European Commission

GPP In practice

Issue no. 104
May 2021

Procurement of low-carbon residential buildings using life-cycle assessment criteria

City of Helsinki (Finland)


Image: City of Helsinki Material bank / Lauri Rotko

Background

Helsinki is the capital city of Finland and its metropolitan area is home to more than 1.5 million inhabitants. The City is currently implementing the Carbon Neutral Helsinki 2035 Action Plan, which directly targets the most greenhouse gas (GHG) emitting areas of the City: heating of buildings, electricity consumption, and traffic.

The City government is striving to finds ways to mitigate the effects of climate change through public procurement. In this context, Helsinki has (since 2019) been selecting several pilot projects where the carbon footprint is measured and sustainable procurement criteria are included. The City is working towards improving existing and developing new procurement criteria that consider life-cycle impacts of the product/service, circular economy and climate challenges. The end goal is to support Helsinki's carbon neutral actions and achieve carbon neutrality by 2035.

This low carbon building construction project – called the Asetelmakatu DB project - represents one of the pilot procurements connected to the EU Life funded Towards Carbon Neutral Municipalities and Regions (CANEMURE) project.

Procurement objectives

The procurement was intended to reduce the project's climate and environmental impacts by setting several minimum requirements and evaluation criteria to steer the design and the construction. The central goal was to find out what kind of a steering effect could be achieved by scoring the carbon footprint of the project as part of the procurement. In practice, this means that in addition to increasing energy efficiency and use of renewables, the aim is to minimise the emissions of construction and material production.

The procurement focused on an ambitious 'design and build' project (same 'supplier') of apartment buildings located in the northern part of Helsinki - the new Kuninkaantammi residential area. This is a place where biodiversity, circularity, energy efficiency, renewable energy production and sustainable constructions come together.

The preparation of the procurement involved several experts: an HVAC (heating, ventilation and air conditioning) planning manager, a developer architect and a project manager from the City's Housing Production Department. They were supported by experts from the CANEMURE project and by climate specialists from the City's Environmental Services. The Finnish Environment Institute and Motiva were consulted for the low-carbon aspects and Bionova for the carbon footprint calculation.

In order to reduce the climate impact, the chosen supplier was required to have an ambitious attitude towards achieving a low-carbon solution for the design and implementation of the Asetelmakatu project. One of the goals of the tendering was to produce as small an E-value and carbon footprint as possible, and various minimum requirements and recommendations were used to reach that goal. The Asetelmakatu zoning regulation already required the buildings to have a primarily wooden structure and to apply the principles of low-energy construction.

The solution had to consider the life-cycle emissions of the buildings (using the Bionova One Click LCA tool) and the construction site was required to be fossil fuel free.

Criteria used

Subject matter of the contract:

The procurement concerned the design and construction of four high-quality and low-carbon wooden blocks of flats, with an underground parking space.

Following an introduction to the technical description of the project, the tender documents described how the project is linked to the City of Helsinki's Carbon Neutral Helsinki 2035 Action Plan.

"The project provided valuable experience with using the carbon footprint as a procurement comparison criterion."

The aim was to design a site where the functional, aesthetic, technical and economic requirements are addressed in a balanced way, taking into account the climate perspective.

Selection of candidates:

Tenderers were required to provide information about their externally verified environmental management system.

Technical specifications:

For the buildings, the following sustainability requirements were applied:

- The load-bearing frame of the facilities must have a primarily wooden structure;
- Wooden materials are required both in the indoor and outdoor parts of the buildings, taking into account fire safety issues.
- The facades must have a primarily wooden coating.
- The sites must be planned and implemented so that the building-specific E value is ≤ 75 kWhE[1]/m^2 - corresponding to energy efficiency class A.
- The buildings must use renewable energy and they must be at least equipped with a solar power system. Alternative renewables are recommended, such as geothermal and/or solar heating and/or waste water heat recovery.
- A charging station for electric cars must be built in the parking garage.
- A centralised supply and exhaust air ventilation system equipped with a heat recovery function must be set up.
- The heating control system must refer both to the outdoor temperature and to weather forecasts.
- The annual degree of efficiency of ventilation systems must be at least 70%. The SFP (specific fan power) value indicating the electrical efficiency of the ventilation system must be ≤ 1.6 kW/(m^3/s).
- The design must favour sustainable solutions and materials.
- The apartment buildings and the parking hall construction site of the project must be implemented in a fossil fuel free manner.[2]

1 The energy efficiency value (E-value) is calculated on the basis of total annual delivered energy consumption (based on standardised use) multiplied by the energy carrier factors of the building's net heated area. It consists of the energy consumed through the heating, ventilation and cooling systems, system auxiliary units, consumer equipment and lighting minus the internal (people, devices) and external heat gain. The figures used as the energy carrier factors are provided under the Land Use and Building Act. For example, for district heating it is 0.5, electricity 1.2 and renewable energy 0.5. The energy efficiency category of the building (A–G) is determined according to the E-value. The best (most efficient) energy category is A. The measure unit is kWhE/m^2,a, where the E stands for equivalent.

2 In the context of this procurement, 'fossil fuel free' means that all worksite machinery is either electric or powered by biodiesel compliant with the EN 15940 (HVO/BTL) standard or similar. The use of worksite machinery powered by other types of fuel must be separately approved by the client. However, if a decision is made to connect the plots to the district heating network (as a source of energy supply for the buildings), then district heating may be used during the construction project

Award criteria:

Tenders were evaluated according to a scoring method based on points according to qualitative criteria (up to 50 points) and quantitative criteria (up to 50 points):

Quality: 50 points in total (50%), split as follows:

a) Life-cycle carbon foot print (residential buildings, parking hall and yard deck): 14 points
b) Energy efficiency (E-value) exceeding the minimum requirement: 6 points
c) Architectural and technical quality: 30 points

Price: 50 points in total (50%):

Regarding point a) Tenderers were required to calculate the project's carbon footprint using the Bionova One Click LCA tool (the tool was shared with bidders; a user manual and training sessions were also provided). The assessment of the carbon footprint is carried out in accordance with the EN 15978 standard and the Finnish Ministry of the Environment's Method for the whole life carbon assessment of buildings. The latter is based on the European Commission's Level(s) method and European standard (EN 15978).

"In order to ensure that the environmental and climate criteria selected for the scoring have a real impact and tenderers also see investing in them as sensible, the criteria must be given sufficient weighting. Based on the experiences from Asetelmakatu, the weighting should be at least 20% in similar competitions."

Contract performance clauses:

The achievement of a carbon footprint corresponding with the offer will be monitored during the construction project. During the contract period, the carbon footprint will be calculated twice: first during the planning phase and later, after the construction is completed, and both calculations must be equal to or better than at the bidding stage. The verification of the calculation is performed at the expense of the contracting authority. If the calculation carried out after the end of the construction phase does not achieve the promised performance, the contracting authority has the right to demand a penalty of 50,000 euro.

As far as the construction site is concerned, a fossil fuel free construction site is required during the construction phase.

Results

The tender documents were prepared during May-June 2019; the call for tenders was launched in August 2019 and remained open up to December of that year. The preliminary agreement with the supplier was signed in September 2020. The design phase is currently ongoing and the construction is expected to start in October 2021. The procurement value is approximately 23 million euro.

As the market of wood construction builders is relatively small in Finland, only two bids were received. Both tenderers provided very similar values in regards to the carbon footprint. In the evaluation process, both tenders were assessed not to meet all of the minimum requirements of the request to tender and the client entered a negotiated procedure. In this phase, the proposal with more ambitious climate goals (including geothermal heating) dropped out, but ultimately all parties were happy with the agreement that was reached, and an architecturally ambitious solution from an operator specialising in wood construction was achieved.

In terms of costs, the wooden materials requirement raised the price of the procurement to a degree, whereas the environmental criteria did not affect prices. The estimated size of the entire construction is 7,000 m^2 (floor space).
In terms of the LCA tool used, the OneClick LCA Tool is considered to be suitable for scaling and is used elsewhere, but it is licensed (not free to use). As this tool is widely used in Finland, suppliers are adapting to it. OneClick LCA has both building and infrastructure packages.

The higher prices in wooden apartment buildings, compared to concrete buildings, are due to sprinkling requirements, weather protection during construction and higher design costs. On the other hand though, the shorter construction time needed for wooden apartment buildings reduces the price. Due to these factors, it is estimated that the difference is about 5-10 percent in favour of concrete. This estimation is based on one made for another project (also situated in Kuninkaantammi), where practically identical concrete and wooden buildings were compared. The same goes for the differences in emissions. More information (in Finnish) **available here**.

Environmental impacts

In this case, the environmental criteria used in the comparison did not work exactly as hoped. The environmental criteria applied to the procurement as minimum requirements played an important role in reducing the environmental impact of the buildings. The wooden structure requirement of the project, the carbon footprint estimation and the low E-value, as well as the requirements for renewable energy and a fossil-free worksite, are particularly important in reducing the greenhouse gas emissions resulting from this particular type of procurement.

Buildings will be energy efficiency class A and E-values of the buildings (72, 73, 75 and 75) are well below the regulated level (of 90). Equipping them with solar power systems will increase the share of renewable energy sources and can cover about 10% of the building's electricity use. This type of system is also utilised in electric car charging stations. District heating will be used to supply the buildings with energy. There have not been any exact calculations of the carbon emission savings derived from the construction materials, but it is estimated that material-related emissions in wood construction can be approximately 20% less than for concrete constructions.

In addition, the environmental criteria used served to communicate the City of Helsinki's ambitious climate goals to the market.

Lessons learned

Market dialogue is essential: Due to the urgent procurement schedule, a dialogue with the market was not carried out in the pre-procurement phase. Ordinarily, it would have been important to listen to the market at least in the form of an information request, as environmental and climate criteria that were new to the procurement unit were included in the procurement, such as the tendering phase carbon footprint calculation and the criteria for a fossil fuel free worksite. Utilising market dialogue is seen as essential in the future, especially when introducing new criteria.

Low-carbon construction is the way forward: The project provided valuable experience with using the carbon footprint as a procurement comparison criterion. In future, it will be surveyed how the carbon footprint can be used as comparison criterion **in plot conveyance competitions**, for example. Additionally, it would be interesting to test the carbon footprint estimation in a location without the wood construction requirement. The fossil-free and low-emission worksite criteria will be applied in the future at all construction sites of the City of Helsinki. More information **available here**.

Sufficient emphasis must be placed on the climate criteria: In order to ensure that the environmental and climate criteria selected for the scoring have a real impact and tenderers also see investing in them as sensible, the criteria must be given sufficient weighting. Based on the experiences from Asetelmakatu, the weighting should be at least 20% in similar competitions.

Main information source:

This GPP Example was prepared based on the Case Study published through the CANEMURE (Towards Carbon Neutral Municipalities and Regions) project.

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Related information:

The EU GPP criteria for buildings are currently under revision – you can follow the process here.

Guidance on the EU Level(s) framework is available here. Links to the 2016 European GPP criteria for Office Building Design, Construction and Management and the Technical Background Report and Procurement practice guidance document are available online.