

BACKGROUND INFORMATION

PROCURER City of Helsinki

OBJECT OF PROCUREMENT

The site being renovated is a rental housing location at Kontulankaari 11 owned by the housing company Helsingin kaupungin asunnot Oy (Heka). The project consists of three eight-story buildings constructed in 1969–1970. The buildings have 288 flats and 18,304 living square metres in total. The developer and party in charge of the tendering process is the City of Helsinki's Housing Production Services (ATT). This case study covers the project planning and general planning stages and the reviews carried out in connection with them. Tenders for the renovation contract will be invited in autumn 2021.

PROCUREMENT VALUE

Total cost estimate of the renovation project prior to the contract calculations: ~ 47.4 million euro
Multi-objective optimisation carried out in the project planning stage: ~ 23,500 euro
Reuse review and plan carried out in the general planning stage: ~ 4,000 euro

PROCUREMENT PROCEDURE

Open procedure



Objectives: improving energy efficiency and promoting circular economy

The objectives of Heka and ATT steer the renovation projects regarding things such as the use and production of renewable energy, recycling of construction waste, promoting sharing economy and improving accessibility, without forgetting the requirements for quality and cost. The primary purpose of the renovations is to prolong the buildings' service life.

Both Heka and ATT implement the Carbon-neutral Helsinki 2035 Action Plan in their operations and aim to reduce the emissions from the City's rental housing, particularly through improving the buildings' energy efficiency. The renovation of Kontulankaari 11 sought the most cost-efficient solution to significantly improve the site's energy efficiency and reduce its lifecycle carbon footprint. The desire was also to promote circular economy in the project planning stage through a reuse review and plan.

By surveying and testing various options that take the climate and circular economy objectives into account, the aim was to increase awareness of low-emission and resource-wise reconstruction at city level, since there are only a few practical experiences of using carbon footprint calculations, energy optimisation and circular economy solutions in renovations.

Experts involved in the development work

The client for the renovation project was Heka eastern office, and the developer ATT was in charge of implementation of the renovation process. The experts of the Canemure project

participated in the development work during the renovation project, which involved a host of experts from institutions such as Aalto University, the Finnish Environment Institute (SYKE), the HYPPY project of Metropolia University of Applied Sciences, the Reuse Centre, the KEINO developer group for low-carbon construction, and the facility and environmental services of the City of Helsinki. The energy optimisation was implemented by Granlund Consulting Oy, while the reuse review and plan was prepared by Sitowise Oy.

The project yields information to support emissions reductions and resource-wise operations

Most emissions produced by Helsinki residents come from the heating and electricity consumption of buildings. Influencing these is key in the City's objectives of achieving carbon neutrality by 2035. Reducing the heating energy consumption of the existing buildings through renovations that improve energy-efficiency is not only a significant emissions reduction measure, but also a cost-effective one in the long run.

In addition to energy efficiency, the City of Helsinki also promotes aspects such as the utilisation of demolished and recycled materials, use of low-emission machinery, lower water consumption, increasing the proportion of renewable energy, local heat and electricity production, and heat recovery from exhaust air and wastewater in its renovation projects.

In the renovation of Kontulankaari 11, the aim is to meet the objectives set in the best possible way and produce information about various low-emission and circular economy solutions. The renovation project is a case study included in the Towards Carbon-neutral Municipalities and Regions project (Canemure), the aim of which is to implement the procurements of the City of Helsinki in a low-carbon fashion and review the suitability of carbon footprint calculations for the direction of procurements. The objective is to achieve successful cases as examples and to produce applicable tools to support the City's carbon neutrality measures.

The market is involved in charting for new solutions

The project involved unusual development work and charted various solutions to improve the low-emission qualities of the renovation. During the work, a host of various experts were consulted, and fruitful collaboration took place both within the City and with external organisations. The estimated duration of the development work from the tendering for the project planning stage up to the contract calculations was about 19 months.

The market was involved, in particular, regarding the review work new to the City. For the tendering for the multi-objective optimisation, implementers were charted, experts were consulted, and the work carried out within the City in the past was studied. The market operators were also consulted about solutions for implementing a light pre-demolition audit, meaning the reuse review and plan, regarding building components, construction materials and fixtures. The solutions on the market to use materials and construction components identified for reuse were studied by both the consultant in charge of the review and the students of Metropolia University of Applied Sciences as a part of their own project.

Reviews set the path for the planning

In order to take the environmental and climate impacts of the renovation into account, criteria were set for the planning based on the Carbon-neutral Helsinki 2035 Action Plan and Heka's and ATT's objectives, as well as reviews carried out during the project.

During the project planning and general planning stages, the following were conducted: energy optimisation using the MOBO Multi-Objective Building performance Optimization tool and lifecycle carbon footprint calculation (based on the Ministry of the Environment's method for the whole life carbon assessment of buildings), a reuse review and plan, that is a light pre-demolition audit, and project works by students from Metropolia University of Applied Sciences regarding the reuse of kitchen fixtures and balcony glazing, in cooperation with the HYPPY project.

The planning aimed at energy conservation, and after the work, the buildings' energy efficiency was expected to rise by at least 32% from the construction stage to the status after the renovations. In addition to this, in the planning phase the potential of using geothermal heating and a solar energy system and its placement opportunities were surveyed. To support the objective, the energy optimisation aimed to minimise energy consumption by taking the technical and financial feasibility, maintenance aspects and energy efficiency and carbon footprint of 25 years into consideration.

Turning the ventilation system into a supply/exhaust air system combined with a district heating and geothermal system was selected as the most cost-efficient solution to direct the project plan. A well-timed energy optimisation helps to yield significant emissions savings, and the solution recommended for this project would achieve a carbon footprint that is 1,620 t CO₂e lower than the current footprint.

As the project plans became more detailed, the feasibility of the measures selected based on the energy optimisation was re-assessed, based on which some solutions deviating from the energy optimisation recommendations were chosen. The reviews of the geothermal heating solution are still underway, but the number of wells must be reduced, while they will also be made deeper. For practical reasons, the number of solar panels must also be reduced.

The original measures recommended for building services engineering and structures, based on the energy optimisation, were the following:

- ▼ Turning the ventilation system into a supply/exhaust air system.
- ▼ Installing a geothermal heating system with 12 wells each with a depth of 300 metres; power of the heat pump 90 kW.
- ▼ The ceiling will only be renovated.
- ▼ Installing 480 m² of solar panels.
- ▼ No recovery of heat from wastewater.
- ▼ Not replacing the heating radiators.

In the planning low-carbon qualities were promoted by using sustainable and long-life materials and fixtures with a small carbon footprint and aiming to reuse recovered materials and the site's demolition materials. Based on the reuse review, the focus was in particular on the reuse of specific fixtures, kitchen appliances (refrigerator-freezers and stoves), balcony glazing and the LECA of the roof both at the site and outside it. In practice, only the refrigerator-freezers will be reused in cooperation with the Reuse Centre.

Case: Planning and development in the renovation of residential buildings

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As for the balcony glazing, it is required that the contractor deliver it for material recycling. The LECA can probably be used in earthworks. In addition to these, the aim is to use eco-labelled (such as the Nordic swan eco-label) products in the renovations, as far as the total budget allows.

Grounds for comparison

The project planning stage was tendered for based on the price as a mini tendering process under the framework arrangements of the City of Helsinki's housing production. The main and architectural planning, structural planning, HPAC and automation planning and electrical planning of the renovation project were tendered for divided into four parts. In all procurement parts, quality was weighted at 70%, while price was weighted at 30%. The reviews tendered for separately, which supported the project planning and general planning, followed the City's instructions for small-scale procurements.

The carbon footprint will be recalculated

As a part of the climate and circular economy objectives, it was recorded that the structural engineer would recalculate the site's lifecycle carbon footprint once the plans have been completed, based on the Ministry of the Environment's method for the whole life carbon assessment of buildings. However, since the calculations in the project's early stages were carried out using different delineations and specifications, the results are not comparable, and no bonuses or sanctions are tied to the calculation results.

Changes along the way

The renovation project encountered a challenge typical of piloting: difficulties in defining the objectives and a suitable level for them. It requires balancing to clarify the shared direction and the preliminary objectives, without overly limiting the potential solutions, but this should be done nevertheless.

The challenges to be resolved also arose during the planning stage, in particular: As the project plans became clearer, it was found that not all the recommendations yielded by the energy optimisation could be implemented. However, it was to be expected that changes may occur, and the project's energy efficiency objectives will still be achieved despite this.

The potential for reusing the fixtures was studied extensively, but this plan was finally abandoned due to the obstacles related to logistics and the organisation's current policies. The reuse of the fixtures was also made more difficult by uncertainties related to the fixtures' anticipated service life and the challenges of maintaining fixtures of different ages.

Regardless, the review yielded new learning experiences, allowing challenges to be tackled proactively in the future. The development work also brought up several new solutions and procedures that were not always welcomed without problems within the organisation. Further education in terms of attitudes is required, in which raising the personnel's awareness and orientation are key.

The objectives will be met and the results can also be used elsewhere

The objectives set at the beginning of the project became more concrete during the process. The successful reviews increased awareness of the solutions and the measures required. Despite the challenges, the objectives set in the beginning will be met: the minimum level of energy efficiency improvement will be reached, the site will use geothermal heating and solar panels and some measures described in the reuse plan will be implemented. Even though the project cannot make use of all the suggestions produced in the development work, they did offer useful results and pre-planned practical measures to be applied to other sites.

Connecting the development work from the project planning to the general planning process allows the concrete measures corresponding to the objectives to be brought into the practical implementation of the renovations. The final result for lifecycle carbon footprint will be acquired, when the calculations will be updated according to the plans finalised for the project. In addition to this, the aim is to implement a calculation for refrigeration appliances suitable for reuse, that also assesses the conservation of natural resources.

New openings for future work

The aim is to use the lessons learned and experience gained from this project in future renovation projects. Best practices can be transferred to the instructions on renovations and demolitions. In addition to these, the project also yielded new openings and suggestions that can be thought about in the future, even if they were not yet implemented in this renovation project. The potential reuse of fixtures raised questions about the realisation of equality among the residents, as well as whether the differences between the furnishings could be taken into account when determining the flats' rent. A sustainable mindset could be communicated to the residents by informing them of climate-smart and resource-wise solutions. The needs for knowledge and challenges faced during the project can also be reviewed in the City's other development work, such as the operations of the circular economy cluster that was launched in summer 2021.

New things were tested at the pilot site

The project planning stage of a renovation project already involves key decisions in terms of emissions, which affect the project's start, the options reviewed and the construction costs regarding updates to the energy solutions, for example. For this reason, new objectives, in particular, need to be taken into account as early as possible. However, specific factors, such as the materials used, can be reviewed and specified even during the planning.

These renovations were the first pilot site where a multi-objective optimisation of the energy solution was carried out to support the project planning. The timing of the energy optimisation proved appropriate, since its results became available during the project planning, thanks to which the site's energy efficiency concept and the related emissions reductions could still be influenced. If the objective is to increase the reuse of building components or materials at the site, the recommendations for reuse must be completed sufficiently early for them to be considered in the plans.

For the time being, renovation solutions are mostly formed on the basis of cost, but as lifecycle reviews become increasingly common, the measures and solutions may change. Clients play a key role in testing and developing new things, and through their projects, low-emission and circular economy solutions can be introduced to both designers and contractors.

In particular, taking circular economy into account will gain ground as the preparedness of the material recipients and other operators develops and the legislation and regulations change. In some parts, this is a matter of definition – for example, what counts as feasible reuse, and in which timeframe the costs and emission impacts of the circular economy solutions are being reviewed. Not all solutions promoting circular economy necessarily reduce the project's carbon footprint, but despite this, they can usually still be used to reduce the use of virgin natural resources. There are grounds for pondering how circular economy should be measured and valued.

Sharing knowledge

The project increased the understanding of the potential of a resource-wise renovation project with reasonable lifecycle impact both among the City of Helsinki's housing production and Heka. During the project, and the reviews carried out within it, in particular, information was produced to support future plans, such as the preparation of the recommendations and instructions regarding demolitions and renovations. Through this, the lessons learned from the pilot project can also be brought into future renovation projects, and eventually become established and unified as operating methods.

The solutions most suitable for each renovation project must always be studied and considered on a case-by-case basis. Specific objectives and model concepts may still be suggested. The development work done during the project has been documented, and the results of the multi-objective optimisation will also be made available to other operators, in addition to the City of Helsinki.



LIFE17 IPC/FI/000002 LIFE-IP CANEMURE-FINLAND
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