NeZeR

Co-funded by the Intelligent Energy Europe Programme of the European Union

Promotion of smart and integrated NZEB renovation measures in the European renovation market (NeZeR)

Contract N°: IEE/13/763/ SI2.674877
01-03-2014 – 28-02-2017

Action plans for Helsinki, Espoo and Porvoo

Date : 10/06/2016

Lead contractor : VTT

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1 ABSTRACT

This report presents a proposal for nZEB renovations of residential buildings for Finnish Cities Helsinki, Espoo and Porvoo.

These cities have different kinds of building stock, but similar methods and guidance can be applied.

The proposed main approach with regard to the Action Plan is that cities will give supportive guidance for building owners so that they would be able to take the energy aspects into account when planning renovations and when making long-term plans for renovations. The goal is that the buildings would be renovated step-by-step to achieve the nZEB-level along the renovation projects.

2 BACKGROUND

The European Union's climate and energy policy aims at reducing the greenhouse gas emissions by 20%, increasing the share of renewable energy sources to 20% of final energy consumption and increasing energy efficiency by 20% by 2020 (European Commission, 2007). The target of the energy strategy of the government of Finland (2008[1]) is to decrease the final energy consumption to achieve the level of 310 TWH in 2020. The European Commission published the so-called low-carbon road map the target of which is to reduce carbon emissions by80-95% by the year 2050 compared to 1990 levels (European Commission, 2011) [2].

The required energy efficiency of the building stock is described in the building regulations with the help of primary energy factors. The procedure differs from that used in other sectors and it is not directly based on emission control.

The construction sector is the largest producer of global greenhouse gas emissions. The Roadmap to Resource Efficient Europe[3] emphasizes the role of building sector as one of the three key sectors. The building sector also has great economic potential for reducing GHG emissions[4]. Actions to reduce emissions of greenhouse gases include the reduction of the buildings' energy consumption, transition to low carbon fuels and the decrease of embodied GHG emissions. Improvements in the energy efficiency of buildings are particularly efficient with regard to emission reductions; it is estimated that emissions from this sector could be reduced by around 90% by 2050. The EPBD-directive emphasizes the meaning of existing building stock and encourages Member States to promote and support energy-efficient refurbishment of buildings.

The objective of the Finnish Building renovation strategy completed in 2007 is to promote pro-active culture for real estate maintenance and repair. With systematic and properly timed refurbishment it is possible to save costs and to respond to the needs of users and sustainable development requirements. The strategy includes action and development guidelines for 2017. The main goals of the strategy are as follows:

- To encourage and consolidate the continuous maintenance and refurbishment culture of buildings
- To develop renovation processes and control instruments
- To increase the renovation of knowledge and understanding and to ensure the availability of resources
- To sharing and disseminate information on successful building renovation.

[1] http://www.tem.fi/files/25123/Ilmasto_ja_energia.pdf

[2] COM (2011) 112: A Roadmap for moving to a competitive low carbon economy in 2050 http://ec.europa.eu/clima/policies/roadmap/documentation_en.htm

[3] European Commission. Roadmap to a Resource Efficient Europe. COM(2011) 571 final

[4] IPCC. Climate Change 2007: Synthesis Report.

Helsinki

Helsinki has been concluded energy efficiency aggreements since 1993 as purpose to execute EU's energy efficiency directive. Helsinki has also agreed the common climate strategy of metropolitan area to decraese the emissions by 39 % by inhabitant and covenant of mayors.

The target of the Mayors agreement on energy and climate is to reduce GHG-emissions by at least 20% compared to 1990[5]. The sustainable energy program of the City of Helsinki describes measures and practical steps to achieve the target. It says that the city offers information on energy efficiency to residents, businesses and other local stakeholders and motivates actors for improved energy-efficiency. Helsinki has stated targets for energy-efficient refurbishment. The targets cover their own buildings. In addition, Helsinki has targets regarding supporting the energy-efficient refurbishment of the overall building stock. These targets concern dissemination of information, the guidance given by the building authorities and some economic incentives. Helsinki also tries to encourage other actors to improve energy efficiency by its own energy saving actions.

Espoo

Espoo has adopted a common climate strategy for the metropolitan area, with the objective of 39% reduction in greenhouse gas emissions by 2030. Espoo has also joined to the local energy efficiency agreement (KETS) the target of which target is 9% energy savings by 2016. Greenhouse gas emissions of Espoo are mainly based on emissions from heating of buildings, electricity generation and transport[6]. The aim is to improve the energy efficiency of new buildings and existing buildings.

The planned measures include, for example the following[5]:

- The assessment of climate impacts and potential increase of renewable energy sources based on local energy production will be done in the context of land use planning.
- Espoo considers the energy-efficiency targets in all own building and refurbishment projects and makes monitoring and auditing to ensure the achievement of targets.
- The city supports the improvement of energy-efficiency in rental housing.
- Espoo develops different kinds of advisory services for different target groups and stakeholders.

[5] Kestävän energiankäytön toimenpideohjelma. Kaupunginjohtajien energia- ja ilmastosopimus Energiansäästöneuvottelukunta. 1.12.2010 http://www.energiatehokashelsinki.fi/tiedostot/seap-tiivistelma-ja-toimenpiteet.pdf

[6] Kestävän energiankäytön toimenpideohjelma (Sustainable energy action plan, SEAP), Kaupunginjohtajien yleiskokous / Espoo

3 CONDITIONS

In Finland the significant part of the residential buildings are blocks of flats built on 1960-1980. The share of these buildings of all building stock is 43% (Figure 1).

Block houses built during 1960-1970 are typically made of concrete elements and their energy efficiency is low. First requirements for energy efficiency were made in 1976. After that the energy efficiency of the buildings has increased. Single and terrace houses were cast-in-place houses until 70's and at 80's the pre-fabricated wooden houses was the dominant technology. Almost all block houses are heated using the district heating. The most common heating system of detached houses is electrical heating and second common is oil heating.

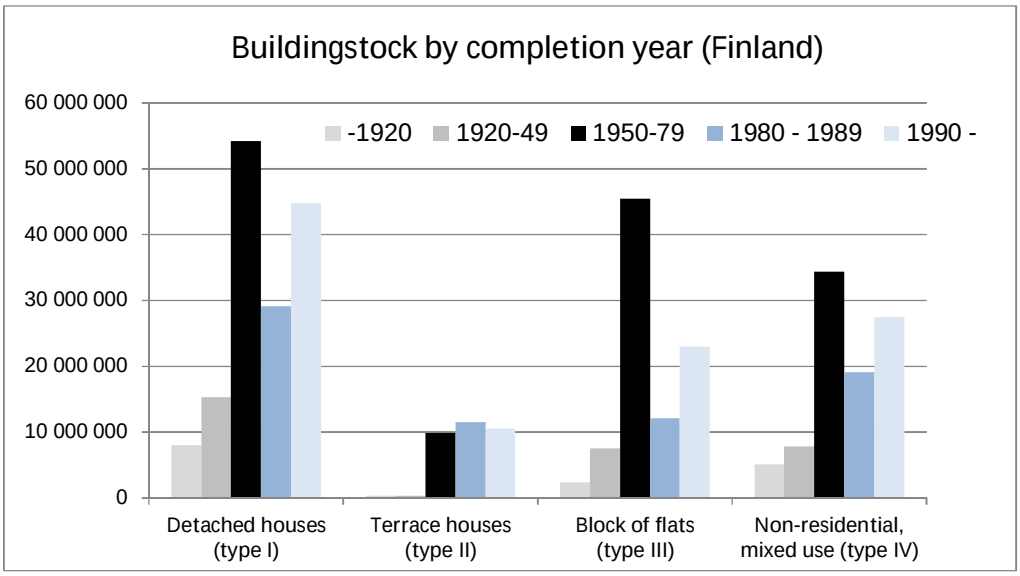

Figure 1. Building stock in Finland (m^2).

However, the building stock in different cities is quite different. In Figure 2 to Figure 4 the residential building stock in Helsinki, Espoo and Porvoo is shown. The buildings are classified as blocks of houses, detached houses and terrace houses. Both the number of buildings and total area of them are shown. [7]

In Helsinki the most part of the area of the residential buildings is in the blocks of flats although the amount of the single houses is larger. In Espoo the total area of the single houses is almost equal compared to blocks of flats. In Porvoo the single houses play a larger role in the building stock.

This means, that need of renovation is different in each city. In Helsinki the actions should be allocated specially to block houses to get maximum impact but in Porvoo and Espoo the owners of the single houses have an equal importance.

[7] www.aluesarjat.fi

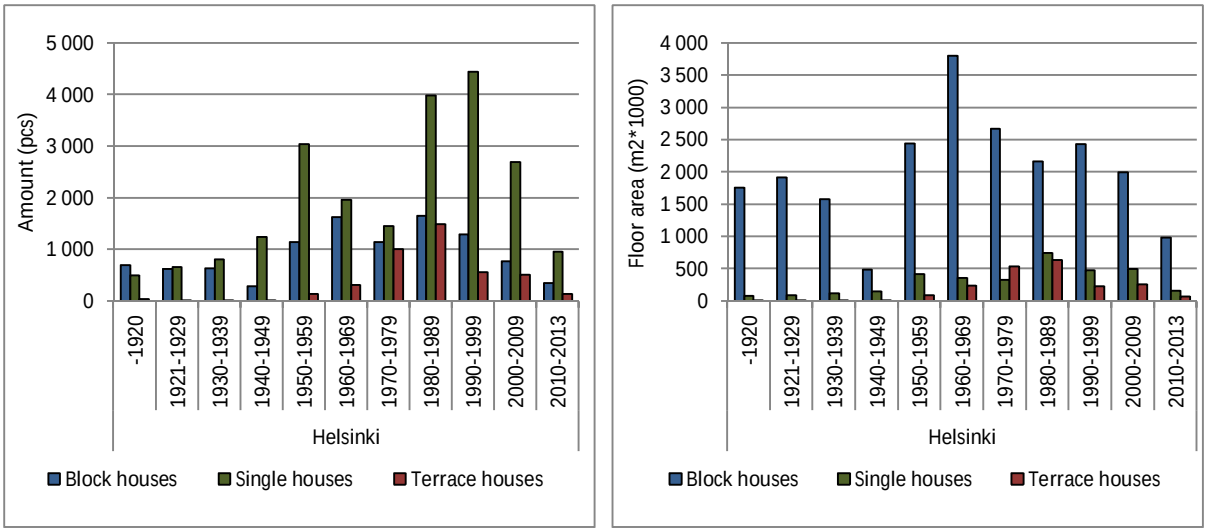

Figure 2. Building stock of Helsinki

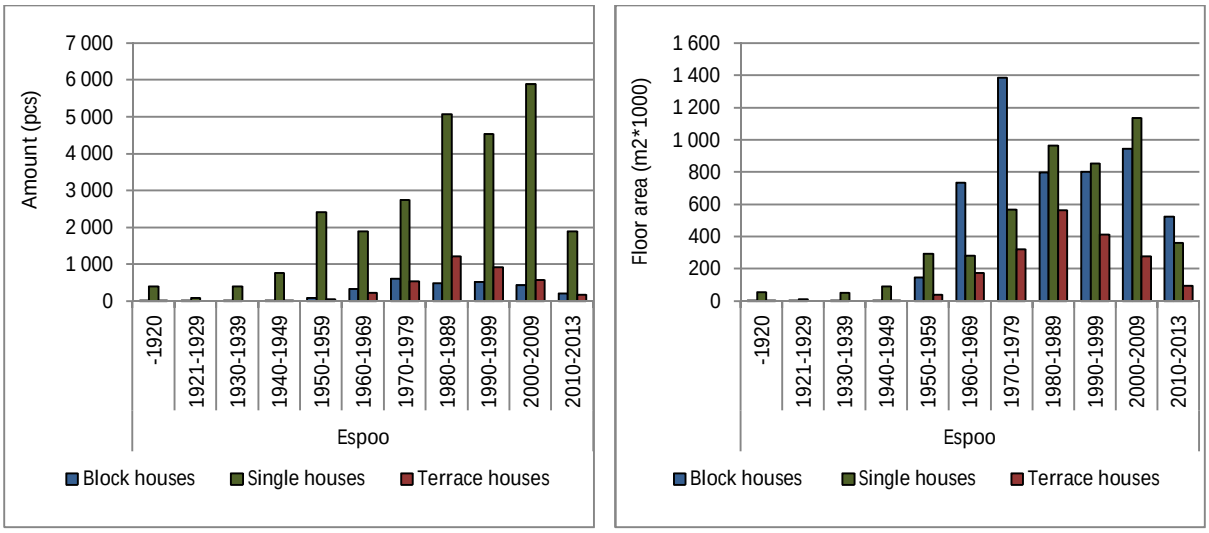

Figure 3. Building stock of Espoo

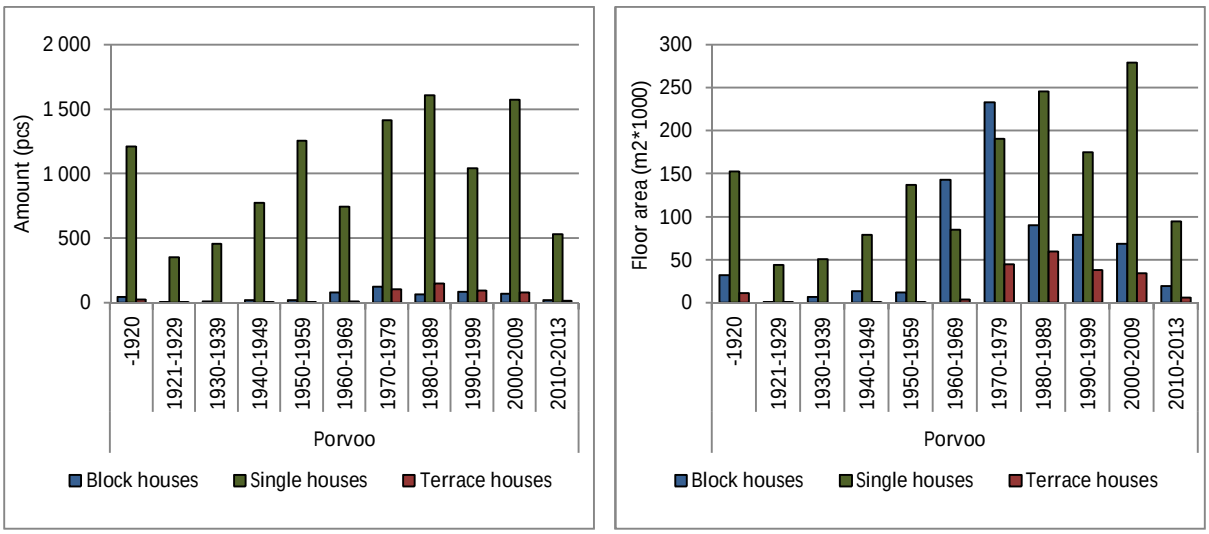

Figure 4. Building stock of Porvoo

4 TARGET GROUP

In residential buildings the ownership structure is related to the decision-making mechanisms of renovations. Ownership structure and also the income level of the owners affect e.g. the interest to make long-term planning of the renovations. In Finland the main part of the residential building stock is private owned directly (single houses) or indirectly by the housing associations (Table 1).

Ownership of the building is an important factor in renovation. If the building is owned by professional building owner, who might have several buildings in the same area, it is more easy to plan and carry out renovations. Professional building owner has expertise and time to prepare renovation and he has also good contacts to renovation companies. Big building owners are also typically motivated to reach savings in energy costs even if the investment in the renovation would be large.

Privately owned buildings have typically housing associations with many owners and they may have different interests concerning the renovation. However, it should be noticed, that typically also private owners want to keep their apartments in good condition. Main problems are that decision making in private sector may be low and there may also be lack of expertise. The housing managers have an important role in the refurbishment projects of private buildings.

Table 1. Ownership of the Finnish building stock

	Residential buildings		
	Amount	Floor area	Amount of apartments
	1 245 700	278 100 000 m2	2 785 300
Share of all buildings	90 %	74 %	98 %
Owned by public sector	23 700	11 600 000 m2	52 900
Share of the all buildings owned by public sector	40 %	26 %	79 %
Share of the buildings owned by public sector of all the buildings (%)	2 %	3 %	2 %
Owned by commercial sector	36 200	24 500 000 m2	81 000
Share of all buildings owned by commercial sector	46 %	32 %	81 %
Share of the buildings owned by commercial sector of all the buildings (%)	3 %	7 %	3 %
Owned by private sector	1 185 800	241 900 000 m2	2 651 400
Share of the buildings owned by private sector (%)	95 %	95 %	99 %
Share of the buildings owned by private sector of all the buildings (%)	86 %	65 %	94 %

In Helsinki over half of the block buildings are rental houses. In Porvoo the situation is different and almost all blocks-of-flats houses and rental houses (Figure 5). In all cities almost all detached houses are privately owned.

When cities are developing the strategy for nZEB renovations, the most important target group are buildings, which are owned by private persons. That is because big building owners, like rental house associations, have already good knowledge about the energy renovation. Private owned buildings – block houses and especially single houses – are typically managed by owners who are not professionals in renovations and thus information and guidance is needed.

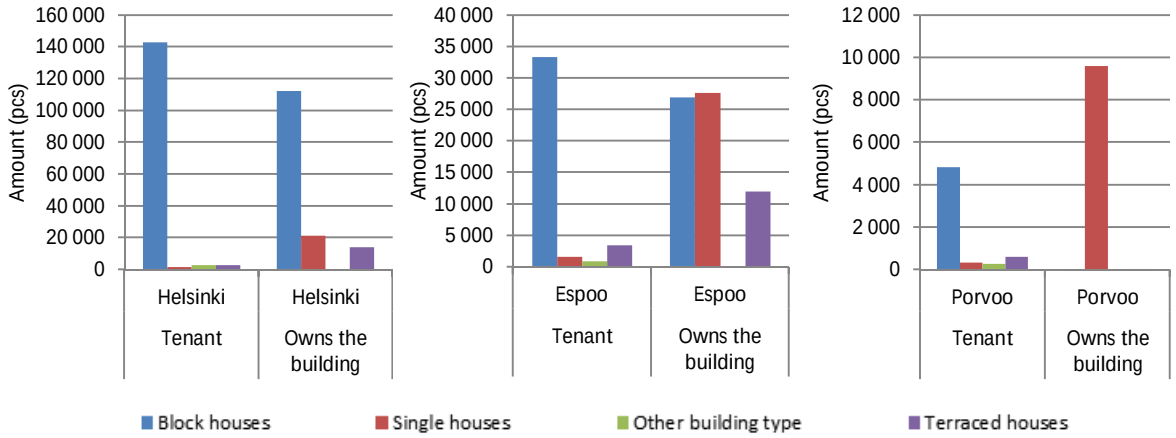

Figure 5. Rented and privately owned flats in Helsinki, Espoo and Porvoo

5 OBJECTIVES

The basic approach for energy-efficient refurbishment is step-by-step method as presented here. In privately owned buildings it is not possible to make comprehensive total renovation in one go as those are too expensive for building owners and it is not possible for residents to live in their apartments during the renovation. Because of that, the energy aspects should be taken into account when making partial renovations along the buildings' lifetime.

This means also that nZEB renovation -criteria should be based on the idea of long-term renovation plan of the building so that each building under nZEB renovation-process should make a plan of renovations for 15…30 years. In this plan all the coming renovations and the order of those should be presented. The advantage of the long-term plan is that the coming renovations can be connected to each other. Because the available fund is limited especially in housing associations, it is impossible to made total NZEB-renovation at one time. When using long-term plan it is possible to make one renovation at the time and as the final result of the renovations will be a NZEB-level building.

Table 2 shows an example of early 70 block-of-flats buildings' approach in the long-term plan for the energy improvements. The plan includes also other renovations even though they are not directly linked to energy efficiency. Examples of these are maintenance rainwater and subsurface drain systems and renovation of car shelters.

Table 2. Taking account of energy efficiency in the context of a residential apartment building renovations

Renovation	Notes for nZEB-renovation
Facade repair	Insulation is added so, that the final U-value is e.g. 0.17 W/m^{2}K. At the same time the building will be sealed so, that of the building, so that air leakage q50 <1 1/h
Roof repair	Insulation is added Inside or outside the U-value of <0.1 W/m^{2}K
Chancing the windows	Replacing the old windows with energy-efficient windows, the U-value of 0.8 ... 1.0 W/m^{2}K
Renovation of the heating system	Installation of exhaust air heat pump to support the heating system and added to the solar collectors.
Ventilation repair / replacement of the roof exhaust fan	Installing the heat recovery in the ventilation system heat recovery (efficiency 70 ... 80%) or installation of the exhaust air heat pump
Renovation of lighting and other electrical equipment as well as potentially whole electricity network	Energy efficient luminaires will be used with lighting control. Photovoltaic system will be added.
Water distribution system	Water meters will be installed, possibly renovation of the new heating system, heat recovery on the ventilation system (efficiency 70 ... 80%) or installation of exhaust air heat pump.
Renovation of the heating system	Installation of exhaust air heat pump to support the heating system and added to the solar collectors.

6 STRATEGY

The proposed approach in the Action Plan is that cities will give supportive guidance for building owners so that they would take the energy aspects into account when planning the renovations and make long term plans for the renovations. The goal is that after the planned renovation are made, the buildings will be renovated into nZEB-level.

Table 3 presents a proposal of actions for the cities. The main idea is that the cities should take an active role in communication and guidance and in showing example for others. Cities should also take a new proactive role in town planning to consider the needs of near in beforehand and thus support the fluent progress also energy-efficient refurbishment at district level.

Table 3. Steps, how the city can accelerate the nZEB-renovations among the building stock in its area

Goal	Action
City will show advanced example to owners of the buildings how to make a step-by-step nZEB renovation	City will create an action plan how to renovate public buildings, like schools and kindergartens and residential buildings owned by the city to nZEB-level step-by-step This action plan will be published and communicated to important target groups such as to design and building companies. Systematic energy auditing will be made in the buildings owned by the city.
All the city officials and authorities concerning construction have a good knowledge and understanding regarding the energy efficient renovation.	The building officials and building authorities of the city will obtain the good knowledge and understanding • of suitable technical solutions • how to apply those to step-by-step nZEB renovation • of the total benefits of the renovation (costs of use, quality of indoor environment, architectural image of the building, energy saving and environmental aspects) Adequate level of the knowledge will be achieved with the help of internal training and collecting and compilation of experimental knowledge.
Effective communication concerning the solutions, implementation and benefits of the nZEB renovation	The City will give information and guidance of applicable solutions and step-by-step renovations for different types of buildings. • information to different building organisations • offering free simulation and calculation tools for use • disseminating information about examples of successful renovation cases • providing information about example solutions • organizing seminars about nZEBR for different target groups

	Concrete communication plan will be created. Allocation of well selected information for different stakeholders will be planned.
In those renovations where the building permission is needed, the supervision of building will guide to use more efficient solutions.	Supervision of building will make the action plan, how to advice to make step-by-step renovations. This will be implemented with the help of effective communication (training courses etc.) between the city and the building owners. The building authorities will be trained as high-level experts in nZEB renovation. City will also offer tools that support making good quality energy calculations in different phases of projects. Competence requirements of designers will be developed to consider energy-efficiency aspects. Owners of detached houses will be guided and trained when they make renovations (that need a building permission) to take the energy efficiency into account. Corresponding training causes will be developed also for the administrative boards of housing associations to be offered when a housing association is preparing to apply for building permission for significant renovation.
Effective financial incentives	City will find out the possible financial incentives and effects of those. Examples of these are decreased rent of the plot, when energy efficient renovation have been made or decreased cost of planning when infill building is made use of to finance the energy renovation.
Renovations at district level	City will find out the potential areas for district level energy-efficient refurbishment and promote energy-efficient refurbishment at district level. City will be pro-active and consider the needs of district level energy-efficient refurbishment already when doing and developing town plans. This is important to avoid a situation where district level refurbishment is significantly delayed because of related changes in town scape and thus need to develop the town plan. The city will also take an active role in promoting district level refurbishment and activate different owners for energy-efficient refurbishment.