing or trade, with an area exceeding 1,000 m^2 GFA”. This excludes smaller buildings (and therefore buildings with lower climate impact), as well as parts of buildings, used for these purposes. Please note that this definition applies only to industrial buildings for logistics and trade heated to at least 10°C and therefore subject to the requirement for an energy performance certificate.

Climate data were obtained from developers, contractors and the LCA software company Plant, covering 28 non-climate-optimised industrial buildings used for warehousing, all with a gross floor area exceeding 1,000 m^2. The climate data used consist predominantly of typical (i.e. non-conservative) data from Boverket’s climate database, although product-specific climate data from EPDs are also used. As they are not climate-optimised and there has been very little change in the generic climate data, these calculations can be assumed to be representative of the climate impact associated with the construction of buildings in 2020. The buildings originate from at least seven different stakeholders, and were carried out at the construction documentation stage or later. The climate impact of the buildings is presented in Figure 7. For all buildings, the climate impact has been calculated specifically for the building elements included within the system boundary of the current climate declaration. In most cases, however, the climate impact associated with fixed fittings, finishes, technical equipment and A5 Energy consist of default values.

Where the climate impact of finishes, fixed fittings and technical equipment is not specified, a conservative supplement of 40 kg CO_2eq/m^2 GFA has been applied. This is likely a considerable overestimate. The buildings delivered with the stated climate impact for the above-mentioned building elements have been based on the default values for multi-dwelling blocks found in the reference value report and subsequently adapted, using assumptions, to correspond to warehouse buildings. In these cases, the climate impact of the above elements averages 20 kg CO_2eq/m² GFA. The climate impact associated with fixed fittings, finishes and technical equipment is therefore not based on robust underlying data, but can probably be regarded as highly conservative. Fixed fittings, such as warehouse shelving systems, were not included in the calculations and are also excluded from the proposed system boundary for limit values.

The climate impact for Module A5 (Energy) is, in most cases, derived from the default value used in the reference value report for buildings with a high degree of prefabrication. In cases where the climate impact has been calculated using measured data, it corresponds to 10–60 per cent of the aforementioned default value. This indicates that the default value for Module A5 (Energy) most likely also represents a considerable overestimation of the climate impact for this building type.

Figure 6. Climate impact of industrial buildings for logistics and trade. It should be noted that default values have been used for the buildings that were calculated in accordance with the scope of the climate declaration.



Source: KTH.

Based on the above calculations, the median climate impact for industrial buildings for logistics and trade is therefore 291 kg CO_2eq/m² GFA, and the 75th percentile is 330 kg CO_2eq/m² GFA.

Single-family houses

During the consultation on Boverket's Report 2023:20, several responses were received concerning single-family houses, and these issues have therefore been examined in greater detail. They concern the following:

- Smaller single-family houses may have more difficulty meeting the limit values. This also applies to single-family houses with two smaller residential units.
- Single-family houses with brick or rendered façades face greater challenges in complying with the limit values, as brick and rendered façades increase the climate impact of single-family houses significantly compared with timber façades. Comments have also been received suggesting that this could result in sub-optimisation, as timber façades have a shorter service life than brick or rendered façades.

With regard to the size of single-family houses, climate-driving elements such as kitchens and bathrooms account for a relatively similar climate impact regardless of the size of the building. Rooms such as living rooms and bedrooms have a considerably lower climate impact per square metre. The façade area per square metre of GFA is also relatively greater for a smaller single-family house. As a result, a smaller single-family house with the same technical solutions as a larger one will have a higher climate impact when expressed per square metre of GFA, even though its total climate impact will be lower. A limit value that does not take the size of the building into account may therefore inhibit the construction of smaller single-family houses.

The reference value study includes three single-family houses with a net heated area of less than 130 square metres, which is too small a sample to draw conclusions from. However, these three buildings have a climate impact per m² of GFA that is approximately 10 per cent higher than that of other single-family houses, although these results must be interpreted with caution.

A brick or rendered façade in a traditional design normally has a higher climate impact than a timber facade. No single-family houses with brick or rendered façades were included in the reference value study. Table 12 presents a comparison of a number of climate calculations for brick or rendered façades and timber façades. As shown in the table, there is a relatively large difference in climate impact between single-family houses with brick façades and those with timber façades.

Table 6. Difference in climate impact of façades for single-family houses compared with a single-family house with a timber façade

Calculation	Brick facade, difference in climate impact compared to timber facade [kg CO_2eq/m² GFA]	Rendered façade, difference in climate impact compared to timber façade [kg CO_2eq/m² GFA]	Source
Single-storey terraced houses	59	Less than half the climate impact	OBOS

Calculation	Brick facade, difference in climate impact compared to timber facade [kg CO_2eq/m² GFA]	Rendered façade, difference in climate impact compared to timber façade [kg CO_2eq/m² GFA]	Source
Two-storey terraced houses	39	compared to brick.	OBOS[35]
Detached house, two storeys	48		WSP
Terraced houses, two storeys	21		WSP

Source: KTH.

Deductions for operational technical equipment

The limit values proposed in Boverket's Report 2023:20 are based on reference values that include fixed equipment in the buildings, referring to white goods such as cookers, ovens, washing machines, tumble dryers, microwave ovens, etc. The same report also proposed excluding fixed equipment from the system boundary for the climate declaration and the limit values, inter alia to achieve better alignment with similar regulatory frameworks in other European countries. An adjustment of previously developed reference values has thus been made as part of this study to reflect climate impacts excluding such activity-related technical equipment. This also better reflects the proposed new system boundary for the calculation of life-cycle GWP and limit value, under which activity-related technical equipment shall be excluded. This has been achieved by removing the default value for white goods (building element 76, SBEF, in accordance with Annex 4 to the reference value study[36]). As the default value is expressed in net heated area, the average ratio between net heated area and GFA for the buildings within each building type has been used to calculate the deduction for activity-related technical equipment ('fixed equipment') for each building type, as summarised in Table 13.

[35] Personal communication with Carl-Johan Sigfridsson, OBOS, 10 March 2025 and 17 March 2025.
[36] https://kth.diva-portal.org/smash/get/diva2:1812831/FULLTEXT01.pdf. Retrieved 10 April 2026.

Table 7. Climate impact of fixed equipment, by building type.

Building type	kg CO_2eq/m² Net heated area	Net heated area/GFA ratio (mean for the building type)	kg CO_2eq/m² GFA	Comment
Multi-dwelling blocks	8.1	0.898165	7.3	
Preschools	7.6	0.89965	6.8	
Offices	0.35	0.918058	0.3	
Schools	1.7	0.93246	1.6	
Single-family houses	7.1	0.812628	5.8	
Special housing	12	0.898165	10.8	
Other buildings	-	-	0.3	Conservative assumption that minimum values for the above building types are used.

Source: KTH.

Buildings and building types with specific, climate-driving conditions

At the hearing held in August 2025, only the proposed limit values for Group 1 and Group 2, without the possibility of exemptions, were discussed. The subsequent questionnaire asked respondents whether they were aware of any building types or circumstances that could make it particularly difficult for buildings to comply with the proposed limit values. This resulted in the summary shown in Table 14. The table also includes comments on how the different categories have been addressed in this study.

Table 8. Comments concerning building types and building-specific conditions that may have difficulty complying with the proposed limit values, received during the hearing.

Building type	Comments (including from the hearing)	Approach taken in this report
Arenas	Should have its own category.	Assessed and limit value proposed in this study.
Indoor swimming pools	Very high climate impact. Should have its own category.	Assessed and limit value proposed in this study.

Building type	Comments (including from the hearing)	Approach taken in this report
Sports halls	Not comparable with other industrial buildings. Should have its own category.	Isolated available calculations indicates that the climate impact is not higher than the reference value for "Group 2, Other Buildings". They are therefore proposed to remain in Group 2.
Education facilities	Should be separated, as they have different conditions. This is a frequent comment.	Suggested to be divided into two categories, preschools and other education facilities.
Industrial buildings for logistics and trade	Good to have a category for these. Should it be defined as 'uninsulated industrial buildings for logistics and trade'? Insulated industrial buildings have a significantly higher climate impact. The treatment of any overhead crane runways should be considered.	It is clarified that the category refers to industrial buildings for logistics and trade with an area exceeding 1,000 m² GFA.
Laboratory facilities	Has a high climate impact and should not be included in 'education facilities'. Special requirements, for example for vibration-sensitive equipment.	Examined. However, as activity-related equipment is not included in the limit value and generally represents only a minor part of a building, no separate limit value is proposed.
Buildings with high security requirements, e.g. prisons, remand prisons and other security buildings, such as police stations and courthouses.	Unlikely to meet the requirements for 'Group 2, Other buildings'. The requirements placed on this type of building mean that material consumption is high, while the possibilities of replacing materials are limited.	Assessed and limit value proposed in this study.
Areas exposed to noise.	Makes it difficult to meet the limit values.	Assessed and supplement to limit value proposed in this study.
Buildings in areas with transport of dangerous goods.	Makes it difficult to meet the limit values.	Assessed and supplement to limit value proposed in this study.

Building type	Comments (including from the hearing)	Approach taken in this report
Certain hospitals.	May not meet limit value in “Group 2 other buildings”.	Isolated available calculations indicate that the climate impact is not higher than the reference value for “Group 2, Other Buildings”. They are therefore proposed to remain in this category. Activity-related equipment is not included in the limit value.
Ground conditions requiring substantial weight.	Where the building requires substantial weight to prevent flotation, particularly in northern Sweden, where the season for casting with climate-improved concrete is short.	Not investigated. This type of buildings should be subject to the same requirements as others.
One-off buildings.	With very high architectural requirements, landmarks.	Not investigated. This type of building should be subject to the same requirements as other buildings, with the exception of buildings with large spans and storey heights.
Very tall buildings.	In the reference value study, the tallest building is 20 storeys. Example: Karlatornet in Gothenburg (74 storeys). This project used different levels of climate-improved concrete, and the rough calculation indicates that the concrete alone has a climate impact of approximately 250 kg CO_2eq/m² GFA (excluding the foundation). Had climate-improved concrete not been used, the figure would have been approximately 50 kg CO_2eq/m² GFA higher.	Not investigated. This type of buildings should be subject to the same requirements as others.
Buildings associated with total defence.		Not subject to climate declaration requirements.

Building type	Comments (including from the hearing)	Approach taken in this report
Buildings constructed over deck structures and buildings associated with public transport infrastructure, such as railway stations.	Proposal to have a supplement of x kg CO_2-eq/bottom surface In metropolitan areas, buildings are being constructed above tunnels, which limits the structural solutions that can be used and increases the climate impact of the storeys closest to the tunnel. At this level, the structure is more akin to a bridge structure, as all loads must be transferred to the tunnel walls. Buildings constructed in these locations are often relatively tall, which means that the climate impact per GFA is not affected to the same extent. Lower-rise buildings constructed above a tunnel could, however, face significant challenges in complying with a limit value.	Assessed and supplement to limit value proposed in this study.
Buildings subject to minor amendments to a previously granted building permit.		No separate treatment considered necessary, according to Boverket, why no further investigation is made.
Cultural buildings		The limited number of available assessments indicates that the climate impact does not exceed the reference value for “Group 2, Other buildings”. These buildings are therefore proposed to remain within this category unless they have exceptionally long spans or very high storey heights, for which a separate limit value is proposed in this study.
Buildings subject to future NATO requirements.	The question raised is whether the proposed classification is compatible with forthcoming NATO requirements.	Not specified what this might involve. Not investigated.

Source: KTH.

The special cases examined as part of this study, together with proposals for any reference values or adjustments to the reference values, are presented below.

Buildings subject to planning provisions that significantly increase climate impact

This may include, for example, buildings subject to specific requirements in the detailed development plan because they are located in areas exposed to noise or subject to requirements relating to the transport of dangerous goods. Many attractive locations where urban densification is sought also present challenges associated with these conditions. Such requirements primarily affect the design of façades or the lowest storeys, often on only one side of the building.

To ensure that buildings in these locations have conditions comparable to those of other buildings with respect to climate requirements, an upward adjustment is proposed to allow façade designs that accommodate these requirements. In the 2023 reference value study, the climate impact of façades ranged from 31 to 45 kg CO_2eq/m^2 GFA (mean for the building type) for the different building types. An upward adjustment of 30 kg CO_2eq/m^2 GFA to the reference value is considered to provide sufficient scope for designs that address these additional requirements.

Buildings with critical societal functions with high security requirements

Buildings with high security requirements may include prisons, courts, police stations and similar buildings. These building types are characterised by stringent functional security requirements, which generally result in strong building elements. This may include a higher proportion of interior concrete walls, thicker concrete walls and floor structure, robust finishes designed to withstand physical damage, etc. No data on the climate impact of buildings with high security requirements were included in the 2023 reference value study. However, a number of climate calculations have been shared with the investigators, clearly demonstrating that security requirements increase climate impact. To ensure that buildings with high security requirements are not placed at a disadvantage compared with other building types in meeting the limit value, it is proposed that the reference value for this category be based on the building in the shared dataset with the highest security requirements. In this case, that building has a calculated climate impact of just over 620 kg CO_2eq/m^2 GFA. Rounded upwards, the reference value is then 625 kg CO_2eq/m^2 GFA.

Public buildings with operational requirements driving climate impact

This may include, for example, research laboratories or certain parts of hospitals, such as MRI scanner facilities. It may also include other research facilities requiring specially adapted buildings. A number of special cases were identified (see Table 15) based on the hearing and other industry consultations conducted as part of the study.

Table 9. Special cases of buildings with operational requirements driving climate impact, and whether or not they are subject to the requirement to submit a climate declaration. Source: KTH.

Case	Subject to climate declaration requirements	Comment
Hospitals with MRI scanners	Yes	This is often a very small part of a building, and the climate calculations available for hospitals indicate that they are of the same order of magnitude as the reference values for “Group 2, Other Buildings”. No further study is being carried out at this stage.
Laboratories, such as chemistry laboratories	Yes	Remains part of ‘Group 2, Other buildings’. See discussion below.
Research facilities with extensive operational requirements	No	This may include particle accelerators, hydrodynamic or aerodynamic testing facilities, or laboratories for explosion or fire testing.
		These are classified as industrial activities and are therefore not subject to the climate declaration.

The design of laboratories can vary considerably depending on their activity and function. Laboratories were identified by several participants during the hearing as a type of activity that may face difficulties in complying with future limit values, as proposed at the hearing. This most likely refers to conventional laboratories for chemical or pharmaceutical research. To investigate the climate impact of this type of building, Akademiska Hus[37], which develops this type of building, was contacted.

[37] Personal communication, Akademiska Hus, Gustav Sandqvist and Per Hilmersson, 15 October 2025.

Activities associated with chemical or pharmaceutical laboratories have a high climate impact attributable to activity-specific equipment and technical equipment. These elements are not included within the system boundary for climate declaration and limit value. Once they are excluded, this building type is similar to office buildings, although there is some variation. It is therefore concluded that buildings for these purposes, which are currently classified under 'Group 2, Other buildings', have not been assigned an unduly stringent limit value but rather a more generous one. It is assessed that no adjustment to this classification is necessary.

Buildings with exceptionally high ceiling heights and long spans

The span and height of a building have a significant influence on its climate impact. Arenas and event venues are characterised by very large spans, robust structural systems and a relatively small gross floor area in relation to the amount of construction material used. This building type may include, for example, sports arenas, large concert venues and theatre buildings, but not sports halls or auditoriums, i.e., non-residential premises with spans exceeding 50 metres. This corresponds approximately to venues with a capacity of 2,000 people or more, or those intended for major sporting/cultural events.

There are few calculated buildings that can serve as the basis for a reference value. During 2025, a competition was held for the Arena District in Gothenburg, where participants also reported the climate impact based on the best possible climate impact reduction technology. One of the submissions also included a calculation of the climate impact for a scenario without climate-improved measures, for which WSP provided the calculation data.

Building 1: span; 144 meters in one direction and 130 meters in the other direction, building height; 28 meters. Estimated climate impact without climate mitigation measures. This building has been calculated with construction in three different materials, which gave a climate impact of 726, 826, and 772 kg CO_2eq/m² GFA respectively. The mean value of these alternatives was 775 kg CO_2eq/m² GFA.

This calculation may be regarded as a conservative reference value for this building type, as it is likely that smaller buildings, such as theatre buildings, have a lower climate impact due to their shorter spans and lower ceiling heights. Larger arenas than the example above are often constructed without roofs and are therefore not subject to the climate declaration requirement.

Therefore, a reference value of 775 kg CO_2eq/m² GFA is proposed.

Buildings constructed on deck structures or predominantly below ground

This includes, inter alia, metro stations and other traffic nodes built largely underground. This category also includes buildings constructed above deck structures. Underground construction offers fewer opportunities than other types of construction to use materials with a lower climate impact, such as bio-based materials or concrete with lower climate impact. Buildings constructed above deck structures generally have special structural requirements, as the loads from the building cannot be transferred to the tunnel roof. The first storey is therefore more akin to a bridge structure, resulting in a high climate impact.

For these buildings, it is proposed that the reference value be increased by 100 kg CO_2eq/m^2 GFA, in addition to the value applicable to that building type. This will most likely not fully account for the additional climate impact associated with construction above a deck structure in the case of buildings with only two or three storeys. However, such developments are typically located in central areas of larger cities, where buildings normally have significantly more storeys.

Indoor swimming pools

Indoor swimming pools often have a high climate impact, partly because they are buildings with high ceilings and long spans, and partly because the indoor environment places stringent requirements on finishes, while the indoor swimming pools themselves make the building geometry more challenging.

NCC[38] has carried out climate calculations for several indoor swimming pools and has provided these to the study as documentation. Of the documentation provided, three calculations are considered representative of the indoor swimming pool building type in a non-climate-improved design. Other calculations also include other building functions. The calculations include the building elements covered by the current legislation and Modules A1–A5. They have therefore been supplemented with default values to reflect the expanded system boundary; see the discussion below.

Finishes and fixed fittings

One issue that plays a major role in how finishes shall be handled is how the pools are handled. In addition, many new indoor swimming pools are now constructed with pools featuring stainless steel finishes, a solution

[38] Personal communication, Ludvig Dahlqvist, NCC, 8 October 2025. Source of all calculations on the climate impact of indoor swimming pools in the section.

associated with a high climate impact. In the proposal below, pools have been treated as part of the building's finishes and are thus included in the limit value. The obtained climate calculations show that the climate impact of a single steel basin can amount to 20 kg CO_2eq/m² GFA. As this value depends on the relative size of the indoor swimming pool, the value should be considered conservative. Indoor swimming pools can also be constructed with several stainless steel pools.

Finishes in indoor swimming pools are characterised by large amounts of tiles and stainless steel. No calculations of the climate impact of finishes have been available for indoor swimming pools. To provide as accurate a picture as possible of the climate impact of finishes and fixed fittings, the value for the building type with the highest value in the reference value study (special housing) has been used, with a conservative supplement of 25 per cent, giving a total of 66 kg CO_2eq/m² net heated area[39], together with a supplement of 60 kg CO_2eq/m² GFA to account for a greater use of tiles and pools with stainless steel finishes. (GFA and net heated area are assumed to be the same in this case.) This amounts to a total of 126 kg CO_2eq/m² GFA.

Technical equipment

Indoor swimming pools are characterised by large amounts of technical equipment for water treatment, pool water heating and ventilation to manage high humidity levels. However, these technical equipments are activity-specific in nature and are thus not included in the system boundary for the climate declaration and the limit value.

Even after activity-related technical systems have been excluded, this building type still has large air volumes to manage due to its high ceilings, resulting in a relatively high climate impact even for building-related technical systems. To estimate the climate impact of these technical equipments, the value for the building type with the highest value in the reference value study (special housing) has therefore been used, with a conservative supplement of 25 per cent, giving a total of 75 kg CO_2eq/m² net heated area (GFA and net heated area have been assumed to be the same in this case).

Total climate impact of indoor swimming pools

Climate impact from the three indoor swimming pools are presented below, in Table 16.

[39] And an assumption that net heated area is the same as GFA.

Table 10. Climate impact of three indoor swimming pools, including a supplement for additional parts of the building, as assumed above.

Kg CO_2eq/m² GFA	Climate impact, extent according to today's climate declaration	Climate impact of finishes and fixed fittings	Climate impact of technical equipment	Total
Indoor swimming pool 1	528	126	75	729
Indoor swimming pool 2	486	126	75	687
Indoor swimming pool 3	476	126	75	677
Mean				698

Source: KTH.

Based on these three representative buildings, the average value has been calculated at 698 kg CO_2eq/m² GFA. A reference value of 700 kg CO_2eq/m² GFA is therefore proposed.

Shelters

Not least in light of the new security situation, the question of how shelters should be handled was raised in the consultation responses to Boverket's Report 2023:20. These are often part of a larger building, with other activities. Boverket therefore examined whether these buildings could be exempted from the limit value requirement, but this is not permitted. The study was therefore tasked with developing a proposed limit value for shelters as well. Accordingly, the possibility of establishing a reference value for this building type has been reviewed.

Shelters require robust construction solutions, often using materials with a high climate impact, such as concrete and steel. The total area of shelters built in Sweden is estimated to be a very small proportion of the total area built. The study carried out found that shelters may require considerably greater allowance for climate impact than "Group 2, Other Buildings". For this reason, shelters have been placed in the group of special cases.

WSP calculated the climate impact of an actual shelter forming part of another building and also carried out a simple sensitivity analysis of the results by varying the concrete grade. The calculation shows that the climate impact for the shelter was between 800 and 1,100 kg CO_2eq/m² GFA.

As the documentation is very limited and any future requirements regarding the design of shelters are not known, the approach taken in proposing a limit value has been to propose a generously set limit value. At the same time, it is important that this limit value be applied separately to the part of the building affected by the design of the shelter.

Annex 4 – Early industry dialogue, March 2025

During March 2025, three stakeholder dialogue meetings were held to gather data for the development of the legislative proposal: one meeting with the EPD Group of Byggmaterialindustrierna, one meeting with the SME Committee of the Swedish Construction Federation (Sw. Byggföretagen), and a broad industry dialogue with developers, contractors, and collaborative organisations. These were offered the opportunity to submit documentation in questionnaire form. Some of the results are presented below.

Levels for limit values

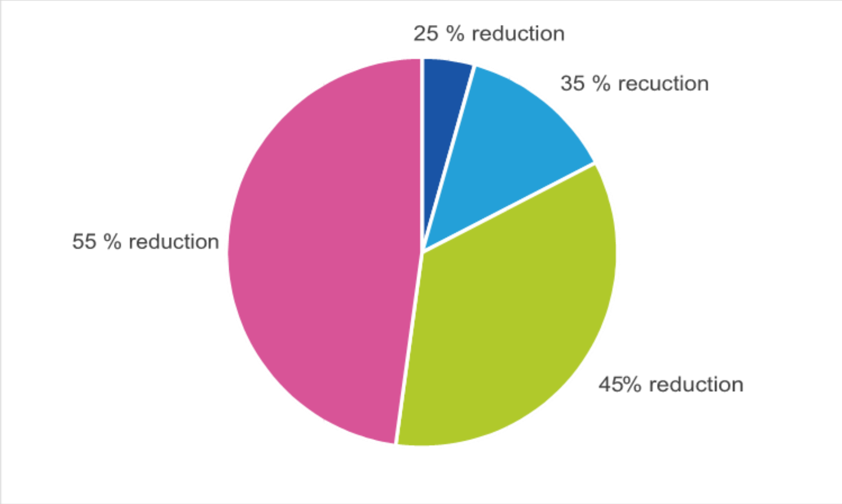
Ahead of these meetings, four alternative levels of limit values were developed, as a discussion paper. These were based on a percentage reduction in the median values of the reference values, and presented as calculated limit values in kg CO_2eq/m^2 GFA, to be easier to relate to. Below is a presentation of the level of limit values recommended by the participants in the broad dialogue group, see Figure 8.

Please note that the majority of the developers who responded stated that they preferred a limit value of a 45 or 55 per cent reduction. This is in line with the consultation responses submitted by developers on Boverket's Report 2023:20, in which several major developers, including Public Housing Sweden (Sveriges Allmännytta), advocated more ambitious limit value levels.

The large contractors who responded to the questionnaire favoured the 35 per cent reduction level.

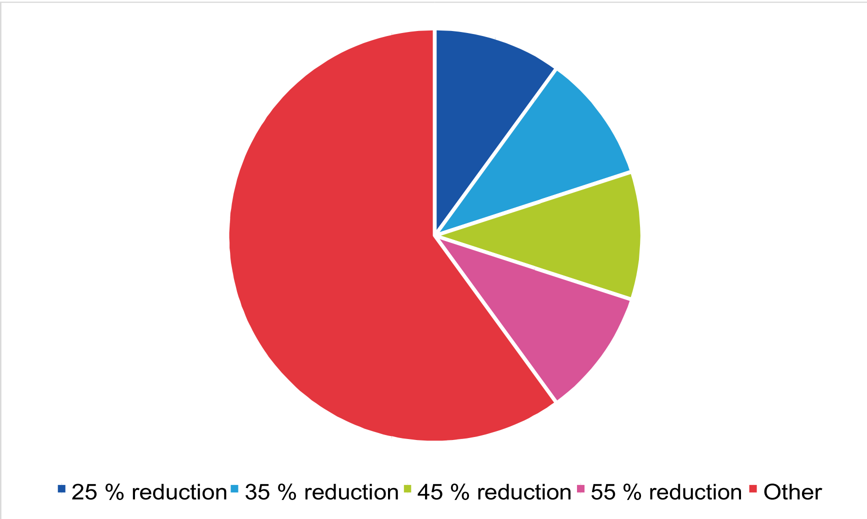
None of the actors in the SME Committee of Byggföretagen invited to provide feedback responded to the questionnaire. During the meeting, it became apparent that the level of knowledge varied considerably and that several stakeholders had no point of reference against which to assess the alternatives presented. In its consultation response to Boverket's Report 2023:20, Byggföretagen supported the level proposed therein, namely a 25 per cent reduction in the 2030 limit values.

Figure 7. Limit value level recommended by respondents, percentage reduction compared to reference value for the building type. Responses from the broad dialogue.



Source: KTH

Figure 8. Limit value level recommended by respondents, percentage reduction compared to reference value for the building type. Responses from building materials manufacturers.



Source: KTH

In the early industry dialogue, building material suppliers indicated that they favour other types of limit values, and their responses show that the majority prefer limit values covering the entire life cycle (see Figure 9).

Cost impact

The questionnaires also asked how the different alternatives were expected to affect organisations' costs of complying with the limit value (not the costs of the climate declaration itself), see Figures 10 and 11, although it cannot be ruled out that some respondents included such costs in their assessment. Several of the clients who responded that all levels would result in unchanged costs already have internal targets that are equivalent to or more stringent than the levels presented here. Consequently, these responses do not reflect the actual cost impact for organisations that do not have more stringent internal targets.

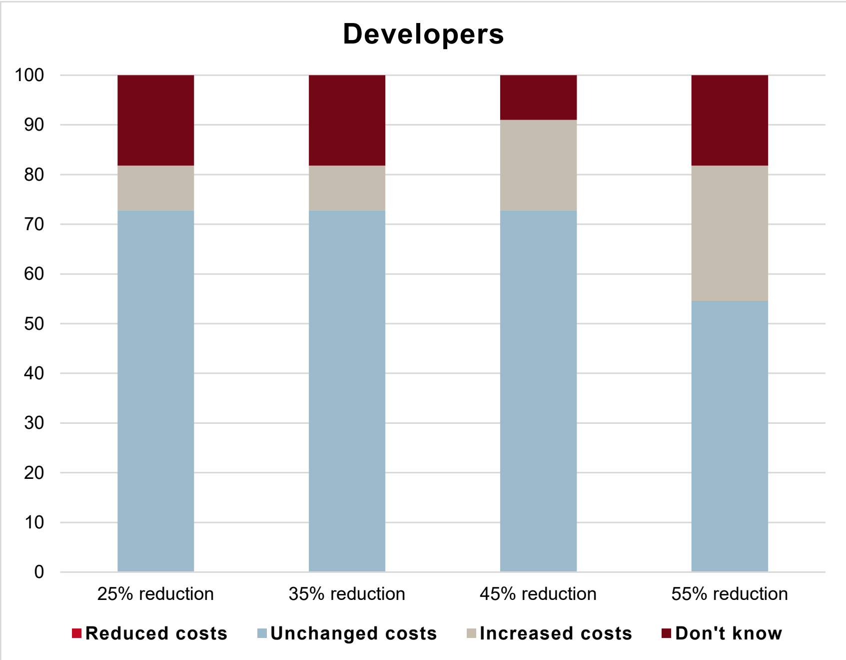
An analysis of the remaining responses clearly indicates that a 25 per cent reduction is not expected to result in increased costs. There is less knowledge about the impact of a 35 per cent reduction, and the proportion of respondents answering 'don't know' increases, whereas the proportion indicating 'increasing costs' does not. More stakeholders consider that reductions of 45 and 55 per cent, respectively, would result in increased costs.

When discussing the cost implications of the different limit value levels, several contractors emphasised the importance of clients addressing climate impact even before a contract procurement is carried out to reduce costs. One respondent noted that, under such circumstances, even a 45 per cent reduction could be achieved at reasonable cost.

Several mention that materials with a low climate impact currently have higher material costs, but considered that this may well change by 2030. Several mentioned the development of material prices in response to changes in emission allowances as a factor that could reduce the additional cost of (or even lower the cost), materials with lower climate impact.

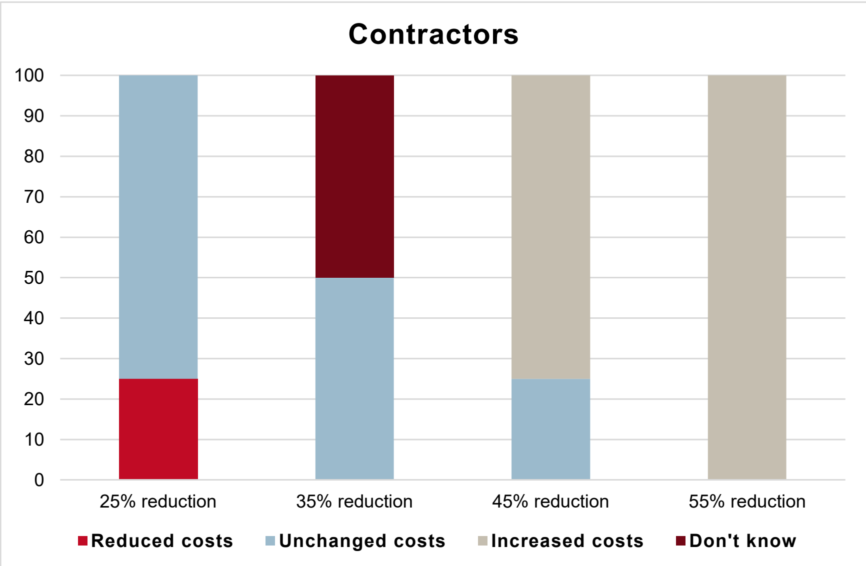
The comments received clearly indicate that, although current climate optimisation work increases the time required for design and calculations, this additional work is expected to decrease over time as experience grows, information management matures, and lower-climate-impact designs become standard practice in the design process.

Figure 9. Assessment of the cost impact of the limit value options, responses from developers, and representatives of developers (n=11), who responded to the questionnaire.



Source: KTH.

Figure 10. Assessment of the cost impact of the limit value alternatives, from contractors (n=4) who responded to the questionnaire.

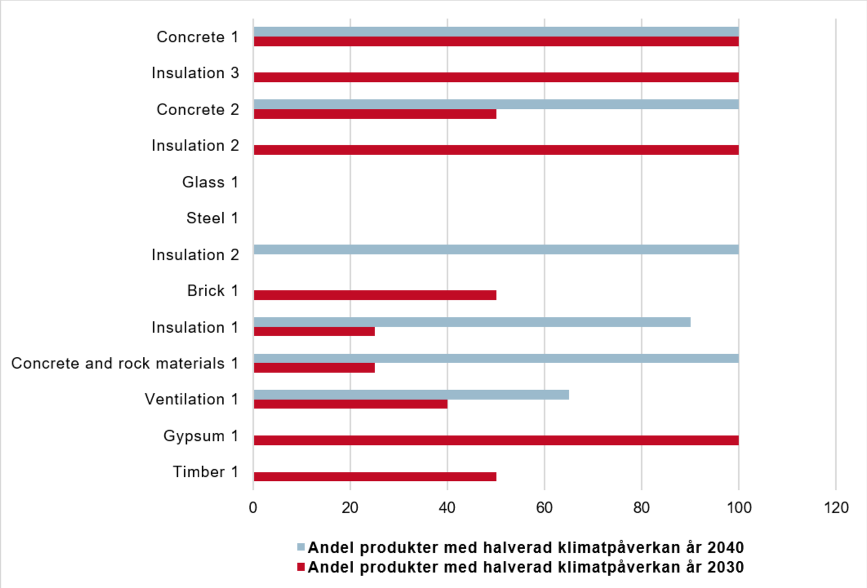


Source: KTH.

Development of building materials by 2030 and 2040

In the dialogues, building materials manufacturers answered what percentage of products they estimate to have a halved climate impact compared to 2020. As shown in Figure 12, respondents have estimated that between 25 per cent and 100 per cent of products sold in 2030 will have a halved climate impact. The corresponding figure for 2040 is between 65 per cent and 100 per cent.

Figure 11. Halved climate impact compared to 2020.



Answer to the question “Estimated share of your market segment consisting of products with a halved climate impact compared to 2020”. Red bars show the proportion that halved the climate impact in 2020–2030 and blue bars the proportion expected to have halved. Source: KTH.

Annex 5 – The construction and real estate sector

This annex provides an overall description of the construction and real estate sector in Sweden. This includes a review of the sector's ups and downs since the 1990s, an explanation of the functions of different stakeholders in the sector, including the distribution of enterprise size for each stakeholder, and an overview of the construction and production costs associated with the construction of buildings.

Construction

The construction and real estate sector and its value chain accounted for approximately 17 per cent of Sweden's gross domestic product (GDP) in 2022 (Boverket, 2025)[40]. Property management accounted for approximately 54 per cent of total value added, renovations, refurbishments, and extensions for 25 per cent, new construction for 19 per cent, and heating for 2 per cent.

Construction investment in new construction and refurbishments of residential and non-residential premises amounted to approximately SEK 495.4 billion in 2024 (at 2023 prices) (Byggföretagen, 2025). Historically, construction investment fell in connection with the 2008 financial crisis and only began to rise again in 2010 when the economy began to recover. This was followed by a few years when investments remained constant before construction investments began to rise in 2014–2019. However, this positive trend was broken in 2020 and has remained at around SEK 500 billion since then, measured in 2023 prices.

Housing construction bottomed out in 2024 with 26,500 apartments started, but has shown a modest recovery during 2025. Falling interest rates and lower construction costs are among the factors driving this development. Investments in non-residential buildings, however, have continued to decline during 2025, mainly due to the weak performance of the commercial real estate sector (Byggföretagen, 2025).

Housing construction has fluctuated considerably over recent decades, see Figure 13. In the early 1990s, approximately 60,000 dwellings were completed each year. Following the economic crisis of the 1990s, construction dropped sharply, and the addition of new apartments fell to

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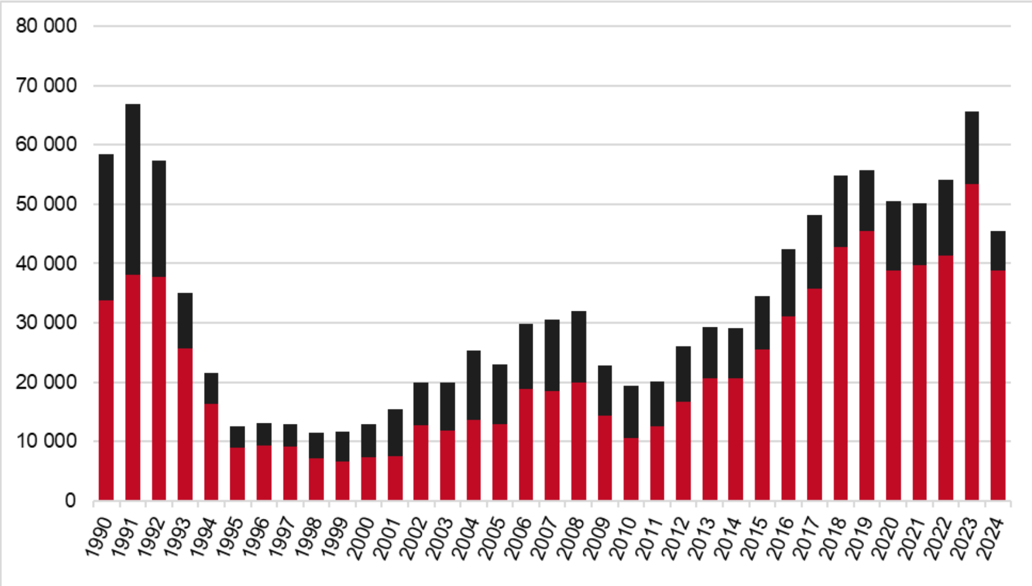
[40] Boverket. (29 January 2025). https://www.boverket.se/sv/byggande/hallbart-byggande-och-forvaltning/miljoindikatorer---aktuell-status/konjunkturen/. Retrieved from *Indikatorer för bygg- och fastighetssektorn* [Indicators for the construction and real estate sector]: https://www.boverket.se/sv/byggande/hallbart-byggande-och-forvaltning/miljoindikatorer---aktuell-status/konjunkturen/

approximately 13,000 per year. It was not until the mid-2010s that construction once again approached the levels seen in the early 1990s.

Figure 12. Number of completed residential apartments in multi-dwelling blocks (incl. special housing) (red) and single-family houses (black), 1990–2024.



Source: Statistics Sweden.

In recent years, the addition of new dwellings has been approximately 50,000 apartments per year. Table 17 below presents the number of completed apartments in newly constructed buildings by building type and year.

Table 11. Number of completed apartments in newly constructed buildings by building type and year.

	2010	2015	2020	2021	2022	2023	2024
Multi-dwelling blocks[1]	10,625	25,565	38,906	39,705	41,258	53,383	38,851
Single-family houses	8,875	9,038	11,573	10,384	12,760	12,212	6,624
Total	19,500	34,603	50,479	50,089	54,018	65,595	45,475

[1]Including special housing. Source: Statistics Sweden

Official statistics do not include data on the number of completed non-residential buildings. However, the building permit statistics for new construction contain information on building permits for all building types without exception. The building types that will be subject to climate declarations and limit values are those covered by the requirement for an energy performance certificate. The building permit statistics for new construction therefore overestimate the number of buildings that will be affected[41]. At the same time, they represent the best available source of information on buildings. As distinguishing building permits subject to the energy performance certificate requirements would require a special order from Statistics Sweden, the building permit statistics are used as an upper limit for the number of new buildings that may be covered. Once a developer has been granted a building permit, construction must commence within two years and be completed within five years (Boverket, 2020)[42]. Table 18 presents building permit statistics by building type: multi-dwelling blocks, single-family houses, office buildings, education facilities, and other non-residential premises. Building permits were issued for approximately 7–13 million square metres per year during the period 2015–2024. By comparison, the corresponding figure in the early 2000s was approximately 6 million square metres per year.

Table 12. Building permits for new construction, million square metres of gross floor area, by building type, 2015–2024.

Year	Single-family houses	Multi-dwelling blocks excluding special housing	Offices	School, university	Special housing, lodging & restaurants	Other buildings	Total
2015	2.20	3.91	0.31	0.24	0.53	2.05	9.25
2016	2.68	4.48	0.36	0.49	0.60	2.37	10.98
2017	2.65	4.91	0.49	0.43	0.60	2.60	11.67
2018	2.20	4.01	0.57	0.42	0.72	2.41	10.33
2019	2.22	3.31	0.51	0.37	0.60	3.00	10.03
2020	2.37	4.15	0.58	0.59	0.64	2.52	10.86
2021	3.05	5.16	0.51	0.44	0.40	4.05	13.60
2022	2.52	3.96	0.57	0.48	0.34	3.91	11.77
2023	1.25	1.77	0.51	0.43	0.35	3.67	7.98
2024	1.14	1.84	0.36	0.35	0.43	2.84	6.95

Source: Statistics Sweden

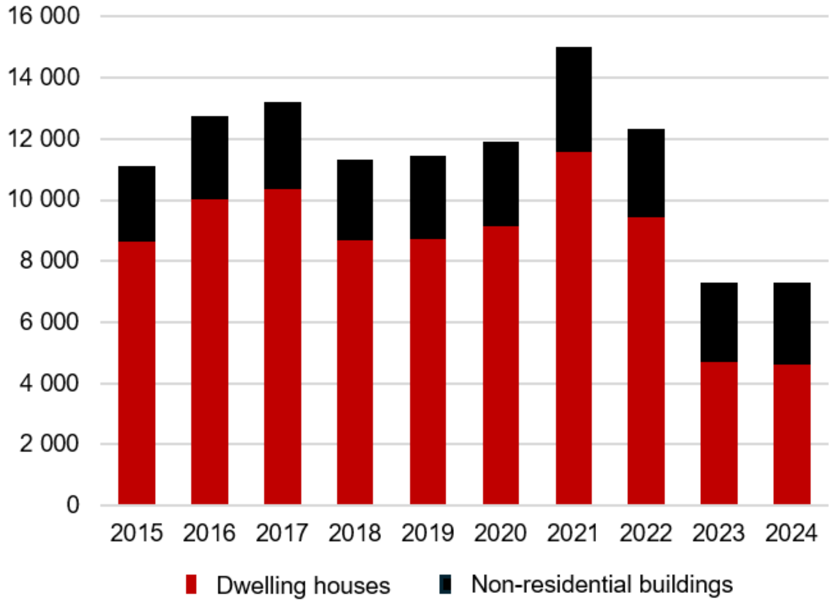
The 7–13 million square metres of GFA for which building permits were issued for new construction correspond to 8,000–15,000 building permits. During the period 2015–2024, an average of around 11,400 building permits for new construction were issued annually, of which approximately 2,800 related to non-residential buildings. The average gross floor area was approximately 700 square metres for residential buildings and approximately 1,400 square metres for non-residential buildings. Figure 14 below shows the number of building permits broken down by residential

[41] As a general rule, buildings exceeding 250 square metres shall have an energy performance certificate when they are first put into use. For certain other buildings, the energy performance certificate shall be completed no later than two years after the building has been put into use. See also: https://www.boverket.se/sv/energideklaration/energideklaration/dessa-byggnader-ska-energideklareras/. Retrieved 5 May 2026.

[42] Boverket. (15 October 2020). When you need a building permit. Retrieved from https://www.boverket.se/sv/byggande/bygga-nytt-om-eller-till/bygglov/

and non-residential buildings during the period 2015–2024. It is worth noting that the peak year, 2021, occurred the year before the requirement for climate declarations was introduced.

Figure 13. Number of building permits for new construction by dwelling houses.

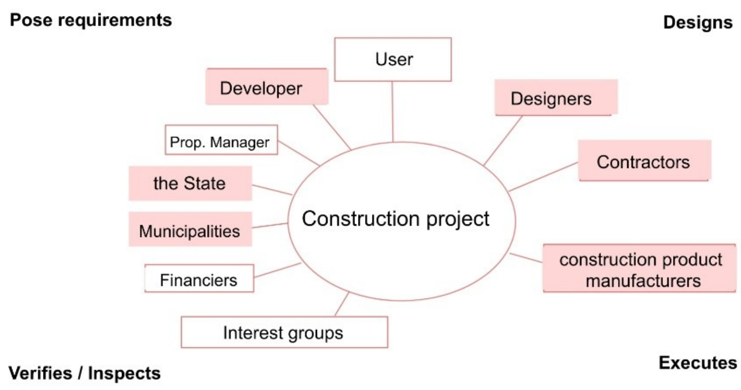


Source: Statistics Sweden.

Stakeholders

The implementation of a construction project involves a large number of actors and stakeholders. **The developer** is the person or organisation that decides to carry out a construction project. The developer determines the project's key parameters, including appearance, standard, quality, price, and form of contract. The developer is responsible for, and has the authority to make, decisions that affect whether the completed building complies with the limit value and for registering the climate declaration. The stakeholders responsible for designing the construction project are typically **project designers**, such as architects and designers. The project is carried out by **contractors** together with their subcontractors providing specific construction services, as well as suppliers of construction materials for the construction project. A construction project also involves **organisations with supervisory or oversight functions**, including public authorities, financiers and property managers. Once the building has been completed, responsibility for its operation and maintenance is often transferred to a property manager. The user is the person using the dwelling or premises. Sometimes, however, the user is the same stakeholder as the manager. Figure 15 below shows the actors and stakeholders involved in a construction project.

Figure 14. Stakeholders in the construction process.



Source: (Cigen, 2003).

Developers and property managers

A narrow definition of developers includes enterprises operating in the Development of building projects (SNI 41.1). According to Statistics Sweden’s company database, there are 1,000 enterprises in the “Development of building projects” industry, all of which are classified as small and medium-sized enterprises (SMEs)[43].

Large property developers that are involved in business activities and are not included in SNI code 41.1 include Riksbyggen, Familjebostäder and Svenska bostäder. These are classified as property managers and can be found under SNI code 68.2, together with tenant-owner associations. Excluding tenant-owner associations, there were approximately 84,000 real estate enterprises according to 2024 data from Statistics Sweden’s Statistical Business Register. Of the 84,000 enterprises in property management, most are small and medium-sized; only 30 are classified as large enterprises. These are primarily enterprises engaged in property management, but also enterprises that develop construction projects for their own operation. However, it is not possible to specify how many of these are involved in developing construction projects. There is also an industry association representing around 100 members, comprising professional developers from a range of industries, from industrial companies to property managers and municipalities and other public-sector stakeholders. (Byggherrarna, 2025). Approximately 30 member companies of the Swedish Construction Clients (Byggherrarna) are property managers, and approximately 20 are public housing companies.

[43] A threshold of fewer than 199 employees is used here to define small and medium-sized enterprises (SMEs), as the available data do not allow extraction in accordance with the standard definition of fewer than 250 employees. https://www.ekonomifakta.se/ordlista/sme-foretag_1209591.html. Retrieved 10 April 2026.

Project designers

Project designers are experts who are trained to translate ideas into action and include architects, designers, environmental consultants, and other stakeholders involved in the planning, costing, and design of construction projects (Boverket, n.d.)[44]. According to Statistics Sweden's business database, there are 18,800 enterprises involved in architectural activities and technical consultancy (SNI 71.11 and 71.12) in 2024.

Of the 18,800 or so enterprises involved in architectural activities and technical consultancy, 17 enterprises are classified as large.

Building contractors

The majority of all construction management is managed and carried out by building contractors. These stakeholders erect buildings on behalf of the developer (Boverket, u.d.). The building contractor usually has construction contracts directly with the developer. There are also other contractor groups in the construction industry, such as land contractors, machinery and crane enterprises, and plumbers and electricians. These are often subcontractors hired by the building contractor to perform certain tasks. There are currently a large number of small construction companies and seven large enterprises. The five largest enterprises – Peab, Skanska, NCC, Veidekke, and JM – employ over a thousand people each. The large companies operate in most areas, but are largely involved in project development, which means that they erect buildings on their own land, rent and manage them and then sell them on. The small enterprises often focus on refurbishment projects and small new construction projects or are hired as subcontractors on construction sites.

The enterprises covered are mainly active in the Construction of residential and non-residential buildings sector (SNI 41.2). According to Statistics Sweden's Statistical Business Register, there are close to 26,900 enterprises within this SNI code: 25 companies classified as large enterprises, and the rest SMEs.

Subcontractors providing specific construction services

In addition to the enterprises that are developers or construction contractors, there are a number of subcontractors that operate in the value chain for new construction. The trade association Byggföretagen estimates that within SNI code 43.3 there are a number of companies in five different SNI codes that may be impacted.[45] This includes, for example, enterprises specialising in plastering and façades, carpentry, floor and wall coverings, and painting and glazing. Enterprises in these industries are affected

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[44] Boverket. (n.d.). *En byggnads liv.* [The life of a building.] Boverket – En byggnads liv [The life of a building]. Retrieved 5 May 2026.

[45] Email dated 24 October 2025.

by finishes, fixed fittings and technical equipment being added to the expanded climate declaration. These enterprises are predominantly small, see Table 19.

Table 13. Enterprises in SNI 43.3 Final Building completion and finishing potentially affected, number of enterprises by size class in 2024.

Industry sector	All enterprises	Small	Medium-sized	Large
43.310 Plastering companies	634	628	6	0
43,320 Joinery installation companies	22,567	22,545	22	0
43,330 Floor and wall covering companies	3,905	3,889	16	0
43,341 Painting	6,849	6,816	31	2
43,342 Glazing	778	773	4	1
Total	36,757	34,651	79	3

Source: Statistics Sweden, Statistical Business Register.

Construction product manufacturers

A construction product manufacturer is the stakeholder that manufactures the construction products (such as concrete, sheet metal, timber, steel, insulation materials, etc.) to be used in building construction. From a climate perspective, concrete and steel dominate greenhouse gas emissions from the construction process. A majority of the steel consumed in the construction sector in Sweden is imported. For example, reinforcement bars have not been manufactured in Sweden since 2001. It is not possible to say exactly how many construction products are on the Swedish market or will be affected by the expansion of the climate declaration. It can be mentioned that Svensk Byggtjänst's product catalogue has over 21,000 products. Some are imported and others are manufactured in Sweden.

The Swedish construction product manufacturing enterprises that deliver to construction projects include enterprises manufacturing concrete products (23.61), cement (23.51), gypsum products for construction purposes (23.62), timber products (16.21-2), pipes and tubes (24.2) and insulation (23.991). These can be found in a number of different industries, and there were a total of 350 enterprises in Sweden in these industries in 2024. Of these, 15 enterprises are classified as large enterprises and the rest are classified as SMEs; see Table 20.

Table 14. Construction product manufacturers (SNI 16.21-2, 23.61, 23.51, 23.62, 23.991, and 24.2), number of enterprises by size, 2021.

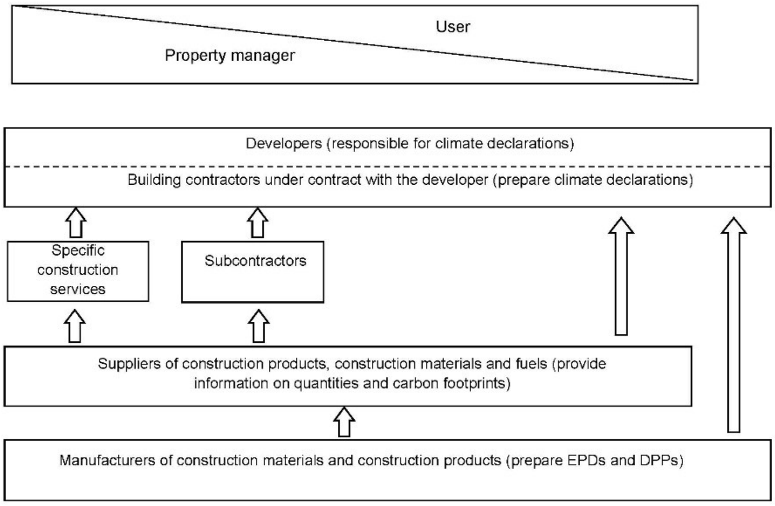
Enterprise size	Number of employees	Number of enterprises	Share
Small enterprises	0–49	319	91 %
Medium-sized enterprises	50–199	17	5 %
Large enterprises	200–500+	15	4 %
Total		351	100 %

Source: Statistics Sweden, Statistical Business Register.

Connection between stakeholders and preparing a climate declaration

Figure 16 below shows the stakeholders in the value chain for new buildings. The arrows indicate the flow of information from the stakeholders to the construction contractor, who is usually the one who prepares the climate declaration.

Figure 16. Value chain for new buildings and information flow for preparing a climate declaration.

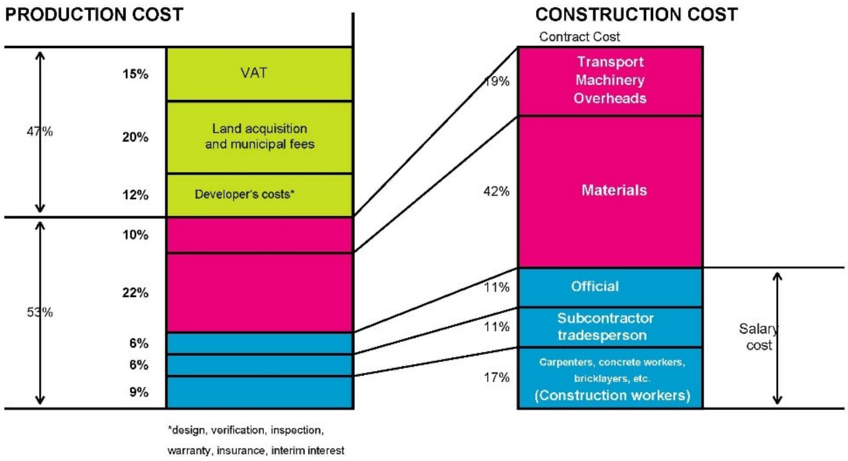


Source: WSP, own processing.

Construction and Production Cost

The term 'construction cost' (*Sw. byggkostnad*) is widely used but is by definition only a part of the total cost of a construction project after all stages of the construction process are taken into account (Konkurrensverket, 2021). The total cost of a construction project is called production cost. Construction costs (*Sw. byggkostnader*) denote what is also called contract costs (*Sw. entreprenadkostnader*). The remaining part consists of developer cost, land cost and VAT (SCB, 2022). Construction cost refers to earthworks and excavation work, construction of the building and rough and fine planning of the land. Developer costs mainly refer to design, interest costs (during construction) and the developer's own administration. Figure 17 below presents which cost items are included in the production and construction costs, respectively.

Figure 17. Construction cost and production cost broken down by item.



Source: Byggföretagen (2020).

As Figure 17 above shows, the construction cost represents slightly more than half of the total production cost. Over time, this proportion has declined in relative terms, as land costs have increased significantly more than the construction cost. According to Byggföretagen, the main explanation is that landowners have charged higher prices since 2006. In 2022, as in the 2020 figure, the land cost accounted for 20 per cent of the production cost. Based on the figure, a simple sample calculation can be produced that shows how cost increases in a single cost item affect construction and production costs. If, for example, material costs rise by 50 per cent, construction costs increase by 21 per cent and production costs by 11 per cent.

Table 21 presents the average construction price per square metre of apartment area for newly built multi-dwelling blocks and single-family houses. The building price includes developer costs and construction costs and VAT. Land costs are not included. In the table, the building price is stated net per apartment area, which means that any subsidies have been deducted. Between 2015 and 2023, the construction price per square metre has increased by about 7 per cent for newly built multi-dwelling blocks and about 21 per cent for single-family houses. It can be noted that the construction price varies slightly more over time for multi-dwelling blocks than for single-family houses.

Table 15. Newly built apartment buildings and single-family houses, construction price per apartment area 2015–2023 (net price in SEK per square metre of apartment area).

	Ordinary multi-dwelling blocks	Collectively built single-family houses
2015	32,748	23,387
2016	34,777	25,109
2017	35,642	25,915
2018	32,832	25,361
2019	34,586	25,302
2020	36,282	27,336
2021	34,684	27,781
2022	33,819	28,801
2023	35,126	28,274

Source: Statistics Sweden

Looking at a longer time horizon, production costs for Swedish multi-dwelling blocks increased by 185 per cent during the period 1998–2023. According to Byggföretagen, the primary explanation is rising material prices, which are determined in part by international markets (Byggföretagen, 2024).

Connection between construction costs and construction

In addition to production costs, construction is affected by the developer's revenues. The decision to build or not to build is influenced by the profitability of the project. The emphasis is usually on anticipated profitability, as construction decisions are made a few years before the building is completed. That is to say, whether expected rent or sales price can cover production costs plus the developer's required rate of return.

Production costs include a variety of components presented above, such as material costs, salaries, and developer costs. For rental apartments, the developer performs a calculation to determine whether the project will be profitable given the construction costs, based on the rent level and the state of the rental market. Previously, rents were primarily determined according to the user-cost method, whereas newly constructed rental dwellings are now subject to market rents. The rental income is usually what determines profitability even for non-residential premises. Tenant-owner flats and single-family houses are usually produced when a certain percentage of the dwellings are sold. Purchases are usually made a few years before access, and a project may suffer if too few apartments are sold as this delays the start of production.

Increased production costs and/or lower sales prices may lead to a decline in construction. Developments in the 2010s have shown that construction costs have increased at the same time as housing construction. One important explanation for this was that higher prices of dwellings could offset the effect of higher construction costs. Low interest rates and rising incomes made it possible to raise prices.

It is generally difficult to isolate the impact of rising construction and production costs[46] on construction by means of statistical regression analyses. The results of studies conducted to isolate the long-term impact of construction costs on construction vary greatly. The impact of a 1 per cent increase in construction costs (factor price index)[47] ranges from a 6 to 0.8 per cent reduction in construction (BKN, 2011); (Blackley, 1999), and the lower end of the range may possibly be lower[48]. It is difficult to explain the wide range of results. However, Blackley (1999) notes that regression analyses using data on percentage changes in construction prices produce lower estimates of sensitivity than regressions based on absolute values. Andersson et al. use an alternative approach in a study of how construction costs are affected by a 5 per cent cost increase, where the impact on construction is simulated in a model that explains the link between housing stock, rent, and the depreciation of the stock (Andersson, Braun Thörn, & Mandell, 2016). According to the results of the simulation model, a 5 per cent cost increase leads to a 1.2 per cent decrease in construction, while rents increase by 2.4 per cent (ibid.). According to the results, a 1 per cent increase in construction costs would lead to a reduction in construction activity of approximately 0.24 per cent. One reason why the correlation is weaker than in the regression analyses is that rents are increasing at the same time, meaning that part of the increase in costs is offset by increased rental income.

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[46] One difficulty is that supply and demand are determined simultaneously, which must then be taken into account in the statistical regression analysis.
[47] According to BKN, the factor price index measures the prices of production inputs used in residential construction, such as labour, materials, transport and machinery, but does not include land prices. The factor price index is likely synonymous with the construction price, i.e. with the production cost, excluding land prices.
[48] In a statistical analysis of the Swedish housing market, Caldera Sánchez and Johansson (2011) report a lower sensitivity to construction costs (0.3), although the result is not statistically significant.

Annex 6 – Policy instruments

This annex reviews policy instruments at both EU and Swedish level that may interact with the limit values and the expanded climate declaration under the EPBD, and thereby influence the effects of introducing these measures. The annex begins with an overview of policy instruments during the life cycle of a building. This is followed by a review and analysis of economic policy instruments in the EU.

The limit values under the EPBD constitute a regulatory policy instrument, meaning that they operate through regulations, legislation, and mandatory requirements rather than through financial incentives or information. Climate declarations are an information policy instrument and the expansion of climate declarations (referred to in the Directive as the calculation and disclosure of life-cycle GWP) under the EPBD thus represents a modification of an information-based policy instrument. Going forward, the EPBD will regulate the energy and climate performance of buildings across the EU. Among other things, it establishes the framework for how the climate performance of buildings shall be reported, sets minimum energy performance requirements, and introduces limit values for climate impact. Neither the limit values nor the climate declarations work by creating financial incentives to reduce climate impact and improve energy efficiency. Instead, they establish mandatory rules and requirements. The EU does, however, have other policy instruments that will operate in parallel with the expanded climate declaration and limit values for new buildings under the EPBD, including the EU Emissions Trading System (EU ETS). In the coming years, additional economic policy instruments will also be introduced, which will affect emissions and prices within the construction sector.

Policy instruments based on the building’s life cycle

The carbon tax and the EU Emissions Trading Scheme (EU ETS) are the two main economic policy instruments affecting greenhouse gas emissions in the construction stage. Both of these policy instruments are applied directly at the source of the emissions. The carbon tax affects the life cycle of a building during the construction and operational stages, as well as all related transport activities. Parts of the construction industry – such as manufacturers of building materials like cement and steel – are part of the EU Emissions Trading System. Emissions in these sectors are exempt from the carbon tax, and the emissions are instead priced through the trading scheme.

In addition to these, there are a number of other policy instruments that directly or indirectly affect greenhouse gas emissions during the life cycle of a building. For example, the energy tax, the landfill tax, building regulations and instructions, as well as the various subsidies and investments made in areas such as the *Klimatklivet* and *Industriklivet* schemes, the forestry industry, and the recycling industry.

Policy instruments at the product stage

Greenhouse gas emissions arising during the product stage are generated during the supply of raw materials, transport to manufacturing, and during the manufacturing process of construction products and components. The policy instruments that affect greenhouse gas emissions at the product stage are either the carbon tax (including all transport) or EU emissions trading (e.g. steel and cement construction product manufacturers). The energy tax also has an indirect impact on carbon emissions as it helps to increase the price of goods, which in turn leads to lower volumes being used.

For construction products, the Ecodesign Regulation (ESPR)[49], which replaces the Ecodesign Directive (2009/125/EC) and forms part of the Sustainable Products Initiative (SPI), will address greenhouse gas emissions. The purpose of the ESPR is to improve the environmental sustainability of products, making sustainable products the norm while reducing their overall carbon and environmental footprint throughout their life cycle. The Ecodesign Regulation (ESPR) is a framework that allows the Commission to decide on ecodesign requirements for sustainable products. It is mainly an administrative policy instrument (e.g. performance requirements), but also an information policy instrument. Specific rules at product level will be decided later by the Commission in delegated or implementing acts. In the long term, almost all types of products introduced into the EU internal market will be covered, including construction products and technical equipment. An important component is the requirement to provide information via a Digital Product Passport (DPP). The introduction will take place over a longer period. In the initial stage, priority will be given to iron and steel.

In December 2024, a new Construction Products Regulation (CPR) was published: CPR-2024[50]. Parts of the Regulation will apply from 8 January 2026, while the other provisions will apply later. During the transition to the new Construction Products Regulation, the previous regulation, CPR-2011, will continue to apply in parallel. (Boverket, Översyn av

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[49] Regulation (EU) 2024/1781 of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for sustainable products.
[50] Regulation (EU) 2024/3110 of the European Parliament and of the Council laying down harmonised rules for the marketing of construction products and repealing Regulation (EU) No 305/2011.

byggproduktförordningen, 2024) The transition is expected to take several years.

One of the most significant updates is the introduction of mandatory environmental reporting. Within this environmental reporting, requirements covering different categories of environmental impact will be introduced gradually, with climate change impacts (GWP) being one of the first environmental impact categories for which requirements will be introduced. Provisionally, the new rules shall apply from 2028.

To comply with the CPR, an extended declaration of performance will be required. The Declaration of Performance (DoP) reports essential product characteristics, such as the load the product can withstand and how long it can withstand fire. This expansion means that the Declaration of Performance (DoP) will be supplemented by a Declaration of Performance and Conformity (DoPC), ensuring that the intrinsic product characteristics declared under the CPR are aligned with the requirements of the ESPR and any other (future) EU common requirements. Environmental performance will be included in the DoPC and the abovementioned digital product passport will be the format for communicating the information.

Harmonised standards for construction products will be developed through the CPR Acquis, an initiative led by the European Commission. This is a comprehensive and time-consuming process, and the first products marked in accordance with CPR 2024 are expected to become available in 2028. Once construction products are covered by a standard harmonised under CPR 2024, reporting climate impact in accordance with that standard will become mandatory. This climate impact must be included in the disclosure of life-cycle GWP pursuant to the EPBD. According to the European Commission, however, it will take approximately ten years before all construction products are covered by CPR 2024. Until then, existing EPDs available on the market may continue to be used.

CPR 2024 will thus require manufacturers to provide information on the climate impact of different product groups. In the longer term, this means that the information required under the Regulation will replace the current EPDs and the default values in Boverket's climate database. However, it will take time before the Regulation is fully implemented. Consequently, the disclosure of life-cycle GWP and compliance with limit values will, at least in part, continue to rely on data from EPDs and Boverket's climate database until all construction products are linked to CPR 2024. Once this is done, it is reasonable to expect time savings for contractors and developers, as they will no longer need to collect and compile EPDs themselves. Accordingly, disclosure of life-cycle GWP under the EPBD can be expected to become less extensive over time.

Policy instruments at the construction stage

During the construction stage, greenhouse gas emissions are generated from energy-intensive activities on the construction site, the transport of, among other things, construction products and machinery, and the production and waste management of materials that are damaged or become waste during transport to, or on, the construction site itself. The level of greenhouse gas emissions depends on the construction method, material choices and weather conditions during different stages of the construction process. Depending on the materials selected, different technical characteristics requirements for the completed building must also be taken into account and fulfilled. These technical characteristics requirements include energy performance, fire safety, accessibility and load-bearing capacity, all of which affect greenhouse gas emissions and are specified in Boverket’s Building Regulations (BBR).

The economic instruments that affect these emissions are the carbon tax and energy tax (transport, use of machinery on the construction site) and EU emissions trading (use of electricity and district heating during the construction period).

Other policy instruments also have an impact on carbon emissions, such as the Planning and Building Act (2010:900), the Environmental Code and the issuing of permits for the various processes. This is because they increase construction costs and affect how buildings are constructed. A more expensive construction process leads to less construction and fewer buildings that emit carbon dioxide, while, for example, various regulations in the Environmental Code affect land use, which in turn affects carbon emissions.

Policy instruments at the use stage

Greenhouse gases produced during the use stage are generated from energy and water use, but also from repairs, replacements and refurbishment. Greenhouse gas emissions are covered by the regulations and general recommendations contained in Boverket’s building regulations (BBR) and Boverket’s European construction standards (EKS). Among other things, there are energy requirements that help to reduce energy consumption during the use stage, which in turn indirectly affects greenhouse gas emissions. Energy performance certificates are another policy instrument (information policy instrument) that can influence greenhouse gas emissions by incentivising energy efficiency improvements in the use stage.

Economic policy instruments such as the carbon tax and the EU Emissions Trading System also affect emissions during the use stage. This primarily concerns construction products used for repair, replacement and refurbishment, as well as energy use (electricity and district heating).

Policy instruments for construction and demolition waste

Waste is generated at different stages of the building's life cycle, and is subject to landfill tax and waste incineration tax. These policy instruments aim to reduce the amount of waste that is sent to landfill and incinerated by making these activities more expensive. This in turn can also encourage stakeholders to minimise construction and demolition waste, and ultimately reduce greenhouse gas emissions. There are also provisions in the Waste Directive that can affect emissions for construction and demolition waste, as there is a separation requirement for parties producing construction and demolition waste. Certain types of waste therefore have to be sorted and stored separately from other waste, which in turn increases the chances of achieving more circular flows of materials in construction and demolition activities.

Overall picture of the impact of policy instruments

It is important to recognise that regulations and policy instruments affect greenhouse gas emissions from buildings in different ways. Some, such as the carbon tax and the EU's emission allowances (EU ETS), are directly targeted at reduction of carbon emissions. Others are support and requirements leading to actions that may reduce greenhouse gas emissions. Rather, additional policy instruments affect the construction process, and thus indirectly the carbon emissions of buildings. The overall picture of steering is difficult to grasp, therefore. There may also be gaps, mismanagement, and too much management or double management in this plethora, making it unclear how greenhouse gas emissions are affected overall. Several of the support measures available for construction may, for example, give rise to rebound effects that offset any emission reductions achieved. A limit value for the building can thus be a reasonable way of regulating matters to reduce emissions when new buildings are erected.

As noted previously, the Swedish Environmental Protection Agency (Naturvårdsverket), in its consultation response, pointed out that there may be a policy gap, as there was no policy instrument specifically aimed at the development and market introduction of new climate-neutral construction products. The limit values could possibly play a role in reducing emissions from construction products. The analysis in this section indicates that greenhouse gas emissions from construction products will also be regulated through other policy instruments that are in the process of being introduced. These include the revised Ecodesign Regulation (ESPR) and the Construction Products Regulation (CPR), which are expected to require manufacturers to report greenhouse gas emissions in their DoPC, provisionally from 2028 onwards, once a harmonised product standard has been established under CPR 2024. The assessment is that there is no clear gap in the management of construction products. In addition, all manufacturing companies will in the future be covered by the expansion of the EU's emissions trading as part of ETS 2. The next section examines how emissions trading works and what changes are expected in the future.

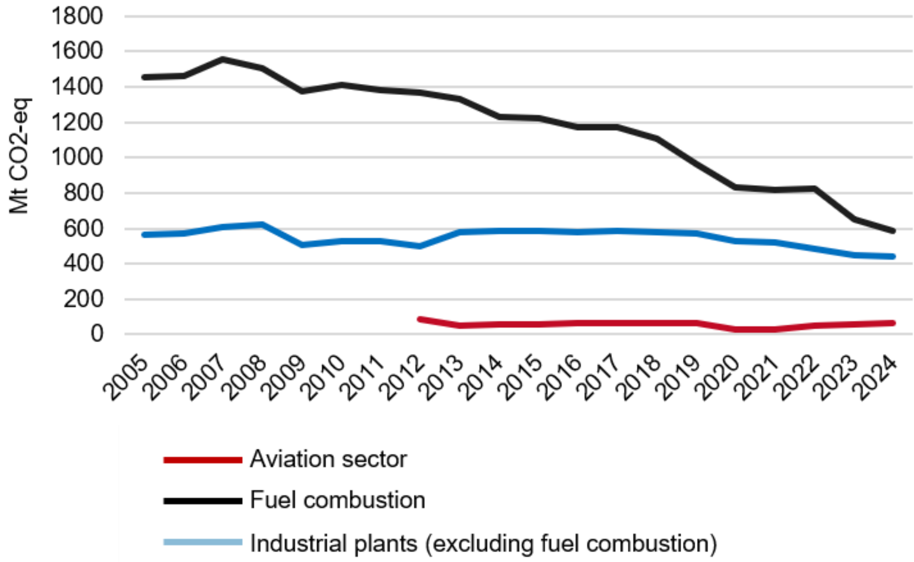
Economic policy instruments within the EU

This section provides a more detailed description of the economic policy instruments that have already been implemented in the EU, how these instruments are planned to evolve, which new economic policy instruments will be introduced in the near future, and how they are expected to interact with the expanded climate declarations and limit values for new buildings under the EPBD.

EU ETS 1

Since 2005, the EU has operated the EU Emissions Trading System (EU ETS, or ETS 1), which sets a cap on a large share of greenhouse gas emissions within the Union, including emissions from emission-intensive sectors related to construction materials and building construction, such as the cement and steel industries. Unlike the EPBD and other administrative policy instruments, the ETS does not regulate emissions through requirements imposed on individual stakeholders. Instead, it creates incentives for emission reductions at source where they can be achieved at the lowest cost. This is accomplished through a market in which emission allowances are traded between stakeholders within the Union. As a result, stakeholders that can reduce their emissions can more easily or at lower cost sell emission allowances to stakeholders for whom emission reductions are more difficult or costly. The price of emission allowances is determined by supply (set by the EU through the emissions cap) and demand for allowances. The objective of the system is to achieve emission reductions at the lowest possible cost by ensuring that reductions take place where they are least expensive. In theory, this means that it does not matter in which sector the emission reductions occur; the end result is the same regardless of whether the reductions take place, for example, in the cement industry or the energy sector. Historically, emission reductions have primarily been driven by reduced combustion of coal, among other things, in conjunction with a transition to renewable energy, as illustrated by the black line in Figure 18 (European Environment Agency, 2025). In recent years, emissions from the cement and steel industries within the EU have also declined, although this is partly attributable to reduced production in the internal market as a result of high energy prices (Marcu, o.a., 2025).

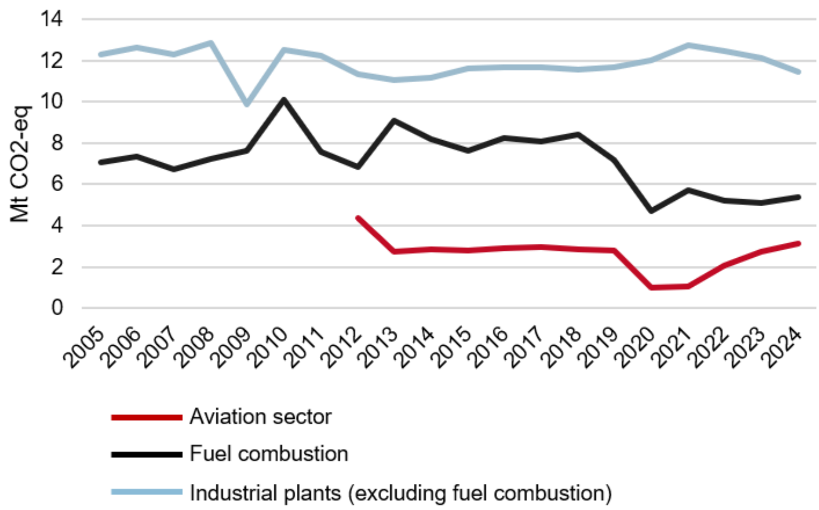
Figure 15. Total verified greenhouse gas emissions in the EU (European Environment Agency, 2025).



Source: European Environment Agency, 2025.

In Sweden, the trend in greenhouse gas emissions has been slightly different, with emissions not declining as consistently, as illustrated in Figure 19. This is not necessarily a concern; rather, it suggests that emission reductions have been less costly to achieve in other countries.

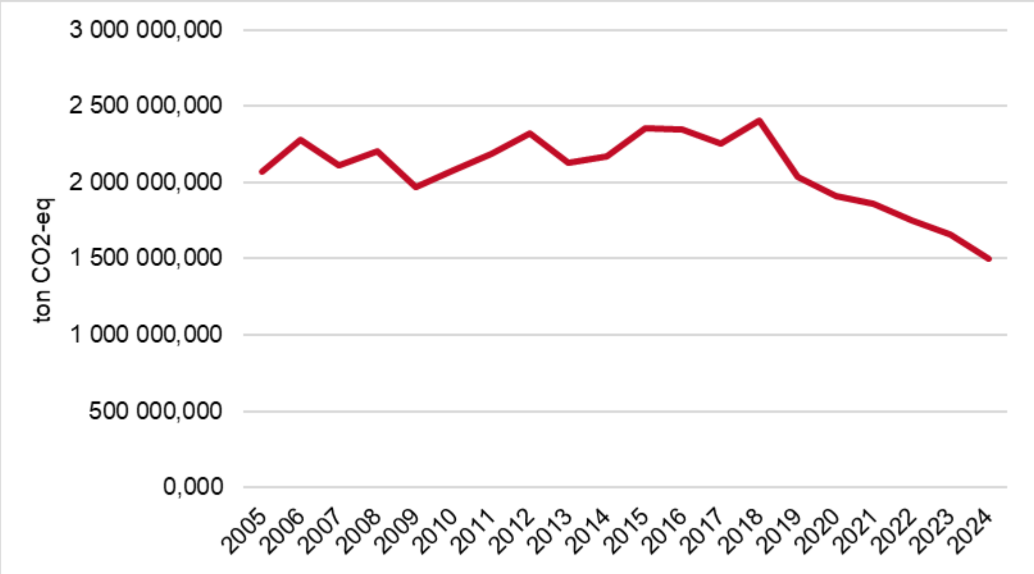
Figure 16. Verified greenhouse gas emissions in Sweden (European Environment Agency, 2025).



Source: European Environment Agency, 2025.

Looking specifically at the cement industry, which accounts for a significant share of the greenhouse gas emissions from the production of buildings in Sweden, emissions from the sector have declined in recent years, as illustrated in Figure 20. However, the extent to which this decline is attributable to reduced production remains uncertain.

Figure 17. Historical emissions from Swedish cement clinker production (European Environment Agency, 2025).



Source: European Environment Agency, 2025.

Emissions from the production of building materials made from steel and cement within the EU are thus already subject to an emissions cap. Over time, this emissions cap will be lowered, which will mean that the price of emission allowances will increase, all things being equal. Building materials with lower greenhouse gas emissions will then become more competitive, as the cost of their emissions will be lower. The higher the price of emission allowances, the more competitive building materials with lower climate impact become. ETS 1 will thus drive the construction sector towards less emission-intensive production, regardless of how stringent the limit values Sweden sets for emissions arising from the construction of buildings.

EU ETS 2

Not all greenhouse gas emissions within the EU have so far been subject to an emissions cap. From 1 January 2027, some of these emissions will be covered by a new emissions trading system, ETS 2. Emissions covered by ETS 2 include carbon dioxide emissions from the combustion of fuels used in road transport, residential buildings and commercial or public premises, farming, forestry, and recreational boating. ETS 2 also covers parts of the energy, manufacturing and construction industries that are not already covered by ETS 1 (Naturvårdsverket, ETS 2 – Utsläppshandelssystem för vägtransporter, byggnader och ytterligare sektorer, 2025), primarily smaller industrial installations that have previously been excluded from the ETS (European Commission, ETS2 Buildings, road transport and additional sectors, 2025). As of 1 January 2025, suppliers and producers that will be covered by ETS 2 have been required to obtain permits and monitor their emissions. However, as trading in emission allowances has not yet commenced, there is currently no market price.

When it comes to buildings in the EU, ETS 2 will primarily have an effect on buildings heated by combustion. The parts of the construction materials manufacturing that have not previously been covered by emissions trading will also be included. Because ETS 2 also covers road transport, it may affect construction processes to the extent they involve transport generating carbon dioxide emissions (it should be noted that emissions from road transport in Sweden are already subject to a price through the Swedish carbon tax).

ETS 2 will overlap with the limit values for building emissions under the EPBD, as emissions from the manufacture of building materials (to the extent that they are covered by ETS 2) and from transport will be accounted for both under the emissions trading system and under the limit values. However, as the limit values apply only to the construction stage, greenhouse gas emissions from the heating of buildings will not overlap.

CBAM

In addition to ETS 1 and ETS 2, another economic policy instrument is in the process of being implemented in the EU: the Carbon Border Adjustment Mechanism (CBAM). CBAM is intended to prevent the ETS from distorting competition between enterprises in the internal market and those outside the EU, thereby reducing the risk of emission leakage, where emission reductions within the EU are offset by increased emissions outside the EU. The system started to be phased in during 2023-2025, during which importers have been required to report the embedded greenhouse gas emissions in imported goods. As of 2026, importers will need to purchase CBAM certificates to cover these emissions. To mitigate the risk of emission leakage, sectors considered to be at high risk receive free allocation of emission allowances under ETS 1. This free allocation includes both the cement and steel industries. In the long term, however, CBAM is intended to replace the free allocation of allowances and this will be done in stages. According to the Swedish Environmental Protection Agency (Naturvårdsverket) (2025), the number of free emission allowances for CBAM sectors will be:

- 97.5 per cent by 2026
- 95 per cent by 2027
- 90 per cent by 2028
- 77.5 per cent by 2029
- 51.5 per cent by 2030
- 39 per cent by 2031

- 26.5 per cent by 2032
- 14 per cent by 2033
- By 2034, the free allocation shall be phased out completely.

CBAM may interact with the EPBD limit values, as greenhouse gas emissions from imports of building materials will both be included in the limit values and, at least in the long term, be subject to a price reflecting the emissions they have generated. From 2034, when CBAM is fully implemented, the cement and steel industries will, in principle, face the same marginal cost of emissions as other sectors within the EU, thereby enabling cost-effective emission reductions (this is a simplified description, as other mechanisms and policy instruments also have an impact). In theory, the emissions from these sectors should therefore be fully internalised even in the absence of limit values for new buildings. When the limit values are implemented in 2030, a large proportion of emissions from the cement and steel industries will still be covered by free allocation. As a result, the cost of reducing emissions will be lower for these sectors than for other sectors covered by the emissions cap until 2034. This effect may be counteracted by the limit values established under the EPBD if they require enterprises to reduce emissions to a greater extent (as a result of changes in demand from contractors/developers) than would have been profitable based on the prevailing market price, including the price of emission allowances. Exactly how CBAM will interact with the limit value depends on the price of emission allowances, and consequently the price of import certificates, will relate to the impact on price and costs resulting from the limit value level.

The Linear Reduction Factor and the Market Stability Reserve

The rate of reduction of emissions covered by EU ETS 1 is determined by the Linear Reduction Factor (LRF). This factor specifies the annual percentage by which the EU ETS cap, i.e. the total number of emission allowances, is reduced. (European Commission, 2024) The LRF is set as follows:

- 2.2 percentage points during the period 2021–2023
- 4.3 percentage points during the period 2024–2027
- 4.4 percentage points from 2028 onwards.

To prevent the price of emission allowances from becoming excessively volatile, the EU ETS 1 includes a Market Stability Reserve (MSR) (a similar MSR will also be established for ETS 2). Put simply, the MSR removes emission allowances from the market when there is an excessive surplus of unused allowances in circulation and releases allowances when the number of unused allowances in circulation is too low. The LRF and the MSR therefore determine the emissions cap within the EU ETS and, consequently, the price of emission allowances. According to microeconomic theory, if the limit values under the EPBD cause companies in the construction and real estate sectors to reduce their emissions more than they would have in the absence of such limit values, demand for emission allowances—and therefore their price—will decline. The lower price would then make it economically attractive for another sector to emit more greenhouse gases, resulting in no net reduction in emissions overall. However, the existence of the MSR means that this outcome does not fully materialise in practice, since reduced demand for emission allowances may instead result in allowances being withdrawn from the market.

Interaction between limit values and economic policy instruments

To summarise, there is an overlap between the EU's economic policy instruments and the limit values. This overlap influences the effects that can be expected from the introduction of limit values. A limit value that is more stringent than the level of emissions that would otherwise result from construction would increase demand for less emission-intensive materials and construction products. However, even in the absence of a stringent limit value, the EU ETS would still influence this demand by internalising the cost of emissions associated with different building components in their market price. Whether the limit values would have a significant impact on greenhouse gas emissions within the EU is questionable, regardless of the level at which they are set. Since emission reductions under the EU ETS are determined by the emissions cap established through the Linear Reduction Factor (LRF), any additional emission reductions resulting from more stringent limit values (beyond those already delivered by the EU ETS) would primarily lead to lower demand for, and a lower price of, emission allowances rather than to further reductions in overall emissions. This phenomenon is known as the waterbed effect, as it resembles the behaviour of a waterbed: pushing down in one place causes it to rise elsewhere. In theory, this would mean that the construction sector would bear a larger share of the cost of emission reductions than is justified from a cost-effectiveness perspective, while other sectors would bear a smaller share. The European Commission states that the purpose of introducing requirements for the calculation and disclosure of life-cycle GWP and limit values for new buildings is to improve the design of new buildings and influence material choices in order to reduce emissions over a building's life cycle. It is possible that the intention is for the limit values to complement the EU ETS by creating incentives for the development of less emission-intensive construction products, materials and construction techniques. Given that the emissions embodied in construction materials and products are already, to some extent, covered by the EU ETS, it is unclear to what extent the Commission has considered alternative approaches for regulating emissions arising during the construction stage. There are, however, several important caveats that may limit the practical applicability of the theoretical reasoning outlined above. Two have already been discussed: the existence of the Market Stability Reserve (MSR) and the free allocation. The presence of the MSR means that emission reductions in the construction sector may result in fewer emission allowances remaining in circulation and, consequently, a lower emissions cap. Furthermore, the fact that both the cement and steel industries have received free allocation of emission allowances means that other sectors have historically borne the cost of emission reductions within the EU. It may therefore not necessarily be unjustified for the construction sector to bear a larger share of the costs of future emission reductions. A third caveat is that more stringent limit values may signal to the market that there will be growing demand for less emission-intensive materials and construction products, thereby accelerating their market introduction as well as research and development aimed at bringing such products to market.

To enable a reduction of emissions from the construction sector, less emission-intensive materials and construction products are required. Such a signalling to the market may thus have practical effects.

Annex 7 – Carbon storage

For carbon storage, the associated benefits and costs arise compared to a scenario in which carbon storage cannot be reported in the energy performance certificate (the baseline scenario). A requirement for a building element to be considered a carbon sink under CRCF[51] is that the building element is built in for at least 35 years. This means that building elements expected to have a service life of less than 35 years are excluded, for example due to weather exposure or normal wear and tear.

The Regulation covers quality criteria, verification and certification procedures, and rules governing certification schemes. Work is currently underway to develop a standard for calculating carbon storage in buildings (DG Clima, 2026). As this work is still ongoing, it is not yet possible to determine the amount of carbon storage that can be expected in an average building. The starting point of the standard is that only additional carbon storage can be counted as a carbon sink. In this context, additional means that only building elements beyond those used in a typical building (the baseline) may be included. There remains considerable uncertainty as to how the baseline should be determined, and, as noted above, the development of the standard is still in progress.

Benefits

The benefit of including the reporting of carbon storage in an energy performance certificate is that building owners can trade carbon sinks. The market for carbon sinks is still developing, and in June 2024 the price of a so-called CEF certificate for timber buildings was approximately SEK 500 per tonne. At the same time, the price of ETS 1 allowances was around EUR 70 per tonne. By 2030, the price of emission allowances will rise and the price of carbon sinks is likely to approach the price of emission allowances. According to the forecast data produced by the European Commission in June 2024, the ETS price was projected to reach EUR 95 per tonne of greenhouse gas emissions by 2030. There is considerable uncertainty regarding both the future price of carbon credits and the proportion of the carbon incorporated into a building that will ultimately qualify as stored carbon. A sample calculation is presented below to provide an overall assessment of the potential significance of carbon credit trading for a building owner.

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[51] Certification for carbon removals and farming (CRCF): EU Regulation (EU) 2024/3012, a voluntary certification framework for carbon removals and carbon farming. The certification framework shall promote and ensure the high quality of carbon removal and carbon capture activities.

Sample calculations

Although much remains uncertain, a rough estimate has been prepared for the reference building Blå Jungfrun[52], which illustrates the approximate order of magnitude. Climate calculations are available for Blå Jungfrun in both concrete and timber construction. The rough estimate of carbon storage is based on the calculations presented in Table 2 of the report *Referensbyggnaden Blå Jungfrun med träbaserade element med lättbalkar och cellulosaisolering* [The Blå Jungfrun Reference Building Constructed with Wood-Based I-Joist Elements and Cellulose Insulation]. Based on a number of assumptions, the assessment concludes that the carbon credit for Blå Jungfrun could amount to an average of 218 kg CO_2-eq per square metre.

To estimate the potential revenue that the sale of carbon credits could generate for the building owner, the assessment needs to be related to the size of the building. The building on which Erlandsson et al. (ibid.) have based their calculations comprises 2,198 square metres of net heated area. The rental value of four similar buildings in the Blå Jungfrun block is approximately SEK 14.4 million (Svenska Bostäder, 2024), of which one quarter is assumed to be attributable to the building in question (approximately SEK 3.6 million). Assuming that the rough estimate can be used to approximate the additional carbon storage, this corresponds to approximately 479 tonnes. If it had been possible to sell carbon credits in June 2024, the revenue could have amounted to approximately SEK 240,000. However, it is difficult to relate to the order of magnitude. Comparing the one-off revenue from the carbon credits in the sample calculation with the rental value, the revenue corresponds to approximately 7 per cent. Note that both the assessment of additional carbon storage and future carbon credit prices are uncertain.

Cost

For enterprises, the cost of including carbon storage in the climate declaration, as proposed in Chapter 9, is deemed negligible. The costs of the proposal will be associated with the adaptation that needs to be made to Boverket's climate database. Furthermore, the possibility to trade carbon credits can have consequences on the construction market by incentivising the choice of building materials that store carbon.

[52] Email from Martin Erlandsson dated 5 December 2025.

Annex 8 – Detailed cost reasoning and sample calculations

Introduction

This Annex brings together the more detailed cost reasoning and sample calculations underlying the summary cost assessments presented in Section 11.7.8. The aim is to provide a transparent account of the assumptions, calculation steps, and uncertainties underlying the orders of magnitude indicated in the main text, without burdening the chapter on impacts with extensive methodological descriptions.

The Annex comprises five main sections:

- examples of training and licensing costs for climate calculation tools
- a sample calculation for additional work with climate calculations linked to limit values
- a range for additional work associated with disclosure of life-cycle GWP
- an illustrative sample calculation of how material choices (solid timber versus concrete) can affect the construction cost.

A fifth part also includes a qualitative assessment of costs.

In addition, an example is provided illustrating how increased construction costs may affect construction volume, together with a table summarising the different cost items. All amounts are in 2024 prices unless explicitly stated otherwise. The calculations are based on questionnaire and interview responses, statistics on building permits, and default rates for time spent and labour costs. The examples are illustrative and should not be interpreted as forecasts or as being precisely applicable to individual projects, but as a basis for assessing orders of magnitude presented in the impact assessment.

Training and licensing costs

Companies will initially need to invest time and resources in training on climate calculations and in acquiring or developing calculation tools. These costs are expected to vary considerably between stakeholders but primarily represent a one-off investment during the start-up phase.

Training costs were not quantified in the interviews, but they can be assumed to be significant in the initial stages. For example, one interviewee reported that it took around 250 hours to develop an in-house Excel-based tool for climate calculations, followed by another 50–60 hours to build up an in-house EPD library.

Regarding annual licence fees for commercial calculation tools, the interviews indicated a range of approximately SEK 5,000 to SEK 200,000 per year. The lower figure relates to an additional climate module integrated into existing calculation software that uses the default values in Boverket's climate database. The higher cost relates to software that both manages calculation and provides access to a comprehensive EPD library.

These costs are particularly relevant in the start-up phase. Once tools, procedures and expertise are in place, both training and licensing costs per project are expected to decrease as volumes increase and work processes become standardised.

Additional work on climate calculations linked to limit values

To comply with a limit value, climate calculations are necessary at several stages during design and tendering. The interviews indicate, among other things, that additional time will be needed to 'piece together' the design so that the building complies with the limit value, as well as to collect EPDs and select materials with lower climate impact.

Based on responses to the questionnaire and interviews, the average additional work associated solely with the limit values is estimated at approximately 40 hours per construction project, in addition to the time required to prepare a climate declaration/disclosure of life-cycle GWP.

To estimate the annual additional cost of climate calculations associated with limit values, statistics on new building permits have been used. During the period 2015–2024, an average of approximately 8,600 building permits for residential buildings and approximately 2,800 building permits for non-residential buildings were issued each year, corresponding to a total of approximately 11,400 building permits annually. This figure is considered a maximum value for the number of buildings that can be subject to a limit value requirement in any given year.

If the additional work amounts to 40 hours per building permit, and an hourly rate of SEK 420 (2016 prices, adjusted upwards using the labour cost index, to 2024 price level), the sample calculation presented in Table 22 is obtained.

Table 16. Calculation of additional work for climate calculations to comply with the limit value (number of building permits for new buildings = maximum value).

		Source
Number of building permits for new buildings (average per year)	11,400	Building Permit Statistics 2015–2024

		Source
Additional work on climate calculations (h/building permit)	40	Survey and interviews
Labour costs, SEK/hour, private sector, 2016	420	(Tillväxtverket, 2017)
Additional cost, SEK million (2016 prices)	192	Calculation
Labour Cost Index	1.22	SCB
Cost of additional work, SEK million (2024 prices)	233	Calculation

This cost is initially borne primarily by contractors, climate consultants, and design firms, although part of the cost is passed on to developers through tenders. The interviews indicate that some contractors include the cost in their administrative overheads, while others explicitly include climate calculations as an item in the tender price, which may ultimately affect rent levels and housing prices.

The number of enterprises that do the climate calculations is likely to be considerably lower than the number of building permits. Large enterprises may have many projects underway at the same time, while smaller enterprises may only have one or a few. Subcontractors are indirectly affected by requirements to provide quantity and product information as input data for the climate calculations.

Additional work involved in disclosure of life-cycle GWP

The additional work associated with the disclosure of life-cycle GWP arises in comparison with the current climate declaration, which covers only the construction stage (A1–A5) and certain building elements. The expanded climate declaration includes both additional life-cycle stages (B, C, and D) and additional building elements (for example, finishes, fixed fittings, and technical equipment).

As it is unclear exactly which default allowances and other forms of support will be available in 2028, two scenarios have been calculated:

- a low scenario, in which EPDs and approved default values are readily available
- a high scenario, in which EPDs are more difficult to obtain and default values are available only to a limited extent.

In the low scenario, the additional work is estimated at around 5 hours per building permit. In the high scenario, the additional work is estimated at around 20 hours per building permit. The calculation is presented in Table 23.

Table 17. Sample calculation with a low and a high estimate of the cost of additional work for the disclosure of life-cycle GWP, compared with the current climate declaration and excluding the limit value (number of building permits for new buildings = maximum value for number of climate declarations).

	Low	High	Source
Number of building permits (average per year)	11,400	11,400	Building Permit Statistics 2015–2024
Additional work on climate calculations (h/building permit)	5	20	Survey and interviews
Labour costs, SEK/hour, private sector, 2016	420	420	(Tillväxtverket, 2017)
Additional cost, SEK million (2016 prices)	24	96	Calculation
Labour Cost Index	1.22	1.22	SCB
Cost of additional work, SEK million (2024 prices)	29	116	Calculation

In addition, there may be additional costs for training and tools. During a transitional period, some manufacturers of construction products and materials may also need to prepare EPDs for product groups where these are currently unavailable, particularly for technical equipment, fixed fittings, and finishes.

Subcontractors (e.g. technical equipment, interior design and groundworks contractors) will need to adapt to new procedures and, to a greater extent, provide quantity and product information to the main contractor or the developer. The time required is expected to be greatest initially and to decrease as information flows, the availability of EPDs and climate databases are established and integrated into design and calculation systems.

Illustrative calculation of increased material costs for solid-timber buildings

To illustrate how material choices can affect construction costs, a sample calculation has been analysed, comparing a multi-dwelling block with a solid timber frame with an equivalent building with a concrete frame.

A Bachelor's thesis from Lund University of Technology (Johansson & Olofsson, 2024)[53] compiles costs for concrete and timber frames. The authors refer, among other things, to one respondent who reported an average price of SEK 4,000–5,500 per m² GFA for a concrete frame for a three-storey building with a 200 m² concrete slab. Another respondent estimates the cost of a solid timber frame at around SEK 20,000 per m² GFA for a similar building. This means a significant increase in the cost of the framework.

In the questionnaire for this study, one developer states that a multi-dwelling block in solid timber is estimated to be at least 20 per cent more expensive than an equivalent concrete building, taking into account both the cost of the frame, the changed amount of concrete required for the foundation slab and shorter construction period. If this estimate refers to the contract cost, and based on 2023 statistics, where the average building price (production cost excluding land) for ordinary multi-dwelling blocks was SEK 35,126/m² of apartment area, the following sample calculation can be made:

- apartment area is converted to GFA using a factor of 1.25 → approximately SEK 28,100/m² GFA
- the contract cost is assumed to account for approximately 53/80 of the building price → approximately SEK 18,600/m² GFA
- a 20 per cent increase in the contract cost results in approximately SEK 22,300/m² GFA
- adjusted to the building price level, this corresponds to an increase in the building price of approximately 13–14 per cent.

If this is interpreted as representative of a stringent limit value (Alternative 1), the limit value could result in cost increases of this magnitude in certain projects. For the intermediate alternative (Alternative 2), the cost increases in typical cases are assessed to be considerably lower, in the order of a few per cent, while Alternative 3 is assessed to be essentially cost-neutral.

However, there are significant uncertainties. The interviews show that the cost increase varies considerably between materials and suppliers. In one case, for example, a price increase of 7–100 per cent is reported for an 80 per cent reduction in emissions, depending on the product. Furthermore, the tightening of the EU ETS is expected to increase the cost of climate-

[53] Johansson, A., & Olofsson, E. (2024). *Trä eller betong som stommaterial för flerbostadshus En jämförelse ur ett miljö-, energi och kostnadsperspektiv*. [Timber or concrete as framework material for multi-dwelling blocks A comparison from an environmental, energy, and cost perspective.] Bachelor's thesis. Campus Helsingborg: Lund University.

intensive materials, which in turn may reduce the price differences between standard and climate-improved products by 2030–2035.

In another questionnaire example, a developer refers to a multi-dwelling block with a climate declaration of 194 kg CO_2eq/m^2 GFA and 82 apartments, where “the project was only 3.5 per cent more expensive than a conventional construction project, despite a longer design period”. If this cost corresponds to the contract cost, the increased design period is not included in this supplement. The example illustrates that part of the increased material costs can be offset through optimisation during the design phase, but that the opportunities to achieve substantial emission reductions without increased costs are limited.

Connection between construction price and construction volume

The sample calculation above can be linked to the literature on the relationship between building prices and construction volume. Previous analyses indicate that a one per cent increase in building prices may lead to a reduction in construction activity of between 0.8 and 6 per cent, depending on the assumed elasticities and whether account is taken of the rental and financing markets.

If a 14 per cent increase in the building price illustrates the cost level for Alternative 1, this may indicate a reduction in construction activity in the order of 4–10 per cent, depending on the extent to which the price increase is passed on and the elasticities applied. The range is wide, and the results are subject to considerable uncertainty.

For Alternative 2, with more moderate cost supplements (a few per cent), the effect on construction volume is assessed to be considerably smaller. Alternative 3, which is assessed to be essentially cost-neutral, is not expected to have any significant effect on construction volume.

As the EU ETS and the CBAM are expected to alter the relative prices between materials with high and low climate impacts, regardless of national limit values, the effect on construction volume will in practice be determined by the combined effect of these policy instruments and the limit values. In this context, the contribution of the limit values may be seen as steering construction towards more climate- and resource-efficient solutions within a development that is already being driven by EU climate policy.

Compilation of cost estimates

Table 24 summarises the key cost items analysed in this Annex: additional work on climate calculations linked to limit values, additional work associated with disclosure of life cycle GWP, and illustrative cost increases at building level for the three limit value alternatives.

Table 18. Sample calculation regarding costs for contractors and developers relating to the disclosure of life-cycle GWP and the 2030 limit value, compared with the baseline scenario.

	Option 1	Option 2	Option 3
Additional work on climate calculations (1)	SEK 230 million	SEK 230 million	SEK 230 million
Additional work on the expansion of climate declarations (1)	SEK 30–120 million	SEK 30–120 million	SEK 30–120 million
Increase in construction costs	+20 per cent	+3–8 per cent	0
Other costs	Training, licences	Training, licences	Training, licences

Note: [1] Based on the maximum number of buildings affected. More time may be required for Alternative 1 compared to the other alternatives.

These orders of magnitude form the basis for the summary assessments presented in Chapter 11, Consequences of the legislative proposal.

Qualitative assessment of costs

Assessment of time required under current regulations

Most companies had a relatively good understanding of the time required to prepare the current climate declarations. According to the interviews, preparing a climate declaration takes approximately one working week, although there is some variation. Some companies reported that it can take up to twice as long, while others stated that it can take just under half that time.

Variables reported to affect the time required include:

- size of the project
- the coverage ratio of the calculations
- whether the enterprise has access to a program that automates the process.

Some enterprises do the calculations themselves while others purchase the service. The cost of procuring the service also varies between projects, with figures ranging from SEK 25,000 to SEK 150,000. The cost of licences for calculation tools also varies considerably, with annual fees ranging from a few thousand to almost SEK 200,000.

In the open questionnaire responses, several respondents indicate concrete cost and time estimates. Respondents indicate that it may require between 40 and 150 hours or more, particularly for the first projects before routines and tools have been established. However, the time required depends heavily on system support and the availability of default data. One respondent states that with established procedures and tools, the time required can be reduced to 15-25 hours. Another respondent states that, if calculation models, BIM systems, and default data are already in place, the work could be reduced from approximately 40 hours to 4 hours per project. Respondents further state that the size and complexity of the project (single-family houses compared with larger projects) affect the time required to prepare the climate declaration.

Assessment of time required for disclosure of life-cycle GWP

Quantifying how the disclosure of life-cycle GWP would affect the time required was considered considerably more difficult than estimating the time required under the current regulatory framework. This is primarily due to the uncertainty surrounding what will be included and the availability of EPDs in 2030.

However, most interviewees considered that the expanded scope would not result in any significant increase in time or costs, if it is made clear:

- which elements are to be included
- what types of values will be accepted (EPDs and default values respectively).

One interviewee specifically raised the problem of how renovations should be handled and that it is common for new owners to make renovations that entail a climate load. The documentation for part B and C of the Climate Declaration is currently undeveloped, and the EPD documentation is inadequate. Several interviewees mentioned that the impact of including Stages B and C in the climate declaration on the workload depends largely on whether default values can be used. If it is permitted to use 100 per cent default values and ready-made default values are available, the additional work is expected to be very limited, as it would then mainly involve entering data. The more project-specific data that need to be collected, the more time the expanded climate declaration will require. Similar reasoning is expressed in the open-ended questionnaire responses. For example, one respondent notes that “adding life-cycle Stages B and C in many cases only requires a few additional hours if default values are used”.

Expanded climate calculation including finishes, fixed fittings, and technical equipment

Regarding the expansion to include additional building elements in the disclosure of life-cycle GWP, the limited availability of EPDs for finishes, fixed fittings and technical equipment is identified as a factor increasing the time required. In most cases, the additional time required is not expected to be particularly significant, provided that supporting data are available. If EPDs and quantity data are readily available, most respondents indicate that the additional time required should not be substantial. At the same time, it is noted that costs for subcontractors may increase if they are required to collect more data. These subcontractors are often small companies with no previous experience of climate calculations, and for them the initial additional workload may be relatively significant until the procedures have been established.

Subcontractors and small enterprises

For enterprises operating as subcontractors providing specific construction services, the inclusion of disclosure of emissions from technical equipment, fixed fittings and finishes will mean that they need to provide data to the construction project on the quantities and climate footprints of the products and materials used. These are almost exclusively small enterprises. They are unlikely to have previous experience of climate calculations, which means that they will need time to familiarise themselves with the information they are expected to provide. In addition, EPDs are currently often unavailable for these product groups, meaning that the subcontractors' own suppliers may in turn need time to develop and make EPDs available.

The time required will therefore depend on:

- the extent to which construction product and material manufacturers produce EPDs and make them available by 2028
- the extent to which standardised elements are developed and approved in the rules.

Similarly to enterprises providing specific construction services, groundworks contractors and foundation enterprises will need to provide the construction project with information on the quantities and emissions associated with ground improvement. The interviewers also asked how the time required would be affected if only ground improvement, rather than groundworks in general, were included in the expanded climate declaration. The responses were like those concerning the time required, namely that, provided documentation is available, the additional time required should not be particularly significant. However, several contractors noted during the interviews that they generally have data on the quantities excavated on a construction site. Nevertheless, groundworks contractors and foundation enterprises are expected to need to spend more time providing information to the construction project than under the baseline scenario, at least during an initial period before more standardised working methods and data flows have been established.

Qualitative assessment of costs for different limit value alternatives

Overall observations from surveys and interviews

Both the questionnaire responses and the interviews reveal variation in respondents' assessments of how each limit value would affect the time required and costs. In response to the questionnaire question on whether the time required for the calculations would be affected, between 50 and 60 per cent considered that the time required would increase. The responses from contractors indicate that almost two thirds consider that the time required for calculations would increase under Alternative 1 and Alternative 2. Regarding additional design work, Alternative 1 stands out in particular, with almost 70 per cent of developers and contractors indicating that it would result in additional costs. The proportion of respondents indicating that the additional cost of procuring materials would increase rises more than proportionally with the stringency of the limit value. Among contractors, almost 75 per cent indicate increased material procurement costs under Alternative 1, around half under Alternative 2, and less than 20 per cent under Alternative 3.

The interviews revealed a general view that it was very difficult to estimate the costs associated with the different limit value alternatives. One contributing factor is that the limit values will not be introduced until 2030 (plus one or more years from the building permit application to the start of construction), making it difficult to predict, among other things, developments in material costs and changes in the available EPDs. Several interviewees also pointed to uncertainty regarding how the inclusion of technical equipment, fixed fittings and finishes would affect the ability to remain below the limit value. Several respondents noted that EPDs for technical equipment and finishes are currently largely unavailable because manufacturers of these types of products are not always accustomed to considering climate impacts in their production processes. It was also noted that the default values previously available for technical equipment and finishes had been high. Against this background, a summary of the interview responses together with the open-ended questionnaire responses regarding the consequences of the three limit value alternatives for 2030 is presented below.

Impact of Alternative 1

Both the questionnaire responses and the interviews show that stakeholders who have come a long way in the transition see positive competitive advantages in Alternative 1. The questionnaire responses also mention potential competitive advantages for the Swedish construction industry. Others point to the risk of unfair competition, with some actors "calculating their way to compliance with the limit value rather than making a real difference" and emphasise the need for effective oversight by the authorities. The interviews made it clear that enterprises working extensively with timber construction were generally more positive towards stricter limit values. However, even some enterprises that do not build in timber expressed support for a stricter limit value, arguing, among other things, that it sends clear market signals and benefits stakeholders that have already invested in climate action. In response to the question of the implications for the insurability of timber structures, it emerged that this is a current issue and that the timber industry, in dialogue with the insurance sector, has developed guidance on robust property protection to facilitate the insurance of multi-storey timber buildings. Some responses state that Alternative 1 will be feasible by 2030 because the industry is maturing rapidly, while others argue that the market, methods and materials will not be fully ready by 2030. Other questionnaire responses mention that it will be difficult to comply with the requirements. One stakeholder already working towards climate targets anticipates only a small increase in costs and time. Another states that they already meet the limit value for Alternative 1 and therefore expect no additional costs. For certain building types with high security requirements, respondents indicate that the limit value under Alternative 1 may not be achievable without adjustments. One respondent asks whether failure to comply with the limit value under Alternative 1 would mean that the building would have to be moved to Group 2. The interviewees also expressed differing views on how difficult Alternative 1 would be to achieve by 2030. Some considered that there should be no difficulty in remaining below the limit value by 2030, while others stated that they did not believe it would be possible for them to compete for and submit tenders for projects with such stringent emission requirements. One representative of small and medium-sized enterprises stated that smaller enterprises are concerned about their survival if Boverket were to adopt Alternative 1 as the limit value for 2030. Regarding costs, the questionnaire responses point, among other things, to longer design periods and highlight that the limit value under Alternative 1 is difficult for small and medium-sized stakeholders to achieve. Several respondents also mention the need for knowledge building and increased collaboration between different roles. The support identified as necessary includes databases, guidance and digital tools. One large contractor states that constructing buildings under Alternative 1 will become significantly more expensive. If project economics become more difficult to balance, this may in turn delay the start of construction. Another respondent notes that achieving a 55 per cent reduction will involve additional costs, although it is difficult to estimate how much. Others express concern that unjustified price increases may affect construction project budgets. There is also concern that insufficient quantities of low-emission products will be available on the market, which in turn could drive up the price of construction materials. The interviews revealed considerable variation in the costs that interviewees envisioned Alternative 1 would entail. Some enterprises were already well advanced, both in terms of the structure of their climate calculations and the emission levels they had achieved, and these enterprises did not expect Alternative 1 to result in any significant cost increases. Others anticipated higher costs relating to design and structural engineering, as well as increased material costs and additional work. It was also noted that a possible consequence for architectural design is that certain material types may be avoided, potentially resulting in more uniform buildings. One respondent suggested that a possible side effect could be a substantial increase in building permit applications before 1 January 2030 to avoid the limit value. Another pointed to a similar issue associated with stepwise tightening.

Impact of Alternative 2

Several questionnaire respondents who mentioned that Alternative 1 would be difficult to achieve considered that, although Alternative 2 requires more time for design and material selection, they regarded the level as manageable. This was highlighted as being particularly important for smaller stakeholders. Alternative 2 also brings a need for competence development.

It is also pointed out that Alternative 2 will not be cost-neutral but would result in cost increases, although not to the same extent as Alternative 1. Respondents who are well advanced in the transition express concern that choosing Alternative 2 instead of Alternative 1 would slow progress and that the industry risks falling behind the roadmap. All interviewees considered that Alternative 2 would be achievable for the enterprises. Some considered that this proposal would not result in any additional costs because their enterprise was already below this limit value. Others considered that it would lead to additional costs and additional work, but not to such an extent that it would threaten the survival of the enterprises.

Alternative 2 was also the proposal advocated by the SME representative.

Impact of Alternative 3

Alternative 3 is identified as the least burdensome alternative for smaller enterprises in the short term, while at the same time carrying the risk that the climate agenda will lose momentum in design and material selection. Several questionnaire respondents dismiss Alternative 3 with reference to the 2050 targets, arguing that there is a risk of slowing progress if the ambition is too low. The questionnaire responses mention that no additional costs would arise as the Alternative 3 level has already been achieved. A similar picture emerged from the interviews. All interviewees considered that they would be able to comply with this limit value in 2030 without incurring additional costs. Several of the enterprises were already well below this limit value in their most recently completed construction projects.

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