KEINO Competence Centre for Sustainable and Innovative Public Procurement

HIGH REDUCTION POTENTIAL

Buildings and building construction

The realisation of emission reductions in procurements is affected by

- The magnitude of emissions from construction and buildings and the main sources of emissions, such as energy and materials
- Low-carbon options for procurement and low-carbon solutions and procurement models on the market
- Existing criteria, tools and means to determine and verify low-carbon solutions
- The know-how of the procurer as well as other existing objectives and boundary conditions of the procurement

Prerequisites for low-carbon construction

Prerequisite	Why is it important?	What enables implementation?
Commitment to / aim at low-carbon construction	Construction is responsible for a large part of the municipality's emission reduction potential and affects how the municipality achieves its climate targets.	• Management engagement • Enough time to prepare the procurement • Taking life cycle costs into account • in addition to the investment cost
Cooperation between sectors; for example, construction and transport solutions	Creating sensible overall solutions	• Already at the beginning of the project, a planning meeting and, if necessary, several meetings during the project, involving the relevant persons (from the point of view of the project) from different sectors.
Competence in acquiring low-carbon buildings	A low-carbon nature is not realised unless the goal of low carbon guides the planning from the very beginning. By skilfully setting low-carbon criteria and describing the price-quality ratio, it is possible to make a building both low-carbon and otherwise high in quality (e.g. healthy, functional, low-cost, architecturally impressive).	• Defining the party responsible for the climate impact of construction procurement • Enough time reserved for project preparation • Willingness to engage in market dialogues • Sparring available e.g. • trough the KEINO competence network • or another body of experts • Possibility to procure as a purchasing service, for example, from a life cycle consultant

Emission reduction measures and their emission reduction potential*

Public construction and the energy consumption of buildings cause more than half of the carbon footprint of Finnish public procurement. The building stock is renewed at an annual rate of 1–2%, so emissions from existing buildings must also be reduced quickly. Taking into account Finland's carbon neutrality targets, the average heating energy demand of existing buildings must decrease (from the 2020 level) by 2030 in approximately same proportion as that of new buildings, by about 12–23%, depending on the building type.

In public construction, the highest possible and cost-effectively feasible life cycle emission reduction should be pursued. With cost-effective energy repairs in terms of life cycle and replacement of heating systems, in-use emissions of existing buildings can be reduced by more than 80%.

The low-carbon nature of the life cycle of buildings can be most strongly influenced at the planning stage, and the opportunity to influence decreases as the project progresses. The most significant measures in the design of low-carbon construction include:

- reuse of old building and reducing the need for construction (80–100%)
- energy efficiency solutions (~80%)
- main heating system based on renewable energy, e.g., heat pumps (30–50%)
- low-carbon material choices (10–15%)

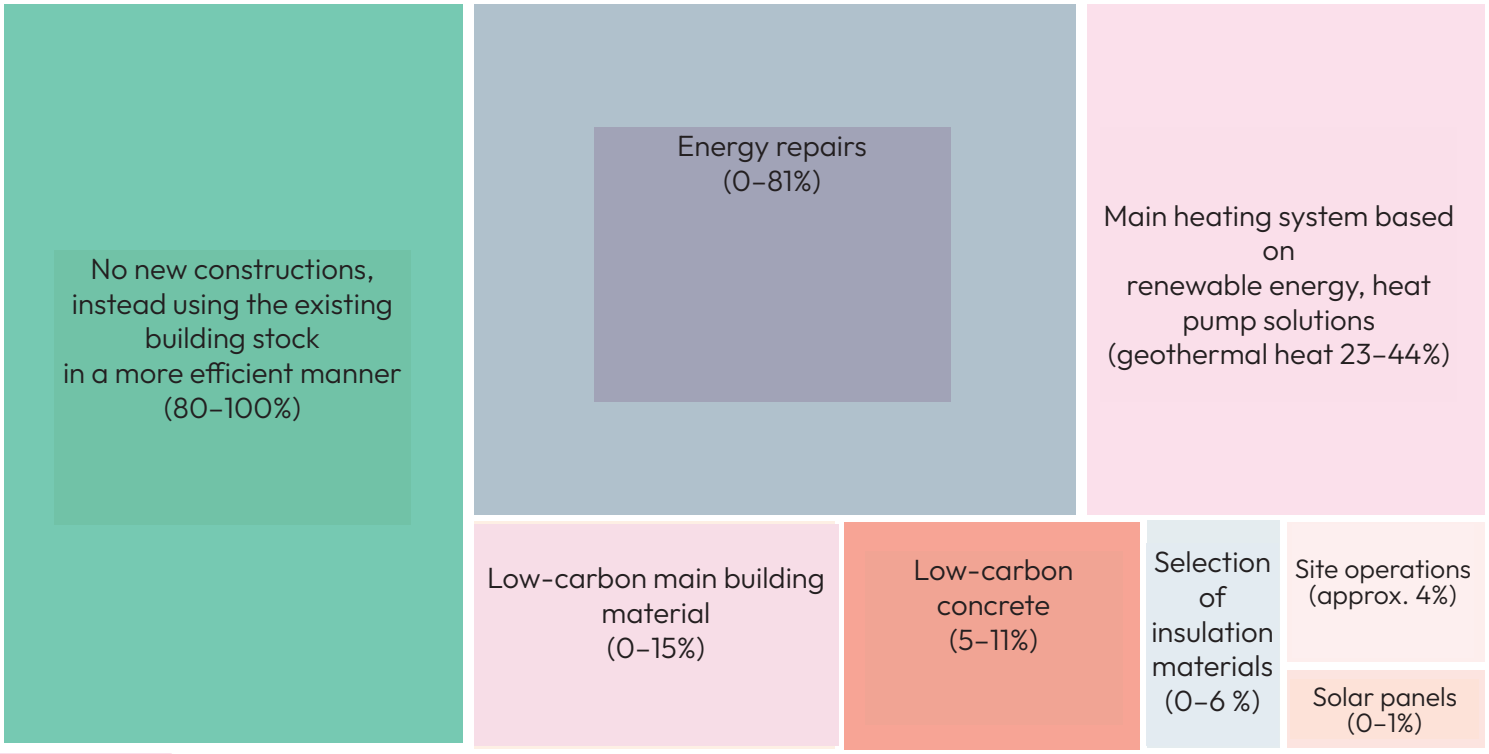

Image. Emission reduction potential of low-carbon measures*

*) The estimation of the emission reduction potential is based on individual case studies in which emission reductions indicated by percentages have been achieved for the measure in question. The percentages describe the difference to the alternative solution presented for the applicable life cycle stage(s), depending on the case. However, the amount of emission reductions depends on the entity, circumstances and starting data, so the percentages are only indicative and cannot be directly generalised or compared with each other. References: Siiskonen et al. 2022; Sankelo & Alhola, 2020.

Measures for planning, tendering and monitoring a low-carbon building

Measure	Impact on low carbon	Matters to consider in the procurement	Feasibility of implementation in practice
Heat pumps are used as the main heating method (geothermal heat, air-water heat pump, also e.g. lake heat)	• Heat pumps are used as the main heating method (geothermal heat, air-water heat pump, also e.g. lake heat)	• For geothermal heat (or lake heat), a suitable plot is required, but an air-to-water heat pump can be installed on a wide range of plots. • Support heating (e.g. district heating) may be required. • Optimisation can help to find the best dimensions for heat pumps.	• The procurement must emphasise affordability and low carbon during the life cycle. • Attractive especially in areas that are not covered by district heating. • Cannot be implemented if there is political opposition in the municipality to the weakening of the position of district heating.
Wood is selected as the main building material of the frame	• Geothermal heat is a cost-effective way to reduce the building's carbon footprint.	• The wooden structure can already be recorded in the project plan. • Sufficient time must be reserved for the planning phase. • Wood construction is estimated to increase the price compared to concrete construction by 0–10%.[1] • For wooden blocks of flats, an accentuated start-up subsidy is granted.	• The municipality's strategic decision promotes wood construction, which in turn promotes the achievement of the emissions target. • Implemented if the procurement aims at healthy and safe indoor conditions. • Not implemented if municipal decision-makers are not in favour of wood construction.
Building's energy efficiency	• Geothermal heat can also be utilised for cooling during warm seasons.	• For geothermal heat (or lake heat), a suitable plot is required, but an air-to-water heat pump can be installed on a wide range of plots.	• Implemented if the procurement emphasises life-cycle costs; energy efficiency reduces operating costs. • Not implemented if it is feared that energy efficiency above the regulation level will lead to "bottle houses" and indoor air problems.
Fossil-free or emission-free construction site	• The impact on the entire life cycle carbon footprint of a building can be moderate, about 4%. • Reduces emissions during the construction phase and can improve air quality at the construction site as well as reduce noise. • Creates more demand for fossil-free machinery and supports the industry's transition to zero-emission practices.	• Fossil-free and emission-free construction sites are different things, fossil-free is an easier prerequisite (it is allowed to use biodiesel in work machinery). • Simple to record in tendering documents. • The Finnish national green deal provides a framework, but can also be implemented without involvement.	• Implemented when the goal is to reduce particulate emissions and noise, especially at city centre construction sites. • Implemented when the measure is seen as a cost-neutral way to reduce emissions during the construction phase. • Not implemented if there is a fear of receiving few tenders.
Utilising solar energy	• Photovoltaic production can reduce the life-cycle carbon footprint by approximately 0–1%.	• The procurement must emphasise affordability and low carbon during the life cycle	• Implemented when the procurement has a target for the utilisation of own renewable energy. • Cannot be implemented in a repair location that does not have a suitable installation area.

1) Kangas et al. (2019):

Measure	Impact on low carbon	Matters to consider in the procurement	Feasibility of implementation in practice
Multi-objective optimisation as part of energy planning	• Multi-goal optimisation can help to find energy solutions that reduce both emissions and life cycle costs.	• The selection and sizing of the main heating system should be included in the optimisation, as well as other possible energy solutions extensively.	• Implemented if optimisation is seen as an investment that pays for itself.
RTS environmental classification required for the building	• The size of the impact will depend on which rating you aim for (1–5 stars)	• The decision to apply for the certificate must be made early enough in the project planning process.	• Implemented when there is a will to create a low-carbon "flagship destination". • Not implemented if it is feared that the certificate will increase investment costs.
Calculation of the carbon footprint	• Provides a concrete measure for assessing planning options and tenders. • Can help reduce project emissions, especially in cases where the tendering process is desired to be technology-neutral, or if, for example, concrete has already been chosen as the main building material.	• Tenderers must be instructed in detail on the calculation of the carbon footprint (method, tool, review limits and time period) in order to make tenders comparable. • It is not necessarily worth setting overlapping criteria: if there is a target in terms of energy efficiency, the carbon footprint calculation can only be done for building materials.	• Implemented if there is a will to find low-emission alternatives in a technology-neutral way. • Not implemented if there is no certainty about how carbon footprints should be scored. • Not regarded necessary if the project already has targets for both energy use and emissions from building materials (e.g. a building with wooden structure and geothermal heating).
Verification of the carbon footprint after the completion of the building, improvement during the contract period (e.g. energy efficiency measures)	• The impact on energy consumption during use may be significant, depending on the case. • The correct adjustments of the systems (air exchange, temperature) have a major impact on indoor conditions and the functionality of the building.	• Requires measurement of conditions and energy systems, as well as expertise to carry out monitoring. • The handover phase of the building is important, as is quality assurance and user guidance.	• Implemented if taken into account already at the tendering stage. • Not implemented if the procurement model or options do not support development during the contract.

The low-carbon nature of buildings can be demonstrated by various means

The Ministry of the Environment's national carbon footprint calculation method and carbon footprint assessment tool are based on EN standards and the European Commission's Level(s) method. The assessment method is intended to be used to assess the carbon footprint of new buildings and large-scale repairs. It covers the manufacture, transport and construction site emissions of construction products, the use and maintenance of the building, as well as demolition and recycling.

» The Ministry of the Environment's national carbon footprint calculation method and carbon footprint assessment tool (in Finnish)

The low carbon nature of the materials can be assessed with the help of the Emissions database for construction . It contains average emissions data for construction products and construction processes and services in use in Finland.

» Emissions database for construction (In Finnish)

Many existing certificates and the Environmental Product Declarations (EPD) system are also suitable for assessing and verifying the environmental impact of buildings. Below are a few examples

» The Nordic Swan Ecolabel criteria for buildings (in Finnish)

» RTS environmental rating

» LEED certificate

» BREEAM certificate

» EPD (Environmental Product Declaration)

KEINO Competence Centre for Sustainable and Innovative Public Procurement

KEINO is a consortium whose various areas are implemented and jointly developed by Motiva Oy, VTT Technical Research Centre of Finland, Business Finland, Finnish Environment Institute SYKE and Hansel Oy.

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