



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 Plan for the City of Stockholm

Date : 29/02/2016

Lead contractor : City of Stockholm

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PREFACE

The City Action Plan for Stockholm describes briefly how the process of achieving NZEB renovation measures in existing buildings can be performed. This is a part of the EU-project NeZeR which aims to promote smart and integrated renovation measures on the European market. However, it's important to notice that the city of Stockholm has no mandate to decide energy levels and working procedures for the private market. In this Action Plan it's only a suggestion on *how* energy efficient renovation in existing buildings can be promoted.

The process described in this plan is one way to perform it. It is a guidance on initial planning, which stakeholders that can have a considerable contribution and what conditions you need to consider before an action plan for renovation is set off.

The Action Plan has been performed by a working group consisting of the City of Stockholm, the Environment and Health Administration, Stadshus AB, Stockholmshem and IVL Swedish Environmental Research Institute.

1 BACKGROUND

In the city of Stockholm there are around 900 000 inhabitants and the population is considered to be rather young and strongly growing in number. The majority of the people, 60 per cent, live in small one person households which means that there is a big need for small apartments in Stockholm. The population density varies a lot: in the inner city there are 200 – 400 persons per hectare and further out the population density is as low as 20 – 100 persons per hectare. There are 400 000 households who live in multifamily houses and only 45 000 in single family houses. Around 55 per cent of the households in multifamily houses are privately owned and the rest, 45 per cent, live in other rental houses. In average there are nearly two persons per apartment in Stockholm.¹

The number of rooms in the apartments varies between 1 and 6 or more, but smaller apartments are dominating. More than 75 per cent of the apartments in Stockholm have three or less rooms. Diagram 1 shows how the number of rooms are distributed among apartments in Stockholm.²

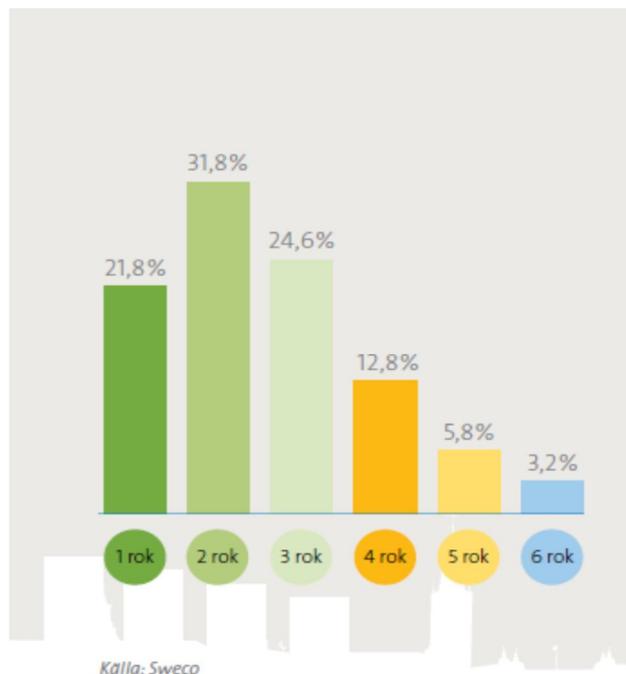


Diagram 1. Number of rooms per apartment; from 1 room up to 6 rooms or more.

The building ages vary a lot; in the centre the buildings are older, mostly built around 1880 to 1920 and further out from the inner circle they are built from 1920 to 1970. Between 1980 and 1990, the buildings are more or less infills in areas where there was space left to build on. From 1990 and onwards there was a significant construction of buildings in areas that earlier had served industrial and harbour purposes, so called transformation areas.³

¹ Statistisk Årsbok för Stockholm

² På väg mot 140 000 nya bostäder, Stockholms Stadshus AB

³ Stockholms Årsringar

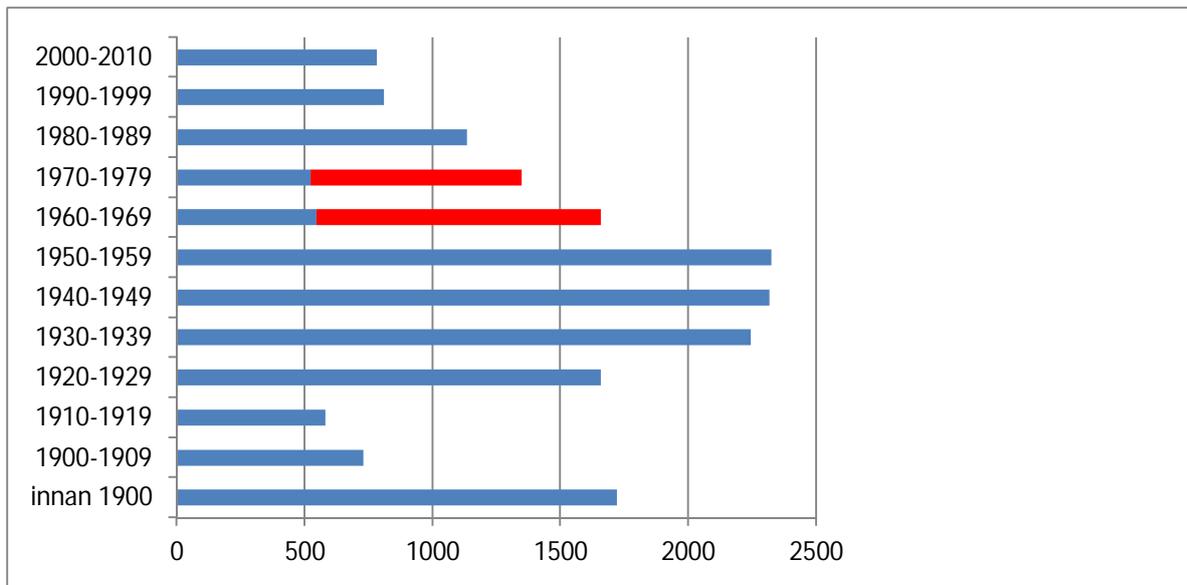


Diagram 2. Partition of buildings per decade. Blue piles represent buildings performed per decade and red piles represent the Million Programme 1964 – 1975.

Depending on the large variation in building types and kinds of inhabitants in Stockholm, the residential segregation is notable. There are differences both between districts and between the inner city and suburbs. Parameters such as education, different payment ability and ethnicity are reflected in the pattern of living. Both certain single family house areas and some of the districts in the remote suburbs have a socially one-sided population.⁴

The energy use is higher in buildings from 1940 to 1970 compared to new buildings. However, in the older buildings from before 1940, the energy use varies a lot; they can be rather energy efficient depending on the building construction.⁵ The public real estate owners have made efforts to reduce energy use in their buildings according to their energy plans. However, the smaller and private companies and private housing associations' haven't taken energy efficiency measures to the same extent since they don't have the same competence and resources. Due to lack of economic incentives it's also harder to reach decisions about energy efficient renovation. If energy efficient renovation in these buildings is accomplished, the outcome will be rewarding. Still, the level of building standard and maintenance is generally high in Stockholm.

The quality of public spaces is a significant issue for the citizens of Stockholm and all the parks and open spaces are important to the inhabitants. The City of Stockholm owns the open spaces and also lots of multifamily houses in the nearby areas. The general opinion according to the Citizens' Survey is that the open spaces and parks in Stockholm are satisfactory and well kept. It's necessary to take into account the impact of both the outdoor quality and safety when developing these parts of the city.

The environmental noise situation is another parameter to consider when planning for energy renovations in a certain area. In Stockholm, around 40 000 apartments are exposed to high traffic noise levels.⁶ The noise problems appear in different parts of the city and they have to be considered in every case. There is a possibility to have a winwin situation to improve the

⁴ Översiktsplanen; Promenadstaden

⁵ SCB

⁶ Miljöförvaltningen, Miljöbarometern

indoor environment concerning noise when performing energy efficient renovations in a building.

During the last years there has been a change of how commercial centres are constructed; there has been a shift from smaller centres in each district to malls located further out. This means that neighbourhood services and daily shops disappear, which in turn might lead to less attractive residential areas.

In general, there is a high awareness of environmental, climate and energy issues in society today and the citizens in Stockholm believe that these issues are very important to deal with. However, when it comes to decisions concerning your private life, people are mostly aware of impacts from the use of household electricity within your own apartment, much thanks to the energy labelling within the Eco Design Directive. Regarding energy use for heating and hot water, the awareness is lower.

The city of Stockholm has already an Environmental Programme concerning both emission levels and reduction of energy use.⁷ Connected to the Environmental Programme, the City has also a SEAP (Sustainable and Environmental Action plan) with climate and energy targets.⁸ Bigger private real estate owners often have plans for energy efficient renovation and the City has set goals for energy reduction among public real estate owners to be implemented. However; small, private housing associations generally don't have any energy plans.

⁷ Miljöprogram för Stockholms stad 2012-2015 and Miljöprogram för Stockholms stad 2016-2019.

⁸ Stockholm action plan for climate and energy 2012 – 2015.

2 CONDITIONS

There is a variety of conditions to take into account in the Action Plan. The most important are parameters concerning ownership of buildings, economy and regulations that concern the City.

Ownership

There are three different kinds of ownerships to consider in this Action Plan; the public real estate owners, private real estate owners and private housing associations. They have different conditions depending on owner structure and possibility to influence decisions. Profitability is often an important parameter for real estate owners when they shall make decisions about new investments.

The diagram 3 below shows the number of dwellings and the distribution between apartments in privately owned associations, rented public and private real estates and single family houses. There are 218 000 apartments in private housing associations, 176 700 rental apartments (among which 67 000 are public and 109 700 private) and single family houses amount to 45 000.⁹

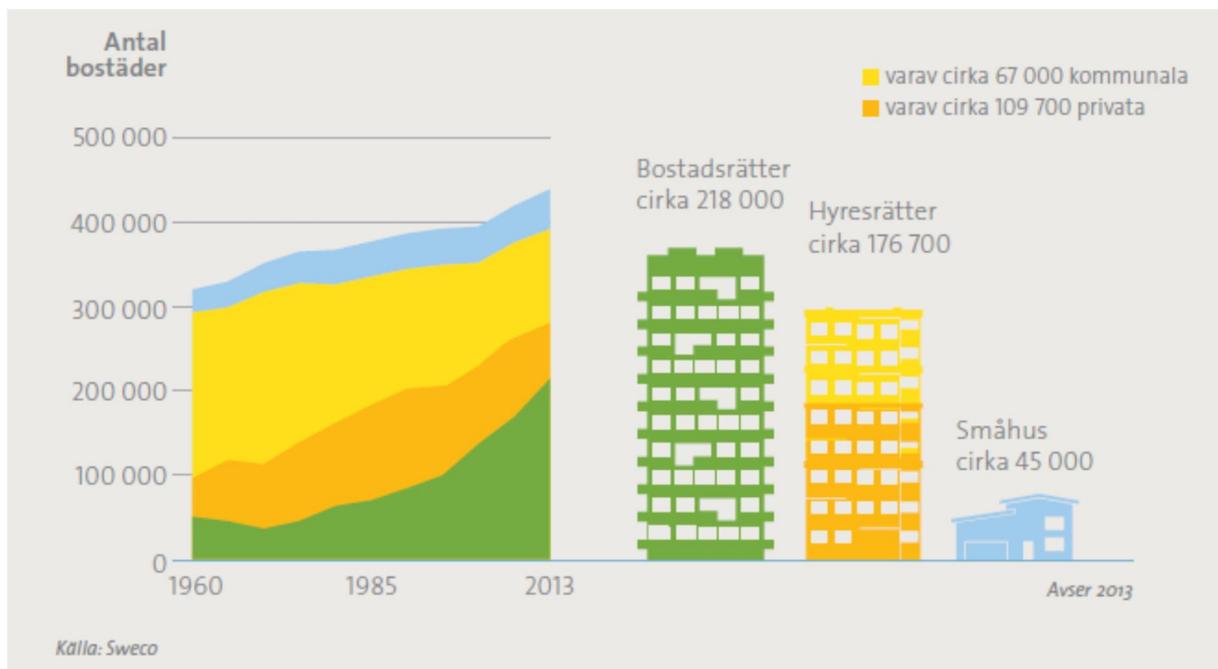


Diagram 3. Number of dwellings in Stockholm; private owned associations, private and public real estate owners and small houses.

The *public real estate owners* in Stockholm have altogether 67 000 dwellings for rent and their mission is to build 2 – 3 000 new apartments each year. The buildings belonging to public real estate owners are normally well maintained but the energy use is still rather high compared to other buildings because the property portfolio contains buildings from a period when energy efficiency was not considered. They make decisions on energy efficient renovation when they also are obliged to renovate for other reasons. They make profound

⁹ På väg mot 140 000 nya bostäder, Stockholms Stadshus AB

renovations at an average of every 50th year. Another scenario for energy efficient renovation can be a wish to change a certain type of technical equipment in all the buildings at the same time; installation of exhaust air heat pumps is a good example. They possess a high competence and a solid experience regarding energy efficient renovation and have also set high targets to reduce the energy use. The public real estate owners belonging to the City of Stockholm have a target set by the City Council to reduce the energy use with 10 per cent between 2012 to 2015 and another 10 per cent between 2016 - 2019.

Private real estate owners are normally interested in making energy efficient renovations in combination with renovations that raise standards as these improvements are the only way to also raise rents. The private real estate owners focus on taking measures mainly to reduce costs and under these circumstances they can invest in installations like heat pumps, window renovations, adjustment of the heating system, roof insulation etc.

The *Private Housing Associations* normally have wellkept buildings regarding ordinary maintenance and each apartment is well taken care of by the owner. These associations are often small entities consisting of a few buildings. Decisions on investments are taken by a board, normally after a vote among the individual owners. However, the investment interest to improve technical installations, such as heating and ventilation systems, is rather low and the time perspective is very short. The owners don't want to commit to any long term obligations for renovations as they might move within the next five years. Consequently, investments with a longer horizon often are excluded and concrete measures that are visual are favoured.. Another parameter is the lack of a technical organisation for maintenance and sufficient competence for energy questions and installations.¹⁰

Economy

There is often a challenge to define a method to calculate the profitability of energy efficient measures. The most common method to calculate profitability is the *Straight Payback Method*, which often leads to the result that more expensive investments are difficult to prove profitable, even if it leads to lower energy costs in the long run. Energy prices have decreased recently in Sweden, which also is a parameter that makes it hard to calculate the profitability of energy measures thanks to energy savings.

Another method to calculate profitability is to use the *Life Cycle Cost (LCC)*; with this method investment-, energy- and maintenance costs are taken into account when calculating the profitability. It makes it possible to compare different alternatives in order to choose the best solution with the lowest energy consumption and the lowest cost in the long run.

For the public and private real estate owners with rentals, the LCC-method is normally used as they have the knowledge to calculate on the technical life cycle for the installations. However, they are not allowed to raise rents in connection with merely energy efficient renovation. In reality the real estate owner must raise the standard in some way to be able to raise the rent. Yet, the public real estate owners do also have other owner directives in their business than economic profitability, such as demands for lower energy use and emission levels. This forces them to make decisions about energy efficient renovations, and although the investments need to be profitable, it allows them to have a longer perspective. However if the real estate owner makes investments that raises the rent it can lead to negative social

¹⁰ Miljöförvaltningen

consequences. Generally extensive renovation of rental properties leads to increased migration which contributes to segregation.¹¹

The challenge is significant for private housing associations because the apartment owners take into account the time during which they may remain in their apartments. Each owner pays a monthly charge to the association and this is supposed to cover both immediate needs such as cleaning and long term investments. The relation between the investments and the raise of the monthly charge is very close and the owners are often sensitive to higher fees. It's easier to decide about investments that keep the building well kept and/or raise the standard through improvements of the laundry facilities, garden and the stairwells etc. than to make energy efficient renovations that are hard to calculate to be profitable for the association.

One of the most important questions is how to manage to initiate essential energy efficient renovations in these residential buildings since energy prices are low. As a consequence, it's difficult to get profitability.

Regulations

On a City level it's not possible to regulate private sector behaviour, because of lack of mandate. For city owned buildings, the City Council has decided that the public real estate owners shall reduce the energy use with 10 per cent in all their buildings between 2012 and 2015. The target is about to be met. A new 10 per cent target between 2016 and 2019 has been decided by the City Council. During comprehensive renovations - when evacuation of tenants is mandatory - there is a demand for a reduction of energy use of at least 30 per cent.¹²

On a local level it's also rather common that private real estate owners set their own targets on reduction of energy use and emission levels and it has become popular with eco-labelling of buildings, even though it's more common for commercial than residential buildings.

In Sweden, the regulations for new constructions are more direct and clear than for existent buildings. On a national level, Sweden has a recommended target for specific energy reduction in the building stock of 50 per cent between 1995 and 2050. There is a strategy for energy efficient renovation in existent buildings¹³ but it has been criticised because there are ways to get around, it's up to the real estate owner to decide whether it's economically and technically feasible.

On an EU-level there is the demand for 50 per cent reduction of energy use in buildings. There is also the directive concerning energy efficient devices, the Eco Design Directive , which has had an important impact on people's choice of products.

¹¹ Boverket "Flyttmönster till följd av omfattande renoveringar", rapport 2014:34, regeringsuppdrag, december 2014.

¹² Miljöprogram för Stockholms stad 2012-2015 and Miljöprogram för Stockholms stad 2016-2019.

¹³ Renoveringsstrategin

3 TARGET GROUP

The important parameters when defining the target group are requirements for high energy consumption and needs for renovation. In this way, energy efficient measures will be a part of the renovation that shall be done at all events. To get synergies, it's also important to both choose buildings that are similar and use more or less the same packet solutions for the energy renovation.

The chosen target group is:

Multifamily buildings built in 1930 to 1960 with an energy consumption exceeding 200 kWh/m² per year. City wide, the total amount of buildings in this group is more than 200 and the average energy performance is 251 kWh/m² per year. The total energy consumption in these buildings is 88 GWh/year including heat, warm water and property electricity.¹⁴



Gubbängen, multifamily building, built 1940.

As we can see in diagram 2, it's indicated that the buildings that are built in the period 1930 – 1960 represent more than 40 per cent of the buildings in Stockholm. According to the public real estate owners in Stockholm there is a great need of renovation that concerns façades, change of sewage systems, bathrooms and kitchens. It presents a good opportunity to simultaneously make energy efficient renovations in the buildings.

The buildings from this period are mostly free standing and three storeyed. The material is usually concrete and the buildings are normally blocked up with stones. The ventilation systems are mostly so called natural ventilation. One challenge is the air valves placed beneath the windows. As a consequence, the incoming air is very cold. The tenants find this very inconvenient and demand the heat to be raised, which leads to a higher energy use.

These buildings are situated in the outskirts of the city. Many of the apartments are inhabited by older people who have lived in the neighborhood for a long time. Another important group of dwellers are "passing through", consisting of families with smaller children. People normally appreciate these types of areas since it's a familiar feeling, it's close to the metro system and nature. There is a sense of being in a small community. The income level among

¹⁴ Energy-performance certificates. Database from Boverket

both the elderly and the young families is generally low, so the capacity to pay a higher rent is rather low. A consequence is usually that they have to move after the refurbishment.



Fredhäll, multifamily building, built 1930.

The buildings will be selected based on information in the Energy Performance Certificates as well as information from real estate owners about building standards. The Municipal Environmental Inspections in multifamily buildings that survey both energy use and indoor quality, will also serve as a source.

In the work with the energy efficient renovations, the real estate owners can use information from the Work Packages 2 and 3, which contain the NZEBR Criteria¹⁵, as well as different packet solutions and profitability calculations¹⁶ that can be beneficial to the project.



Hökarängen, multifamily building, built 1950.

Depending on the size of the project, a plan for follow-ups can be performed in order to evaluate the measures taken. It concerns energy use, health and social environment. Measurements should be performed before and after renovations.

¹⁵ NeZeR_D2_3_NZEBR criteria

¹⁶ D3.3_Proposal of relevant incentives for NZEBR

4 OBJECTIVES

In the target group – buildings from 1930 to 1960 and with an energy use exceeding 200 kWh/m² per year - there are in total a little over 200 buildings. Thereof around 65 buildings are owned by the public real estate owners, 65 by smaller private associations, 35 by private real estate owners (companies) and 60 are owned by private real estate owners (single person corporations). The Energy Performance Certificates have been accomplished between 2007 and 2011, which means that there is a possibility that some of the buildings already have been renovated. The municipality has the authority to take decisions about energy efficient renovation in its own building stock. However, for the rest of the real estate owners, the city doesn't have that mandate, but can support and promote energy efficient renovation in different ways. The following objectives can be set:

The public real estate owners:

According to the Environmental Programme for the City of Stockholm, the public real estate owners have a goal to reduce the energy use with 10 per cent from 2016 – 2019. The objectives in this Action Plan are:

- Energy use: to achieve the level “Deep renovation”, 90-110 kWh/m² per year (NeZeR_D2_3_NZEBR criteria) for all buildings within a period of 5 years.
- Follow up: The energy use should be followed up separately and concern heating, warm water and property electricity for common use. Measurements should be performed before the renovation and 1 and 2 years after the final inspection.
- Social sustainability should be taken into account which means that surveys and inquiries could be made in connection with the project. If there is a general, social problem in the neighbourhood, such as violence, problems with drugs or degenerated neighbourhood, the local department in the city could be notified. Perhaps it's possible to set a project to improve both the social environment and the buildings at the same time.
- Profitability: LCC-calculations shall be made in order to decide profitable solutions. The real technical life time in the LCC-calculations will be used. Rents is another important aspect. If the real estate owner makes renovations that lead to raised rents, it can contribute to segregation.

Private associations and smaller private real estate owners

Since the municipality doesn't have the mandate to set objectives for these private real estate owners, the project will be more supportive in character, which means that the municipality can offer help to and support these companies to achieve the objectives.

An idea is to establish a group consisting of partners both from the municipality, real estate owners and organisations such as HSB, Riksbyggen, Fastighetsägarna and Bostadsrätterna. It would be a constructive solution to use this group as a platform for the work with the private associations and smaller private real estate owners. If it would be accepted by all partners, the City of Stockholm would be able to support and promote the actions in the Road Map that each private real estate owner undertakes. The template that has been elaborated by the Municipality for the public real estate owners could be used. As the time schedule is lagging one year behind the public real estate owners, there will be a possibility to learn from experiences made by them.

The buildings owned by the private real estate owners could have the following objectives but starting one year after the public real estate owners within a period of five years. However, the objectives are not mandatory:

- Energy use: to achieve the level “Moderate renovation” from NeZeR_D2_3_NZEBR criteria, 110-130 kWh/m² per year for all buildings within 5 years.
- Follow up: The energy use could be followed up separately and concern heating, warm water and property electricity for common use. Measurements could be performed before the renovation and 1 and 2 years after the final inspection.
- Social sustainability could be taken into account which means that surveys and inquiries could be made in connection with the project. If there is a general, social problem in the neighbourhood, such as violence, problems with drugs or degenerated neighbourhood, the local department in the city could be notified. In that case it could be possible to set a project between the Municipality and the private real estate owner in connection with the renovation project in order to improve the social situation.
- Profitability: LCC-calculations could be made in order to decide profitability. The real technical life time in the LCC-calculations will be used. Rents is another important aspect. If the real estate owner makes renovations that lead to raised rents, it can contribute to segregation.

Bigger private real estate owners

In this group large companies are found. They probably have their own energy departments and resources to make their own action plans for energy efficient renovation. The Municipality doesn't have the mandate to influence these companies but encourage networks for exchanging plans and experiences. The objectives set for the smaller private real estate owners will be promoted as well as the experience made the public real estate owners to this target group. These objectives are:

- Energy use: to achieve the level “Moderate renovation” (NeZeR_D2_3_NZEBR criteria) 110-130 kWh/m² per year for all buildings within 5 years.
- Follow up: The energy use could be followed up separately and concern heating, warm water and property electricity for common use. Measurements could be performed before the renovation and 1 and 2 years after the final inspection.
- Social sustainability could be taken into account which means that surveys and inquiries could be made in connection with the project. If there is a general, social problem in the neighbourhood, such as violence, problems with drugs or degenerated neighbourhood, the local department in the city could be notified. In that case it could be possible to set a project between the Municipality and the private real estate owner in connection with the renovation project in order to improve the social situation.
- Profitability: LCC-calculations could be made in order to decide what solutions that are most profitable. The real technical life time in the LCC-calculations would be used. Rents are another important aspect. If the real estate owner makes renovations that lead to raised rents, it can contribute to segregation.

5 STRATEGY

The strategy to achieve the objectives includes different activities with various stakeholders. The target group involves different types of real estate owners; both those that the municipality can influence and those who they can't. Because of that it's important that the strategy involves activities that in the long run can affect even the properties that the municipality don't have the mandate to regulate.

When the NeZeR-project has approved the Action plan, this document could be a help and support when performing future plans and budget for energy efficient renovation within the city. An idea is that the Municipality organizes a project group that will be involved in the work both with the common real estate owners and with the private real estate owners.

The project concerning the public real estate owners could be led by Stockholmshem and Stadshus AB, both part of the Municipality, and would take a supportive role in the project. For the private real estate owners, the Municipality would work to promote and support the efforts that need to be made by these real estate owners. As mentioned before, the Municipality can only share knowledge, information and experiences in this part of the project; the initiative must come from the companies and associations.

If the project starts there is a need for a more profound analysis of the data in order to find out which buildings that will be subject for interest. Important considerations during the planning of measures are the results achieved in Work Packages 2 and 3 as well as the preconditions for each building.

For each building there should be a survey of the entirety. Both technical solutions, behaviour relating to energy use and even the social environment would be considered. For questions concerning the social environment, contacts should be made with the concerned local administration.

In the Road Map below for the City of Stockholm the different activities are described.

| Roadmap for Action Plan in Stockholm | | | | | | |
|--|--|---|--|---|--|-----------------------------------|
| | Target: Achieve level Deep renovation for buildings built in 1930-1960 with a specific energy use higher than 200 kWh/m ² , year within the period 2017-2021. | | | | | |
| | Startpoint: | | | | | Final point: |
| Timeschedule | Starting point | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Stakeholders | | | | | | |
| Environmental department | Decision of project | | Seminars and workshops about energy savings with the tenants | | Seminars and workshops about energy savings with the tenants | Final report |
| Politicians from Municipality | Decision of budget | | | | | |
| Stockholmshem | | Leading the renovation project | | | | |
| Stockholmshem | | warm water and property electricity. Establishing a website and suitable social media-accounts for the project. | | | | Measurements and Follow Up |
| Social department and Stadsdelsförvaltning | | Survey of the social situation | | Projects concerning social sustainability | | Follow Up of the social situation |
| Tenants | | Giving opinions on the project | | | | |
| Consultants | | | Planning of renovation | | | |
| Suppliers | | | Giving propositions of energy efficient solutions | | | |
| Construction companies, contractors | | | Construction, renovation | | | |