Green Finance Institute   Søren Jensen Institute

GFI x SJI Built Environment Carbon Cost Curve

Initial findings on price signals and decision drivers in Danish low-carbon construction

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Why this report exists: This report exists to provide initial market findings for the GFI Denmark x Søren Jensen Institute joint research initiative funded by Realdania and the Laudes Foundation. Insights draw on input from an advisory board of leading Danish developers, investors, engineers and design practitioners, providing direct market perspective on how decisions are made in practice today.

Project Executive Summary

The project seeks to answer under what conditions low-carbon and nature-positive construction choices are financially viable in Denmark and how might future carbon and nature price scenarios impact these.

Project success is the delivery of a technically robust, multi-scenario Marginal Abatement Cost Curve (MACC) that quantifies, at variant level, the incremental cost of low-carbon design choices alongside their exposure to current and anticipated regulatory and market-based carbon price signals (e.g., Danish CO_2 taxation, ETS2 pass-through effects, and compliance with BR18 climate requirements).

The variant analyses will be modelled across multiple time horizons and price trajectories using verifiable lifecycle data calculated in accordance with EN 15978 and compliant with BR18 requirements. Financial assumptions will be transparent and scenario based.

The project is successful when this analysis enables developers, lenders, and institutional investors to:

- Assess cost-competitiveness under tightening climate regulation
- Quantify sensitivity to carbon pricing trajectories
- Incorporate transition-risk exposure into capital allocation decisions
- Prioritise low-carbon materials and design choices over conventional high-carbon alternatives in construction projects

Preliminary research findings

1. **Regulations drive the decision-making process**. Denmark's tightening climate impact limits for buildings leads to material and design choices being primarily driven by compliance rather than carbon pricing.
2. **Low-CO_2 building materials are not necessarily more expensive**; a small comparison of retail shelf prices for three Danish cement products suggests that EU and Danish carbon pricing mechanisms are likely already somewhat reflected in the prices of exposed materials, but are not sufficient on their own to drive substitution in projects.
3. **Project constraints affecting emissions reduction often arise outside the areas directly influenced by carbon pricing**, particularly across design, approvals, procurement, and delivery.
4. **Lack of transparency is a significant barrier**. The absence of project-level data on total low-CO_2 costs maintains conservative material choices.
5. **Long horizon and standardization improve the business case**. Some actors manage to offset the increased costs associated with green material choices – especially those with longer investment horizons and developers with standardized processes.

Initial findings on decision drivers in the Danish built environment

Below is a qualitative synthesis from advisory board discussion and market dialogue. It describes the order in which carbon-related issues currently tend to enter project decision-making in Danish construction.

Figure 1. Danish construction decision hierarchy

Regulatory gate	Can this scheme meet current and future climate impact limits?	**01**
Delivery confidence	Do we know how to build it, with which suppliers, and with a manageable consultancy burden?	**02**
Return preservation	Can the developer preserve margin, protect rental economics, and avoid damaging exit value?	**03**
Strategic upside	Does it improve energy resilience, lower operating volatility, protect future compliance, or strengthen brand and access to deals?	**04**
Carbon price	Is there a clear €/tCO2 or credit revenue signal that impacts the project business case?	**05**

In practice, each level acts as a gate: a project must clear compliance before delivery risk is assessed, delivery before return is tested, and return before strategic positioning is considered. Carbon value enters last because regulation, buildability, and financial return are pass/fail gates for approvals, while an explicit carbon price is used selectively by some advanced actors as an internal tool, not required by any approval process. With further tightening of BR18 climate limits expected in 2027 and 2029[1], lower-emission material choices will increasingly become a pre-requisite for project approvals and permits, rather than a cost-driven decision.

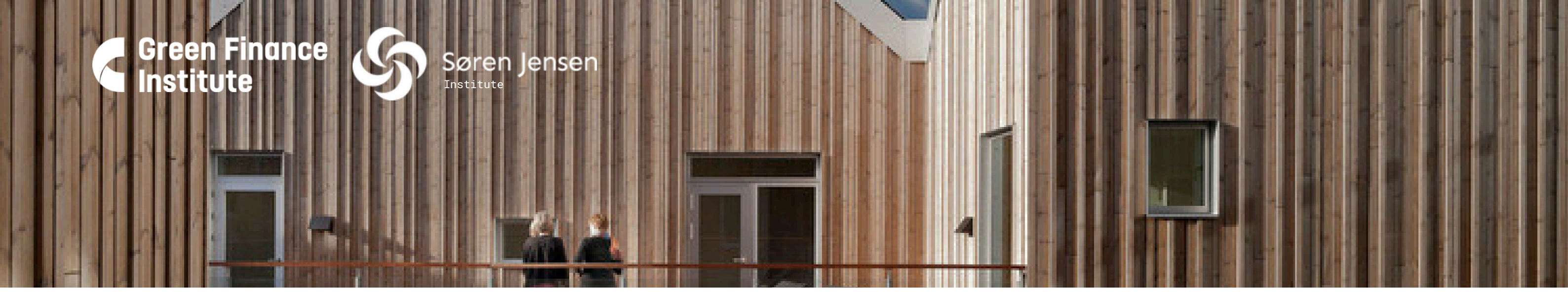
This aligns with the common market assumption across real estate and infrastructure that construction decisions are driven by risk, return, and compliance. The decision hierarchy above adds operational clarity on how these drivers are sequenced in practice, with carbon value consistently treated as a fifth-order consideration within project decision-making.

Project drivers of material and design decision beyond carbon price

If carbon price is not the first decision gate in Danish construction, the next question for the project is to examine where the practical project costs and risk friction exists. Advisory board input suggests this friction often enters after material selection, in the work required to specify, approve, document, insure, and deliver lower-carbon schemes.

> "Projects targeting materially lower embodied carbon can carry additional costs as the industry is adapting to new construction technologies. The additional costs mainly stem from fire protection, noise mitigation, and weather protection. Earlier supply-chain involvement is key to minimize additional costs"
> – ***Johan Madsen***, *Head of Decarbonization at Urban Partners*

[1]Danish Parliament (Folketinget), BR18 climate requirements and planned tightening trajectory (2027, 2029), 2025-26.



Urban Partners, a Nordic investment and development firm, reports that its Copenhagen project Ripple Residence is projected to have construction costs ~20% higher than that of conventional projects, while delivering embodied emissions of ~5 kg CO_2e/m^2/year and maintaining overall commercial viability.[2] Table 1 below provides a high-level overview of the costs not directly impacted by carbon pricing that can enter project economics in lower-carbon schemes in Denmark.

Table 1. Project cost categories not directly impacted by carbon pricing in lower-carbon schemes

Project cost category	Potential implications for cost and decision-making in lower-carbon schemes
Compliance, LCA, and reporting	Additional iteration, documentation, and verification may be required where lower-carbon solutions are less standardised and require more detailed compliance documentation.
Design, engineering, and approvals	More extensive design development and specialist input may be needed where material or system choices differ from standard construction approaches.
Procurement and supply chain	Earlier and more detailed supplier engagement may be required to identify, specify, and validate lower-carbon materials and systems.
Construction execution and site process	Changes to construction methods, sequencing, or site practices may arise where delivery approaches are less standardised.
Testing and technical assurance	Non-standard materials and systems may require additional validation or approval processes, particularly in fire, moisture, and structural performance.
Project coordination and capability	Delivering unfamiliar solutions may increase coordination requirements and place greater demands on internal capability and experience.
Financing and commercial case	Upfront capex and uncertainty around value recovery may influence how projects are assessed within the financial model.
Risk, contingency, and programme	Approval uncertainty and less established delivery pathways may increase contingency requirements and programme sensitivity

While carbon pricing mechanisms can influence certain material prices, they do not capture the broader project cost categories outlined above, which can shape project economics. This distinction can be illustrated using cement as an example of a highly carbon-price-exposed construction material.

Cement products are exposed to carbon pricing through mechanisms such as the EU ETS and Denmark's national CO_2 taxation, which are policy tools designed to push the market towards adopting lower-emission alternatives. Table 2 below shows the retail shelf prices for three same-supplier and strength class cement products across three major Danish retailers.

Table 2. Observed Danish cement prices (material-level, 25 kg bags)

Retailer	Low-CO2 cement (DKK/25kg)	Mid-CO2 cement (DKK/25kg)	High-CO2 cement (DKK/25kg)	Δ vs Mid-CO2 (DKK)	Δ vs High-CO2 (DKK)
10-4	84	84	99	0	-15
Davidsen	100	86	130	14	-30
XL-BYG	85	90	99	-5	-14

Table note: Observed retail prices for Aalborg Portland FutureCEM, BASIS and RAPID (25 kg bags), labelled here as low-, mid-, and high-CO2 cement respectively. Prices include VAT and exclude delivery. Only same-date matched 25 kg retailer observations where all three products were listed are included. A1-A3 embodied carbon (EPD basis): FutureCEM ~454 kg CO2e/t, BASIS ~577 kg CO2e/t, RAPID ~646 kg CO2e/t.[3]

[2]Urban Partners, "Ripple Residence."
[3]10-4; Davidsen; XL-BYG, product listings accessed 26 March 2026; Aalborg Portland, "EPD FutureCEM," 2025; Aalborg Portland, "EPD BASIS," 2025; Aalborg Portland, "EPD RAPID," 2025.

Using Table 2 as an indicative market example of a common construction material highly exposed to carbon pricing, retail price observations indicate that lower-CO_2 cement may be cost-competitive to higher-CO_2 comparators outside of project and procurement economics. However, market uptake appears to be driven primarily by regulatory requirements and supply-side standardization, rather than by an explicit carbon price signal.

Despite rapid adoption into the Danish market since its launch in 2021[4] and strong policy support in Denmark, lower-CO_2 cement types have not yet reached full market penetration and are expected to reach 80% by 2027-2028[5]. This reflects persistent coordination and behavioral frictions across the construction value chain, including designers' preference for familiar, standardized material specifications, fragmented decision-making across project stakeholders, and risk-averse material selection, which together constrain substitution toward lower-CO_2 alternatives.

For the GFI x SJI joint research initiative, this is a useful early insight. It challenges a key modeling assumption in MACCs, which typically assumes carbon price drives market adoption and instead implies adoption is constrained by factors higher in the project decision hierarchy, limiting carbon price's ability to drive material substitution at the project-level. As such, the project must make visible the wider delivery and coordination constraints and value drivers within the decision hierarchy that shape which lower-CO_2 choices clear Danish investment and approval gates.

This raises a critical question: if the main cost drivers sit beyond carbon price's direct sphere of impact, can low-carbon construction still meet required return thresholds? Early evidence from Danish projects suggests that it can under specific conditions. The following examples highlight how these conditions are being achieved in practice.

Examples of how to make low-CO_2 choices financially viable

Two Danish cases suggest that materially lower embodied carbon can be commercially workable under specific conditions. Urban Partners reports that Ripple Residence is expected to still achieve commercial viability through financing, sales, and construction efficiencies. Home.Earth positions Nærheden[5] as a record-low carbon multi-storey residential project and links performance to a long-hold ownership model, repeated delivery capability, and early design control. These are case signals, not market averages.

> "Lower-carbon construction becomes easier to justify when you can capture value over time, not only at handover. Ownership model, procurement discipline, and repeat delivery capability make a real difference to what is commercially possible."
> – **Dan Pham**, Co-Founder Sustainability, Home.Earth

Both cases share structural traits: long-hold ownership, repeat advisor teams, early procurement control, and tighter supply-chain partnerships. These are not incidental. They are the conditions under which delivery-level costs compress and the financial case for lower-carbon construction begins to close.

For the GFI x SJI Built Environment Carbon Cost Curve, these examples indicate that financial viability is shaped by project delivery and coordination dynamics at earlier decision stages rather than carbon price alone. The next stage of the project will apply variant analysis and cost-abatement modelling to real buildings to quantify how these dynamics, together with carbon and nature monetization, affect the competitiveness of low-CO_2 design choices.

[4] Aalborg Portland, "FUTURECEM™ launch," 2021.
[5] Børsen, "Nye krav til byggeriet brænder igennem hos cementgigant," 2025.
[6] Home.Earth, "Bæredygtighed Nærheden"; BygTek, "Rekord: Nybyggeri i Nærheden har 4,7 kg CO_2 pr. m2."

Appendix

A1. Scope and interpretation
This brief presents initial findings from Track 1 of the GFI x SJI Built Environment Carbon Cost Curve. It is not a full market-wide cost curve, sector-wide price survey, or procurement benchmark.

The decision hierarchy is a qualitative synthesis based on advisory board discussion and market engagement. It is intended as a practical framing tool, not a statistically representative ranking.

Case examples and quoted cost signals are project-specific and should not be interpreted as market averages. Additional costs in low-carbon construction can arise across design, procurement, compliance, delivery, and financing, and are not fully captured by material-level price observations.

A2. Price comparison method and boundary
Table 1 is a narrow indicative retail-channel comparison designed to test whether lower embodied CO_2 is reflected in transparent Danish cement list prices.

The comparison covers three Aalborg Portland grey cement products sold in 25 kg bags and presented in the report as low-CO_2, mid-CO_2, and high-CO_2 cement. The underlying products are FutureCEM, BASIS, and RAPID. They were selected because they are from the same domestic producer, sit in the 52.5 strength class, are sold in the same bag format (25kg), and can be observed through the same public Danish retail channels. This makes them suitable for an indicative retail-channel comparison across a carbon gradient, but not fully functionally identical across all projects and use cases.

Only same-date retailer observations where all three products were publicly listed in 25 kg format were included in the headline sample. Prices were captured on 26 March, 2026. Reported prices are public list prices including VAT and excluding delivery.

Product carbon values are based on official 2025 Aalborg Portland EPDs using A1-A3 product-stage values only: approximately 454 kg CO_2e/t for FutureCEM, 577 kg CO_2e/t for BASIS, and 646 kg CO_2e/t for RAPID. These values are used only to establish the relative carbon gradient in the comparison and should not be interpreted as whole-building or lifecycle emissions.

Public ready-mix evidence was reviewed separately and not combined with bag-channel pricing, as ready-mix is quoted per m^3 and may differ in VAT basis, delivery, pumping, admixtures, and site-specific adjustments.

The comparison does not represent bulk ex-works cement pricing, negotiated contractor procurement pricing, ready-mix invoice pricing, concrete mix equivalence, or project-level cost. It also does not derive abatement cost from retail bag prices, because retail shelf prices and A1-A3 EPD values do not share the same commercial or system boundary. Any such analysis would require primary commercial data.

A3. Technical notes
- 1 tonne = 40 × 25 kg bags.
- Δ (DKK/t) = Δ (DKK/25 kg) × 40.
- CO_2 reduction values reflect A1-A3 product-stage differences only.
- Regulatory compliance in Denmark is assessed using defined lifecycle modules. Product-stage emissions and construction-stage emissions are assessed separately.